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Economic incentives to promote environmentally friendly maritime transport in the Baltic Sea region

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Abstract
Within environmental policy, economic incentives refer to economic measures that accelerate improvements in the environmental performance of human activities, such as maritime transportation. In the maritime field, economic incentives include measures such as environmentally differentiated operational fees and taxes, as well as national and EU co-funding for investments in technology and practice. A relatively diverse palette of such economic incentives is currently available in the Baltic Sea region.

This study provides a comprehensive overview of the existing economic incentives for maritime transportation in the Baltic Sea region. The aims are to estimate the impact of these incentives, to recognise challenges related to them, and to discover best practises. These provide material for considering international recommendations on economic incentives. The specific purpose of this report is to contribute to work within the HELCOM GREEN TEAM on the use of economic incentives in the Baltic Sea Region.

The report is based on a comprehensive literature review and on questionnaires sent to national administrations, shipowners and shipowners' associations. For shipowner respondents, the questionnaire was followed-up by semi-structured interviews. Economic incentives to promote investments to improve the vessels' environmental performance, both in new ships and retrofits to existing ships, were found influential in reducing the environmental impact of shipping. The administrations of the Baltic Sea region have established several measures to support sustainable maritime transport. National state aid, EU co-funding and financing tools have been relevant instruments and have promoted the investments into environmentally friendly technology. In addition to these methods, environmental taxation was found as an effective economic incentive.

Financing a new ship appears to be a challenge for shipowners today. According to the results, various ship financing possibilities should be further developed to ensure the implementation of environmentally friendly technology in new ships. In the short term, banks in the region could be encouraged to sign agreements with the European Investment Bank (EIB) to facilitate access to its green ship financing instruments. Environmentally differentiated operational fees were not found to significantly influence the investments on improving the vessels' environmental performance. Besides the low economic benefit compared to the magnitude of the required investments, the concept was questioned as the gain is not directed to the investor. The shipowner responsible for the investment may act as a tonnage provider and does not necessarily bear the operational fees.

The findings highlight the importance of sharing of information and best practices on different economic incentives on a regional level and in public-private collaboration. The available co-funding for forerunners to invest in environmental technologies appeared as an important tool to lower the investment risk and to promote additional environmental investments beyond existing legislation. Predictable and coherent systems of economic incentives were called for and should be designed with a long-term perspective.

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alusrahoitus, EU, HELCOM, IMO, Itämeri, merenkulku, rahoitustuki, taloudelliset kannustimet, valtiontuki, verotus, ympäristöinvestoinnit, ympäristösääntely, ympäristönsuojelun, ympäristöperusteiset maksut

Tiivistelmä
Ympäristöpolitiikassa taloudellisilla kannustimilla tarkoitetaan taloudellisia ohjauskeinoja, joilla ihmistoimintojen ympäristövaikutuksia voidaan vähentää. Itämeren alueella on käytössä monipuolinen valikoima taloudellisia kannustimia, jotka keskittyvät erityisesti meriliikenteen ympäristövaikutusten vähentämiseen. Meriliikenteen alalla taloudellisten kannustimien käsite kattaa ympäristöperusteiset maksut, verot sekä julkiset (kansalliset ja EU) tuet ympäristöinvestointeihin.

Tämä tutkimus luo kattavan yleiskatsauksen Itämeren alueella sovellettaviin taloudellisiin kannustimiin. Tavoitteena on arvioida näiden kannustimien vaikutuksia, tunnistaa niiden käyttöön liittyvät haasteet ja löytää parhaat käytännöt. Tunnistettuja parhaita käytäntöjä voidaan tulevaisuudessa jalostaa kansainvälisiksi suosituksiksi. Tämän raportin erityinen tarkoitus on tukea HELCOM GREEN TEAM -alatyöryhmän työtä Itämeren alueen meriliikenteen ympäristövaikutusten vähentämiseksi taloudellisten kannustimien avulla.

Raportin tulokset perustuvat kattavaan kirjallisuuskatsaukseen sekä kyselytutkimukseen, johon kutsuttiin kansallisia viranomaisia, Itämeren alueella toimivia varustamoita sekä varustamoyhdistyksiä. Laivanvarustajien kirjallisia vastauksia täydennettiin haastattelun avulla.

Kirjallisuuskatsauksen perusteella Itämeren alueen maissa on käytössä monipuolinen valikoima taloudellisia kannustimia. Kyselyyn osallistuneiden mukaan nämä taloudelliset kannustimet ovat tärkeitä työkaluja ympäristöystävällisen merenkulun edistämisessä, sekä uusien ja olemassa olevien alusten osalta. Erityisesti kansalliset ja EU tuet sekä julkiset lainat ja takaukset ovat edistäneet laivanvarustajien investointeja ympäristöystävälliseen tekniikkaan. Näiden keinojen lisäksi ympäristöperusteiset verohelpotukset todettiin tehokkaiksi taloudellisiksi kannustimiksi.

Vastausten valossa erityisesti ympäristöystävällisten uudisrakennusten rahoitus näyttäytyy merkittävänä haasteena laivanvarustajille. Erilaiset laivanrahoitukseen liittyvät tukitoimenpiteet ovat tästä syystä tärkeitä ympäristöystävällisen tekniikan käyttöönoton varmistamiseksi ja niitä tulisi kehittää edelleen. Lyhyellä aikavälillä Itämeren alueen pankkeja voitaisiin kannustaa allekirjoittamaan vaadittavat sopimukset Euroopan investointipankin (EIP) kanssa vihreän alusrahoituksen saatavuuden helpottamiseksi.

Saatujen vastausten mukaan ympäristöperusteiset satama-, väylä- ja muut operatiiviset maksut eivät olleet merkittäviä tekijöitä varustamoiden päätöksissä, jotka koskivat ympäristöjalanjälkeä vähentäviä alusinvestointeja. Ympäristöperusteisten maksujen ja alennusten pienuus verrattuna vaadittujen investointien suuruuteen oli yksi juurisyy. Tämän lisäksi alennusten ei koettu toimivan kannustimina aikarahtimarkkinoilla toimiville laivanvarustajille.

Tutkimuksen tulokset korostavat taloudellisiin kannustimiin liittyvien parhaiden käytäntöjen jakamisen tärkeyttä, niin valtioiden välillä kuin osana julkisen ja yksityisen sektorin yhteistyötä. Vastaajat toivoivat myös ennustettavia ja keskenään johdonmukaisia taloudellisia kannustimia, joita kehitetään pitkäjänteisesti.

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Sammandrag
Inom miljöreglering syftar ekonomiska incitament på ekonomiska åtgärder som accelererar utvecklingen mot en minskad miljöpåverkan av mänskliga aktiviteter, såsom sjöfarten inom Östersjöområdet. Inom sammanhanget omfattar begreppet miljömotiverade avgifter och skatter, samt direkta ekonomiska stöd och lånearrangemang från såväl nationella institutioner som EU. I dags dato finns det ett brett utbud av sådana incitament tillgängliga för sjöfarten i Östersjöregionen.

Denna studie ger en omfattande överblick av olika ekonomiska incitament som är tillgängliga för sjöfarten i Östersjöregionen. Syftet är att uppskatta deras påverkan samt identifiera utmaningar och goda tillvägagångssätt. Dessa kan användas som underlag för framtida rekommendationer och fortsatt arbete kring regionala och globala ekonomiska incitament inom sjöfart. Ett specifikt ändamål för rapporten är att bidra till arbetet kring ekonomiska incitament för hållbar sjöfart inom den regionala gruppen HELCOM GREEN TEAM.

Denna studie baserar sig på en omfattande genomgång av tillgängliga källor samt en frågeundersökning som skickades till nationella sjöfartsmyndigheter, rederier och nationella redareföreningar. De deltagande rederiernas representanter intervjuades också muntligt.

Litteraturstudien visade att myndigheterna runt Östersjön har upprättat flera incitament för att stöda utvecklingen mot en mer hållbar sjöfart. I svaren från de medverkande framkom att dessa incitament uppfattades i regel som betydande i arbetet för att minska miljöpåverkan från nya och existerande fartyg. Direkta ekonomiska stöd och lånearrangemang från nationella institutioner och EU är de incitament som har tydligast främjat investeringar i miljövänligare sjöfartsteknologi och driftpraxis. Dessutom uppfattades miljödifferentierad beskattning och skattelättnader som effektiva ekonomiska incitament.

Finansiering av nya fartyg verkar vara speciellt utmanande för majoriteten av redare i regionen. Resultaten pekar på behovet för vidareutveckling av finansieringsverktyg för att säkerställa användningen av miljövänlig teknologi ombord nya fartyg. Som en första åtgärd förslås att de banker i regionen som är aktiva inom sjöfart ingår avtal med Europeiska Investeringsbanken (EIB). Detta skulle underlätta de lokala rederiernas deltagande i EIBs program för grön sjöfart.

Miljödifferentierade avgifter uppfattades inte ha lika stort inflytande i rederiernas investeringsbeslut kring miljöteknologi. Utöver låg ekonomisk betydelse i förhållande till investeringar, ansågs sådana sänkta avgifter inte belöna investeringar som gjorts av de rederier som specialiserat sig på chartertonnage.

Resultaten betonar vikten av att dela god praxis kring ekonomiska incitament på regional nivå och mer generellt inom offentlig-privat samverkan. Investeringsrisken för föregångare inom branschen borde sänkas för att främja miljöinvesteringar utöver befintlig lagstiftning. Respondenterna efterfrågade förutsägbara, sammanhängande och långsiktiga incitamentshelheter.

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Executive Summary

Economic incentives refer to a set of policy instruments that aim to initiate or accelerate the development towards a common goal, here towards environmentally friendly maritime transport. These instruments include EU and national co-funding for new technology development and investments, taxation (e.g. reduced fuel and electricity tax), and environmentally differentiated operational fees (i.e. reduced port fees or fairway dues). A relatively diverse palette of economic incentives is currently available in the Baltic Sea region.

This study describes the current economic incentives, considers their impact and provides an overview of the best practises for future incentives. One of the objectives of this study is to catalyse sharing of user experiences, both encouraging examples and the identified challenges. This information can be used to develop targeted economic incentives to reduce the environmental impact of maritime transport.

On the last page of this executive summary you can find a table with a selection of best practices and themes emerging from the study as well as possible next steps in terms of regional work.

An overview and survey on economic incentives in the Baltic Sea

In order to provide an overview of the topic, data for this study were collected via a review of literature and other written sources as well as via a survey. A questionnaire was sent to three categories of actors: i) national administrations, ii) shipowners and iii) shipowners' associations. For shipowner respondents, the questionnaire was followed-up by semi-structured interviews using the same questions. The participants contributed to this study by sharing their experiences as well as up-to-date information on the availability and use of economic incentives in the Baltic Sea region.

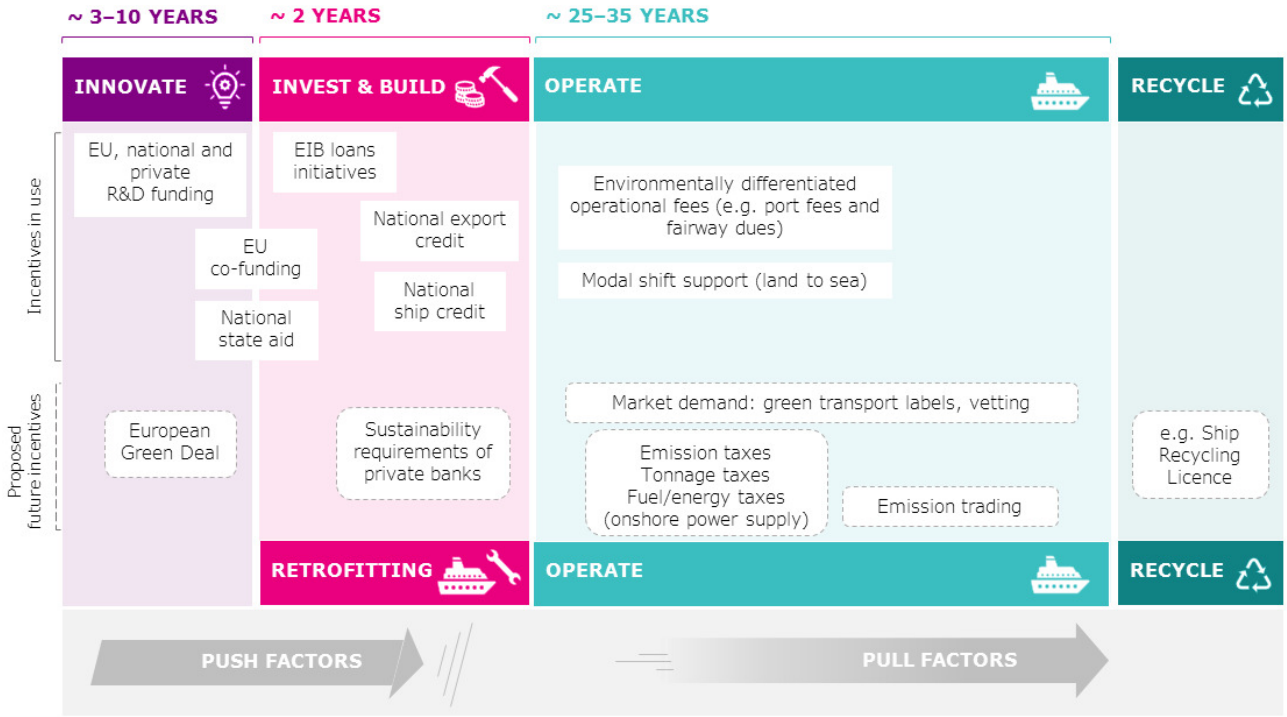
Information on incentives in the Baltic Sea region is not readily available

As one important finding of the report, it became evident that information on economic incentives for environmentally friendly shipping in the Baltic Sea region is not readily available in a compiled and up-to-date form. The findings highlight the importance of sharing of best practises and continuing the regional public-private cooperation within the Baltic Sea region. A compilation of the available incentives would make their utilization easier for many shipowners who lack the capacity to do the research required at the moment.

A long-term perspective needed to cover the long life span of vessels

A general recommendation and a common concern emerging from this study was that the economic incentives should be designed and applied in a long-time perspective in order to allow for the industry to implement changes in their operation and have predictability for further investment plans. This is important also due to the long lifespan of vessels. Different types of economic incentives are relevant for, and needed to cover, the different phases of a vessel's lifecycle (see Figure on next page).

In addition to investing in better technology during the building phase as well as during later retrofits, the environmental performance of ships can be improved by incentivising operational changes. For example, enabling and supporting the use of onshore power would reduce the ships' emissions while berthing at port.



A schematic overview of the economic incentives for environmentally friendly maritime transport during a vessel's lifecycle from innovating to recycling. Public co-funding and other support can also be considered as economic incentives working as push factors, while less direct incentives such as market demand, differentiated operational fees and taxation could be considered as pull factors.

Economic incentives important for better environmental performance

Among the respondents, the general attitude towards the economic incentives was positive and despite the critique, the incentives were found to incite the improvement of environmental performance of both new and existing ships. Incentives lower the investment risk of forerunners and drive environmental investments beyond the minimum requirements of existing legislation.

Financing for environmentally advanced vessels is a key challenge

A fairly clear ranking of the incentives in terms of importance for shipowners emerged from the responses. In the light of this study the most important measures to promote green investments are related to ship financing (loans and securities). The second topic in terms of importance was co-funding instruments, including European Union (EU) funding instruments and national grants for technology investments as well as innovation. The third topic was environmentally motivating taxation. Environmentally differentiated fees, including port and fairway dues, were perceived as less influential at least for shipowner investment decisions.

Particularly the financing of a new environmentally advanced ships appears to be a challenge for shipowners, and consequently an issue where economic incentives can have a major role. This study summarises recommendations for the ship financing sector emerging from the responses, such as increasing the collateral value of the vessel used as a guarantee for a loan or allowing for longer period of repayments. There is a clear need to investigate and develop further ship financing options both within EU and nationally in order to ensure the implementation of environmentally friendly technology in new ships. An immediate challenge related to European Investment Bank (EIB) financing is that a relatively few banks in the region have signed agreements with the EIB, which slows access to certain financing instruments.

Innovation funding should be secured also in the future

Research and Development (R&D) funding is a key factor enabling a sustainable shift in Baltic Sea maritime transport. Future research programmes both in the EU and nationally should include sufficient funding focused on the maritime sector. National R&D funding dedicated to green shipping would also be welcomed and experienced as more easily administered and accessible for shipowners compared to EU co-funding.

Environmental taxes an important category of economic incentives

Taxation came up as an important economic incentive for environmental performance although the topic was not brought up in the questionnaire. The model of the Norwegian NOx tax and NOx Fund, sometimes called recoverable emission payment, was perceived as a potentially effective way to cut emissions and improve the environmental performance of maritime transport in the region but would require EU level action. Another identified good practice/possible measure in the field of taxation was tax exemptions on Onshore Power Supply (OPS) energy provided by Sweden, Germany & Denmark, with a potential to reduce the price of energy provided to vessels at berth.

Environmentally differentiated fees not significant for investments

Compared with financing and co-funding, the environmentally differentiated operational fees currently applied in the Baltic sea were not found to significantly initiate or accelerate investments on more environmentally friendly technology. One reason for this is that the operational fees are only a minor share of the total operational costs of a ship and currently the amount of discount hardly covers the cost of the investments even in the long run. Another is that while only the shipowner is responsible for investments in new environmentally friendly technology onboard, it can be the charterer who benefits directly from environmentally differentiated operational fees, depending on the chartering agreement.

The results show that harmonisation of discount schemes of the environmentally differentiated operational fees and of application processes of environmental indexes would improve their utilisation and minimise the added administrative burden. Both the discount schemes and the criteria for environmental indexes should be designed in long-term to realistically promote investments in environmental performance.

Market demand for green shipping awakening but needs regulatory push

When discussing the drivers of change to improve the environmental performance of their fleet, some shipowners pointed out that customers are interested in the environmental impact of the transport chain. Despite the reluctancy to pay substantial extra for more environmentally friendly transport, many service providers have launched green shipment services. Minimal environmental footprint may have economic value, but since the customers do not currently cover the costs of the necessary improvements, the key driver of change remains to be the regional and global regulation.

The summary table *with a selection of best practices and themes emerging from the study as well as possible next steps in terms of regional work. The topics, except three general points, have been ordered based on decreasing degree of priority according to the overall results of this study. EU=European Union, EU CEF= EU Connecting Europe Facility, EIB= European Investment Bank, R&D= Research & Development, SME=Small and Medium-sized Enterprises, OPS= Onshore Power Supply, EU ETD= EU Energy Taxation Directive, NO_X=Nitrogen Oxides, HELCOM GREEN TEAM= A regional body in the Baltic Sea working with green technology and alternative fuels in shipping.*

Topic	Highlight/Best Practice	Possible regional Next Steps
1. Loans and Securities for new ships	Further public initiatives enabling 15+ years loans and guarantees for building new environmentally friendly ships	Consider dedicated national and EU initiatives on long term financing for new environmentally friendly ships.
2. EU co-funding for investments	EU CEF Blending Facility call, as well as some EIB instruments, require arrangements with banks which are not in place in all countries.	Promote conclusion of agreements between EU institutions (EIB) and banks in the region.
3. National co-funding for R&D	National R&D funding is more accessible for SMEs by involving less administrative burden compared to EU projects.	If not already available, develop national R&D initiatives for green shipping including piloting and demonstrations.
4. EU co-funding for R&D	EU funding is an important catalyst of green shipping innovations.	EU member states of the Baltic Sea region could work to ensure maritime transport component of emerging new CEF, Horizon Europe as well as proposed European Green Deal related EU funding.
5. Environmental taxation	Onshore Power Supply (OPS) is currently an uneconomic alternative due to unfavourable energy taxation and not widely available	Consider promoting more favourable pricing of Onshore Power Supply (OPS) services in the Baltic Sea ports via reliefs from energy taxation. For EU member states this would indicate exemptions for OPS from the 2003 EU Energy Taxation Directive, as well as looking for more permanent solutions via ETD revisions.
	Norwegian NO_X tax and NO_X fund	Consider supporting proposals in the EU framework for an EU wide refundable emission payment scheme for shipping, inspired by the Norwegian approach.
6. Environmentally differentiated operational fees	Ports and fairway charges are only a minor share of the total operational costs of a ship and do not always work as an incentive for the ship builder/owner.	Consider stronger environmental differentiation of operational fees with larger discounts for the most advanced vessels.
	Harmonisation of the discount schemes on environmentally differentiated operational fees in the Baltic Sea area would be important.	Consider further harmonization and development of Environmental indexes used in awarding environmental discounts.
7. Customer demand & Green labels	Service providers are leading the way in green labelling of maritime transport but operate largely in the absence of a regulatory framework	Advance regulatory frameworks supporting and enabling increased customer demand for green transport products.
General	A compilation of economic incentives for maritime transport in the Baltic Sea is not available.	Initiate a mechanism to regularly share up-to date information on economic incentives in the Baltic Sea area. This could be a task for HELCOM GREEN TEAM of another similar arrangement.
		Consider a regional follow-up study on economic incentives with a particular focus on financing.
	Economic incentives need to be designed and applied with a long-time perspective	Consider the element of predictability and time in economic incentives for sustainable shipping in the Baltic Sea

Contents

Appendices

List of acronyms

AIS	Automatic Identification System
BSAP	Baltic Sea Action Plan (HELCOM)
CEF	Connecting Europe Facility
CNG	Compressed Natural Gas
CO	Carbon monoxide
CO_2	Carbon dioxide
CSI	Clean Shipping Index
DCS	Data Collection System (IMO)
DWT	Deadweight tonnage
ECA	Emission Control Area
EEA	European Economic Area
EEDI	Energy Efficiency Design Index (IMO)
EEOI	Energy Efficiency Operational Index (IMO)
EEXI	Energy efficiency existing ship index
EEZ	Exclusive Economic Zone
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
EIC	European Innovation Council ('EIC Accelerator')
EMSA	European Maritime Safety Agency (EU)
ERDF	European Regional Development Fund
ESI	Environmental Ship Index
ESIF	European Structural and Investment Funds
ESSF	European Sustainable Shipping Forum
ESPO	European Sea Ports Organization
ETD	Energy Taxation Directive (EU)
ETS	Emission Trading System (EU)
EU	European Union
EUDP	Energy Technology Development and Demonstration Programme (Denmark)
GHG	Greenhouse gas
GSG	Green Shipping Guarantee Programme (EIB)

GT	Gross tonnage
HELCOM	Baltic Marine Environment Protection Commission
IAPH	International Association of Ports and Harbors
IMO	International Maritime Organisation
LMA	Loan Market Association
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships (IMO)
MEPC	Marine Environment Protection Committee
MGO	Marine Gasoil
MoS	Motorways of the Sea
MRV	Monitoring, Reporting and Verification. An EU legal instrument aiming to collect data on CO_2 emissions from large ships using EU ports.
NECA	NO_X Tier III Emission Control Area (MARPOL NECA)
NIB	Nordic Investment Bank
NO_X	Nitrogen oxides
NSF	No-special-fee
OPS	Onshore Power Supply
PM	Particulate Matter
PRF	Port Reception Facilities
PSSA	Particularly Sensitive Sea Area (IMO)
REP	Refundable Emission Payment
R&D	Research & Development
RoPax	Vessel built for freight vehicle transport along with passenger accommodation
SECA	Sulphur Emission Control Area
SEEMP	Ship Energy Efficiency Management Plan (IMO)
SME	Small and Medium-sized Enterprises
SO_X	Sulphur oxides
TEN-T	Trans-European Transport Network
TFEU	Treaty on the Functioning of the European Union
WPCI	World Ports Climate Initiative
WPSP	World Ports Sustainability Program

1 Introduction

Economic incentives refer to measures based on economic rewards which can be used to accelerate green investments to maritime transport. A broad definition[1] of the concept includes charging measures, such as environmentally differentiated fees (e.g. reduced port or fairway fees) and taxes, governmental and EU support for environmental technology investments, as well as emission trading. In the work to minimize negative environmental impacts of maritime transport, economic incentives mainly refer to the first two categories[2] and often serve as a voluntary complement to existing or planned obligatory measures and regulations.

Particularly during the last decades, economic incentives have attracted interest from regulators of ship emissions as they are considered relatively easy to administrate and also have the potential to catalyse reductions, which go beyond regulatory minimum requirements imposed by the International Maritime Organisation (IMO) Conventions, EU or national regulations.[3]

The administrations, shipowners and ports of the Baltic Sea region, and Northern Europe at large, have been global forerunners in the development of more environmentally friendly maritime transport.[4] This pioneering applies also to the use of economic incentives to attract early adapters of clean technology and less polluting practices. The number of economic incentives available in the region has increased steadily from the initial initiatives, such as the environmentally differentiated fees in Nordic ports.[5] In 1995 the Baltic Marine Environment Protection Commission (HELCOM) Baltic Strategy agreed *inter alia* to fund the development related to port reception facilities (PRF) infrastructure in the Baltic Sea region.[6] Another central component for regional work was the HELCOM no-special-fee (NSF) recommendation[7] which has been an important catalyst to the delivery of ship-generated wastes to the Baltic Sea ports. In the field of exhaust gas pollution, the Swedish environmentally differentiated fairway dues established in 1998, [8] but also the preceding restrictions to emissions in urban ports were important catalysts for cleaner technologies.

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[1] e.g. Nikolakaki, G. 2013. Economic incentives for maritime shipping relating to climate protection. WMU J Marit Affairs. 12:17–39 DOI 10.1007/s13437-012-0036-z

[2] Even if a GHG emission trading scheme for maritime traffic has been proposed within the IMO (Maritime Emissions Trading Scheme, METS) (e.g. Nikolakaki 2013) as well as EU (EU-ETS) (European Green Deal 2019), it remains a theoretical concept.

[3] Examples of relatively early studies on the feasibility and potential of economic incentives to reduce ship emissions in the EU see e.g. NERA. 2005. Economic Instruments for Reducing Ship Emissions in the European Union. European Commission, Directorate-General Environment. 117 p.
NERA (2004) Evaluation of the Feasibility of Alternative Market-Based Mechanisms To Promote Low-Emission Shipping In European Union Sea Areas. 106 pp.
& Davies, M.E., Plant, G., Cosslett, C. Harrop, O. & Petts, J. W. 2000. Study on the Economic, Legal, Environmental and Practical implications of a European Union System to reduce ship emissions of SO_2 and NO_X. BMT. 56 pp.

[4] Tan, A. 2006 Vessel-Source Marine Pollution, Cambridge Studies in International and Comparative Law 416. at p.84

[5] e.g. Stockholm 1991 see for example COGEA et al. 2017. Study on differentiated port infrastructure charges to promote environmentally friendly maritime transport activities and sustainable transportation. CONTRACT MOVE/B3/2014-589/SI2.697889. p.44

[6] HELCOM 1995. Baltic Strategy for Port Reception Facilities for Ship-generated Wastes and Associated Issues in Activities of the Commission 1995. Baltic Sea Environment Proceedings No. 62. pp. 86-106. (2.3.2020)

[7] HELCOM 1998. Application of the 'no-special-fee' system in the Baltic Sea Area. HELCOM Recommendation 19/8 (superseded)

[8] HELCOM 2005. Information concerning applied and potential incentives to curb emissions from vessels (document 6-1, HELCOM MARITIME 4-2005)
HELCOM 2006. Economic incentives as a complement to existing regulations for improvement of the environmental performance of shipping (document 7-5, HELCOM MARITIME 5-2006)

A relatively diverse palette of economic incentives is offered today in the Baltic Sea coastal countries, including national mechanisms to support green investments as well as more than 20 ports offering environmentally differentiated fees (see Table 6 on page 48). As a sign of their real-world relevance, the industry in the region is also utilising these opportunities. Based on the successful early trials on fees in Sweden and other countries in the region[8], a dedicated regional recommendation on economic incentives was adopted in 2007[9] and revised in 2019.[10]

Purpose and aims of this report

Since the early national trials, economic instruments have also been discussed within regional working groups working with sustainable shipping practices and technologies in the Baltic Sea. This includes the Maritime working group of HELCOM and its GREEN TEAM subgroup, a regional public-private platform aiming to accelerate mainstreaming of the use of green technology and more environmentally friendly alternative fuels in the Baltic Sea region. In particular, the latter group aims to map existing systems of economic incentives, clarify regulatory challenges and identify available regional solutions to specific issues such as financing of ship investments.

On the basis of the initiative by the HELCOM GREEN TEAM 3 meeting, the HELCOM MARITIME 19-2019 meeting[11] considered initiating a study to gain more knowledge on financing of sustainable shipping in the Baltic Sea region. The meeting agreed that such a study would be useful and welcomed the offer by Finland to take the lead in the work. This report is to contribute to this work to give an overview of existing economic incentives in the Baltic Sea region and to identify how well these have promoted the use of environmentally friendly technology and alternative fuels. As such it aims to highlight and catalyse sharing of best practices on economic incentives as well as overcoming identified challenges. Moreover, it provides material for further regional work and recommendations on incentives and needs in ship financing.

[9] HELCOM 2007. Introducing economic incentives as a complement to existing regulations to reduce emissions from ships. HELCOM Recommendation 28E/13.
[10] HELCOM Recommendation 28E/13, 2019, Introducing economic incentives as a complement to existing regulations to reduce pollution from ships
[11] HELCOM 2019. Outcome of the 19th meeting of the Maritime Working Group (Maritime 19-2019)

2 Material and Methods

This report is based on data collection via a literature review as well as via questionnaires and interviews. For shipowner respondents the questionnaire was followed-up by semi-structured interviews using the same questions. The data collection and writing of the report was carried out during the period February-March 2020.

While the focus of the study scope was on gathering the experiences of the respondents, a literature review was needed to provide an overview of economic incentives in the region. The literature review was based on recent documents and reports identified by previous knowledge of the field, documents submitted to HELCOM meetings, reports on economic incentives for environmental investments in the field of maritime transport as well as relevant websites. In addition, supporting searches covering academic journal articles were carried out on specific topics. A bibliography of the traditional publications or documents used as material in this study can be found in the Bibliography. Websites are only referred to in footnotes, which are used also for the publication references.

According to the study scope, questionnaires targeting three categories of actors (shipowners, shipowner associations and national administrations) were used to collect more informal experiences as well as up to date information on the availability and use of economic incentives in the Baltic Sea region. The questionnaire for each actor can be found in the Appendix I: Questionnaires.

All the national administrations of the Baltic Sea coastal countries were contacted, as well as shipowner associations and some shipowners. The contacted shipowners were selected among those companies known to have fleets which operated frequently in the Baltic Sea area as well as those with a known interest in investing in environmental performance. A complete list of actors which responded to the questionnaires in this study can be found in the Appendix II: Respondents.

In addition to the questionnaire, shipowners were interviewed with the same semi-structured questionnaire in order to clarify the written responses and collect more direct experiences from utilisation of different existing economic incentives. Some of the participated shipowners provided their input only via the interview.

3 Establishing the context

3.1 Economic incentives for environmental measures in maritime transport

According to a classical division, *economic incentives* represent one of the two main strands of environmental regulation, the other being traditional approaches to environmental regulation based on environmental quality, emission levels, best practices and technologies.[12] In the case of shipping, the traditional environmental regulations define limits for harmful discharges and emissions from ships. These regulations are usually goal-based regulations, i.e. technical means to meet these limits are not defined in the regulations. This means e.g. that the sulphur limit for fuel oil can be met either by using fuel oil with the required sulphur limit or by using exhaust gas cleaning systems. However, IMO has often developed guidelines for approval of this kind of equipment, which contain specific requirements for the equipment in question. In contrast, economic incentives refer to diverse policy instruments which use market, price and other economic variables reduce environmental impact. In other contexts, this kind of instruments are also called with terms such as market-based environmental instruments.[13]

Defined broadly, economic incentives can be considered to encompass three main categories of instruments: i) different types of environmentally differentiated taxes and charging, ii) public sector co-funding or investment support, as well as iii) emission trading.[1] The first group, environmentally differentiated charging, includes various forms of environmentally motivated taxes (e.g. fuel taxes, tonnage taxes) and other charges such as environmentally differentiated port fees and fairway dues. The criteria for this kind of reduced fees can be based on an environmental score awarded by a third party (see Chapter 4.5.1), or other measurements of environmental performance. The second category, public sector co-funding, covers various national and EU systems for partial or full recovery of costs related to the development, deployment and use of environmentally friendly technology or practices. The last category, emission trading, includes a range of different approaches from local voluntary schemes to global cap-and-trade systems.[1]

3.2 Baltic Sea shipping and environment

The Baltic Sea is considered a particularly sensitive marine environment. Approximately 85 million people live in the relatively large catchment area of the Baltic Sea causing a high pressure to its ecosystem that adds to various other pressures such as the impact human activities at sea. The Baltic Sea is a shallow brackish water body with a limited water exchange with the Atlantic Ocean and the low water volume intensifies the impact of different pressures.

The Baltic Sea is an area of heavy maritime traffic, which connects the region closely to the rest of the world. Based on the automatic identification system (AIS) data from 2016 there are on average ca. 1 500 vessels with an IMO number in the Baltic Sea at any given moment.[14] The maritime traffic intensity has increased in the past 10 years and further growth has been predicted, reflecting mainly intensifying international co-operation and economic growth[14] supported by initiatives such as the European Commission's ambition to shift transport from road to sea.[15] The EU-

[12] Some of these have also been called 'command and control' regulation.
[13] Other terms for economic incentives include *economic instruments*, *price-based instruments*, *new environmental policy instruments (NEPIs)* and *new instruments of environmental policy*.
[14] Maritime activities in the Baltic Sea. HELCOM Maritime Assessment 2018. Baltic Sea Environment Proceedings no.152. ISSN 0357-2994
[15] EU, 2011,White Paper on transport, DOI:10.2832/30955

controlled fleet (including Norway) expanded by more than 70% in the Baltic Sea region from 2005 to 2014, both in gross tonnage (GT) and in deadweight tonnage (DWT). [16] There has also been a trend towards larger ship sizes, especially for cargo transport, with an increase in GT as large as 33% from 2005 to 2010 based on data on bulk ships visits a subset of ports in the Baltic Sea.[17]

Figure 1 illustrates the geographical distribution of carbon dioxide CO_2 emissions from shipping in the Baltic Sea during 2018. Figure 2 shows the emissions of the Baltic Sea fleet during 2006–2018, based on vessel specific emission modelling[18]. Sulphur oxides (SO_X) and particulate matter (PM2.5)[19] emissions decreased significantly in 2010 and in 2015 as a result of policy changes limiting the sulphur content in fuel oil for ships navigating in the Baltic Sea.[18]

Analysis of one decade of CO_2 emissions from Baltic Sea ships reveals a downward trend and indicates a 20% increase in energy efficiency of the Baltic Sea fleet during 2008–2018 (Figure 4). In absolute terms, the CO_2 emissions from ships have decreased by -6.2% and transport work has increased by +12.5% when compared to year 2008 totals. Estimated fleet operational index was 18.7 g ton^{-1} km^{-1} in 2008 and 15.6 g ton^{-1} km^{-1} in 2018. This corresponds to 20% energy efficiency improvement in the Baltic Sea area.

Based on AIS data 2006–2016 the relative share of distance travelled by ships registered outside the Baltic Sea region has increased (Figure 3) which highlights the need for international cooperation on environmental matters related to maritime transport.

[16] Interreg Baltic Sea region, 2016, Shipping in the Baltic Sea. Past, present and future developments relevant for Maritime Spatial Planning
[17] Madjidian, J., S. Björk, A. Nilsson & T. Halén (2013). Clean Baltic Sea Shipping final report p.43
[18] HELCOM 2019 Emissions from Baltic Sea shipping in 2006 - 2018 (Document 5-2). HELCOM MARITIME 19-2019.
[19] Particulate Matter < 2.5 µm diameter

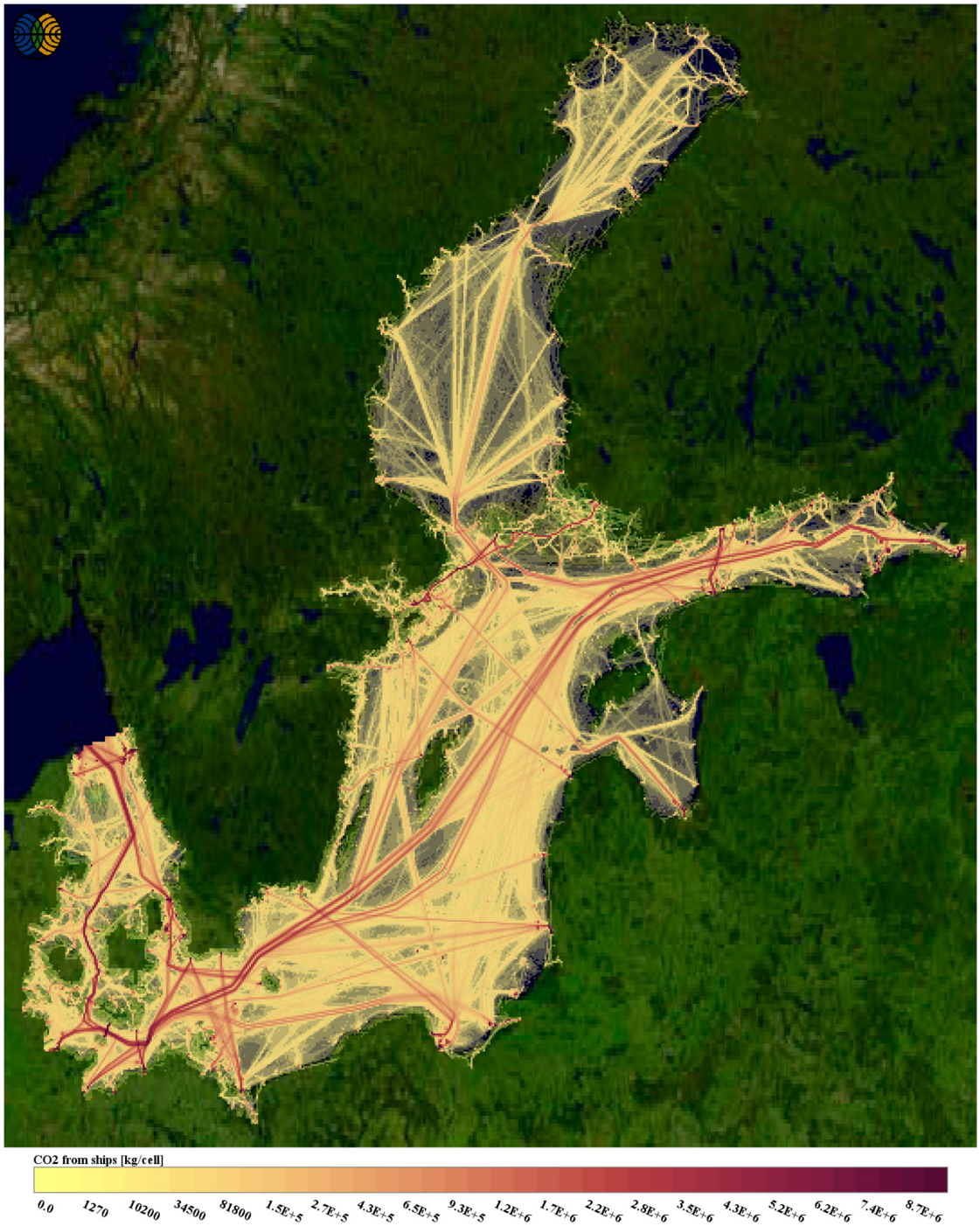


Figure 1. Carbon dioxide (CO_2) emissions from shipping in the Baltic Sea during 2018. Values are reported as mass (kg) of CO_2 emitted inside a grid cell of 15.65 km^2. Courtesy of Jukka-Pekka Jalkanen, Finnish Meteorological Institute.

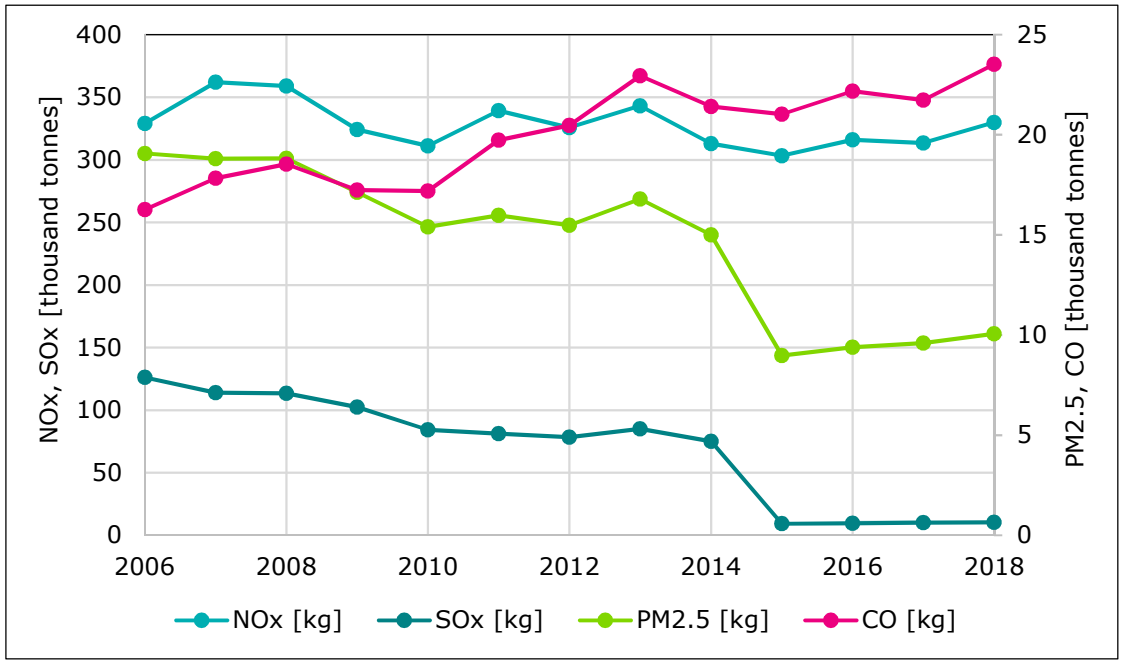


Figure 2. Total emissions of nitrogen oxides (NO_X), sulphur oxides (SO_X), particulate matter (PM2.5)[19], and carbon monoxide (CO) from all ships with an active automatic identification system (AIS) transceiver in the Baltic Sea during 2006–2018 (Jalkanen & Johansson, 2019).[18]

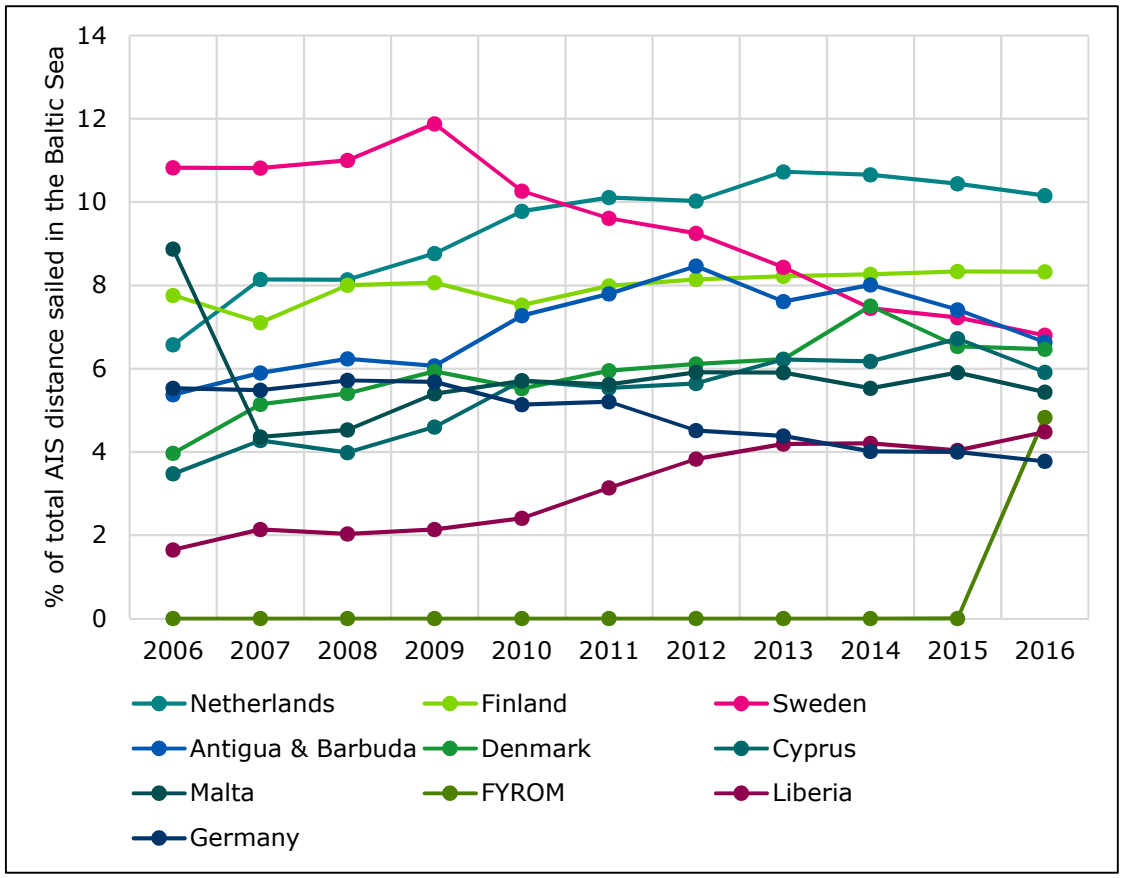


Figure 3: Development 2006–2016 in the shares of the total distances sailed in the Baltic Sea area by the ten ship flags (registries) which had the longest sailed distance in 2016 in the region. The figure is based on regional automatic identification system (AIS) data and thus includes only vessels carrying an AIS transponder. For the purposes of the calculations the Baltic Sea has been defined by delimiting its border toward the Skagerrak by the line Skaw-Gothenburg. The underlying data has been provided by the HELCOM Secretariat / Florent Nicolas.

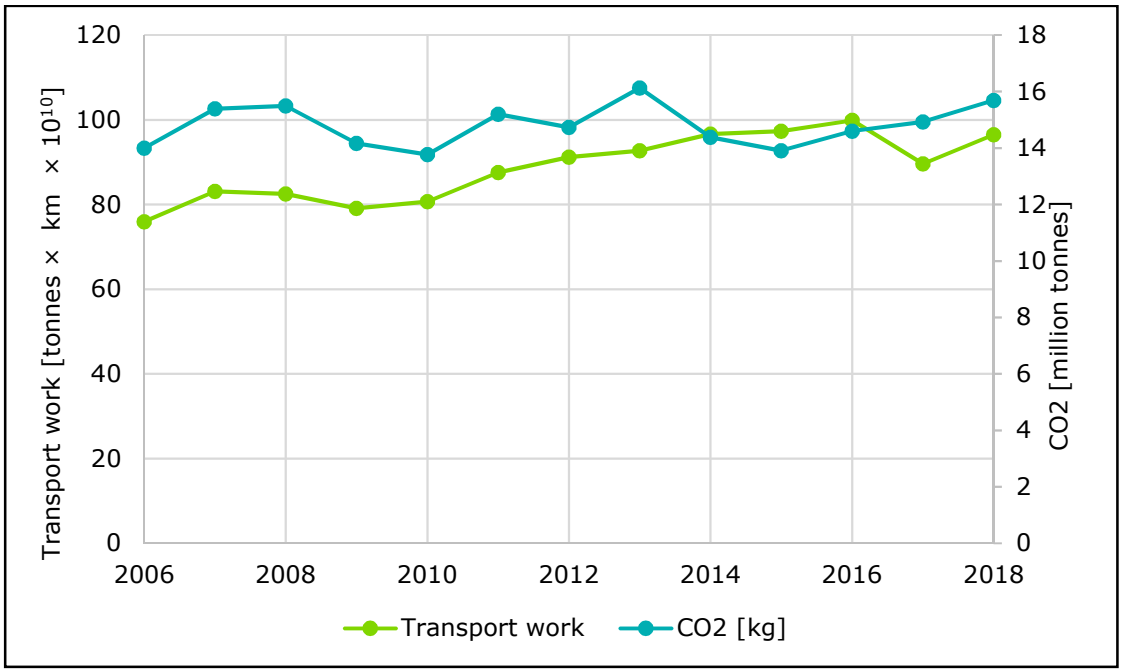


Figure 4. Transport work and carbon dioxide (CO_2) emissions of the Baltic Sea fleet during 2006–2018 (Jalkanen & Johansson, 2019).[18] Transport work (light green) has increased by +12.5% while, the emissions of CO_2 (dark green) have reduced by -6.2% during 2008–2018.

3.3 HELCOM work on economic incentives for environmental measures in the Baltic Sea

The gradually tightening environmental regulatory requirements for maritime transport have intensified cooperation regarding economic incentives in the region. A dedicated regional recommendation on economic incentives was adopted in 2007.[9] Economic incentives were also included in the work plan of the HELCOM GREEN TEAM, a regional public-private platform established in 2014[20] aiming to accelerate mainstreaming of the use of green technology and more environmentally friendly alternative fuels in the Baltic Sea region. As a result, the recommendation 28E/13 on economic incentives was revised in 2019.[10]

The GREEN TEAM meeting 3-2019[21] considered the possible need for a study on financing for sustainable shipping in different countries in the Baltic Sea region in order to gain more knowledge regarding the processes and principals involved and what kind of measures in this regard have been beneficial for promoting sustainable shipping. The meeting agreed that such a study would be very useful and consequently invited MARITIME 19-2019 to consider initiating such a study. The MARITIME 19-2019 meeting[11] agreed to initiate this study on financing of sustainable shipping in the Baltic Sea region.

The substantial resources invested in reducing pollution from land-based sources has led to public and political pressure that also maritime traffic should contribute a fair share to the achievement of regional environmental targets. As a result, the Baltic Sea, together with the North Sea, is an area where a relatively stringent regime of environmental regulation is applied when compared with most other seas of the world.

Accordingly, the Baltic Sea has been designated as a special area for the purposes of the International Convention for the Prevention of Pollution from Ships (MARPOL)

[20] Within the HELCOM system, the GREEN TEAM is formally a sub-group of the HELCOM Maritime working group.
[21] HELCOM. 2019. Outcome of the HELCOM GREEN TEAM 3-2019 meeting.

Annex I (oil), Annex IV (sewage), Annex V (garbage) and Annex VI (Prevention of air pollution by ships). The Baltic Sea was designated in 1997 as the first Annex VI Emission Control Area (ECA) in the world, for the purposes of Sulphur oxides (SO_X) Emissions Control Area (SECA).[22] The SECA limit of sulphur content in ship fuel has been tightened gradually to 0.1%, and remain considerably lower than the global limit of 0.5% valid since 1 January 2020. In 2016, the IMO designated the Baltic Sea as a nitrogen oxides (NO_X) Tier III Emission Control Area (NECA[23]) according to MARPOL Annex VI, in parallel to a similar designation for the North Sea.

Some of the above MARPOL special area regulations are still in the process of entering into a phase of active enforcement. The Baltic Sea MARPOL Annex IV (sewage) special area designation will take effect gradually during 2019–2023 for passenger ships.[24,25] New vessels built after January 2021 will have to comply with the new NECA regulations in Northern Europe covering both the North Sea and the Baltic Sea.

Besides MARPOL, also other international conventions regulate and influence the international environmental performance on maritime transport in the region. These include other IMO Conventions such as the 2004 IMO Ballast Water Management Convention, which entered into force 8 September 2017. As a more recent and related development to control the spread of non-indigenous aquatic organisms, there is an ongoing HELCOM process to create a regional Baltic biofouling management roadmap[26] based on the work within the COMPLETE project[27]. The whole Baltic Sea, except for the territorial waters of the Russian Federation, has also been designated by IMO as a Particularly Sensitive Sea Area (PSSA).

Also, the 1992 Helsinki Convention[28] includes targeted measures on maritime transport, two of which exceed MARPOL requirements; mandatory discharge of all wastes to a PRF and the prohibition of incineration of ship-generated wastes in the territorial seas of the Baltic Sea states and incineration of other wastes (not incidental to or derived from the normal operation of ships) in the entire Baltic Sea area.

In the 1990s, the Baltic Strategy[6] initiative identified priority improvement projects in the Baltic Sea ports for national projects as well as international donors and funding entities, with World Bank, EU and IMO involvement. In addition to port investments, the Baltic Strategy[29] initiative introduced incentives to use PRF, particularly the no-special-fee (NSF) system for ship waste fees.[6] According to the NSF approach, waste fees are collected regardless of whether waste facilities are used, and the fee should in principle be the same regardless of how much waste is delivered. In other words, the NSF aims at a 100% indirect fee. The NSF principle has been a Baltic Sea best practice standard since the 1990s even if applied

[22] IMO: Special Areas under MARPOL (27/02/2020)
[23] IMO 2018. Resolution MEPC.301(72) Amendments to MARPOL Annex VI
[24] IMO. 2012. Guidelines on implementation of efluent standards and performance tests for sewage treatment plants. MEPC.227(64) Annex 22. 2012.
[25] IMO. 2016. Resolution MEPC.275(69) Establishment of the date on which regulation 11.3 of MARPOL Annex IV in respect of the Baltic Sea special area shall take effect
[26] Anon. 2019. Concept for a Regional Baltic Biofouling Management Roadmap (HELCOM Maritime 19/2019, document 4-2).
[27] Interreg Baltic Sea region project, COMPLETE - Completing management options in the Baltic Sea Region to reduce risk of invasive species introduction by shipping. (05/03/2020)
[28] HELCOM 1992. Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992
[29] HELCOM 1995. Baltic Strategy for Port Reception Facilities for Ship-generated Wastes and Associated Issues in Activities of the Commission 1995. Baltic Sea Environment Proceedings No. 62. pp. 86-106. (2.3.2020)

differently in different ports of the region.[30]

3.4 IMO initiatives

In 2018, IMO adopted the initial strategy on reduction of GHG emissions from ships, to be complemented by a more developed strategy in 2023[31,32]. The initial strategy sets out a vision, which confirms IMO's commitment to reduce GHG emissions from international maritime transport. There is a clear ambition to pursue efforts towards phasing out GHG emissions entirely by the end of this century. The strategy envisages a reduction in carbon intensity of international shipping. The CO_2 emissions per transport work, as an average across international shipping, should be reduced by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared with 2008. The total annual GHG emissions from international shipping should reach their peak as soon as possible and be reduced by at least 50% by 2050 compared with 2008 whilst pursuing efforts towards phasing them out.

CO_2 emissions of new and existing ships are currently regulated differently at IMO. For new ships, IMO has agreed on the use of the Energy Efficiency Design Index (EEDI) as a technical measure of energy efficiency. The current regulations for existing ships include only the requirement to develop a plan for the management of ship energy consumption and emissions, i.e. the Ship Energy Efficiency Management Plan (SEEMP). The Energy Efficiency Operational Index (EEOI) is a tool that can be voluntary used to monitor the vessel's performance in operation.[33,34] More concrete requirements for existing ships will likely follow the negotiations on technical and operational regulations to improve energy efficiency of existing ships, including new proposals such as the Energy Efficiency Existing Ship Index (EEXI).[35]

The IMO's Data Collection System (DCS),[36] in force since 1 January 2019, is used to collect and report fuel oil consumption of ships, providing indirect evidence on CO_2 emissions from maritime transport. The DCS system is integrated to the SEEMP, which should include a description of the methodology that is used to collect the fuel oil data and of the process to report the data to the ship's flag state. Ships of 5000 GT and above are required to collect consumption data for each type of fuel oil they use, as well as other, additional, specified data including proxies for transport work. The aggregated data is reported annually to the flag state after the end of each calendar year. The flag state is required to subsequently transfer this data to the IMO Ship Fuel Oil Consumption Database. IMO Secretariat is required to submit an annual report summarizing the data collected to the Marine Environment Protection Committee (MEPC), with the first report likely submitted in 2020.

3.5 European Union policy developments

In addition to IMO, the European Union (EU) and its institutions have been

[30] Usually a level of reasonable/excessive amount of waste is defined. Amounts exceeding such limits are charged in addition to the NSF fee.
[31] IMO (2018). Resolution MEPC.304(72), Initial IMO Strategy on Reduction of GHG Emissions from Ships (aiming to implement IMO 2018).
[32] IMO adopts climate change strategy for shipping (18/03/2020)
[33] IMO Guidelines for the use of EEOI (26/02/2020)
[34] IMO Energy Efficiency Measures (27/07/2020)
[35] IMO (2020). Document ISWG-GHG 7/2/6 (Draft amendments to MARPOL Annex VI to incorporate the goal-based energy efficiency improvement measure utilizing Energy Efficency Existing Ship Index (EEXI)).
[36] DCS was adopted as amendments to MARPOL Annex VI by IMO (2016). Resolution MEPC.278(70), Amendments to MARPOL Annex VI, Data collection system for fuel oil consumption of ships.

important drivers of environmentally friendly maritime transportation, also in the Baltic Sea region where eight out of nine coastal countries are EU member states. A selection of the recent developments are highlighted below.

The availability of more environmentally friendly alternative fuels has been one area of EU level work. In January 2013, the European Commission launched the clean fuel strategy, which is an ambitious package of measures to ensure the build-up of alternative fuel stations across Europe with common standards for their design and use. The EU directive (2014/94/EU)[37] on the deployment of alternative fuel infrastructure was adopted in 2014 to ensure the build-up of alternative refuelling points across Europe. The directive sets regulatory rules for the following fuels: electricity, compressed natural gas (CNG), hydrogen and liquefied natural gas (LNG) and requires a minimum coverage to ensure accessibility of LNG in main maritime ports (i.e. core ports of the Trans-European Transport Network, TEN-T) by the end of 2025.

The EU system for monitoring, reporting and verification (MRV)[38] of CO_2 emissions from large ships using EU ports is a development parallel to, and catalyzing, the IMO DCS. From 1 January 2018 onwards, large ships[39] are to monitor and report their related CO_2 emissions, and other relevant information, such as fuel consumption, distance travelled, time at sea and cargo carried on a per voyage basis at ports in the European Economic Area (EEA). Large ships have these MRV obligations regardless of their flag or country of ownership, and whether loading or discharging cargo or passengers. A monitoring plan is obligatory for each complying ship, and the reported CO_2 emissions have to be verified by independent certified bodies and sent to a central database managed by the European Maritime Safety Agency (EMSA, THETIS-MRV[40]).

The new EU directive on PRF for the delivery of waste from ships, adopted in June 2019, [41] is a recent development related to PRF infrastructure. The new directive was the result of a lengthy revision process which was initiated in 2015. In the revised directive, the regional Baltic Sea NSF approach has been included in the revised 2019 EU PRF directive[41] for the purposes of reception of garbage (MARPOL Annex V). The Baltic Sea NSF concept will thus be applied in the whole EU for this type of waste. Relevant for this report, the directive includes the concept of green ships which will qualify for a mandatory economic incentive in the form of reductions in the waste fees collected by ports. In the context of the directive, such green ships refer to vessels that can demonstrate reduced quantities of waste and sustainable on-board waste management. According to the directive, the EU Commission will include a definition of such green ships in an implementing act by June 2020.

Finally, the European Commission proposal European Green Deal[42] was published in December 2019. The European Green Deal includes at least four proposals potentially of importance for the shipping sector: i) to extend the European

[37] EU (2014) Directive 2014/94/EU on the deployment of alternative fuels infrastructure. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0094&from=EN
[38] EU. 2016. Commission Delegated Regulation (EU) 2016/2071 of 22 September 2016 amending Regulation (EU) 2015/757 of the European Parliament and of the Council as regards the methods for monitoring carbon dioxide emissions and the rules for monitoring other relevant information
[39] over 5 000 gross tonnage (GT)
[40] EU-MRV system to report CO_2 emissions from ships according to the EU Regulation 2015/757 (06/03/2020)
[41] EU. 2019. Directive (EU) 2019/883 of the European Parliament and of the Council of 17 April 2019 on port reception facilities (PRF) for the delivery of waste from ships, amending Directive 2010/65/EU and repealing Directive 2000/59/EC
[42] EU. 2019. The European Green Deal COM(2019) 640 final (Brussels, 11.12.2019)

emission trading system to include GHG emissions from ships,[43] ii) onshore power supply (OPS) should be used when the ship is berthed,[44] iii) the current tax exemptions for marine bunkers will be reconsidered[45] and iv) the directive on alternative fuel infrastructure will be reviewed.[46]

European Green Deal includes an Investment Plan called the Sustainable Europe Investment Plan, which aims to mobilise at least €1 trillion of sustainability-related investments within the EU over the next decade, as both public and private investment.[47] A key instrument for this will be the InvestEU programme. As part of the Sustainable Europe investment plan, the EU Just Transition Mechanism will mobilise at least EUR 100 billion, to provide targeted support to regions, workers and sectors that are most affected by the transition towards the green economy.[48] The new climate strategy and Energy Lending Policy of the European Investment Bank (EIB) aligns lending with the Paris Agreement from the end of 2020. Among other measures this will mean a stop to the financing of fossil fuel energy projects from the end of 2021.

For partner countries the Green Deal includes an External Investment Plan (EIP) and the European Fund for Sustainable Development Plus (EFSD+) which will be available 2021-2027 with a new External Action Guarantee of up to €60 billion. The Guarantee is expected to leverage EUR 0.5 trillion worth of sustainable investments worldwide.

[43] EU. 2019. p.11 *"Similarly, the Commission will propose to extend European emissions trading to the maritime sector, and to reduce the EU Emissions Trading System allowances allocated for free to airlines. This will be coordinated with action at global level, notably at the International Civil Aviation Organization and International Maritime Organization."*
[44] EU. 2019. p.11 *"It [The Commission] will take action in relation to maritime transport, including to regulate access of the most polluting ships to EU ports and to oblige docked ships to use shore-side electricity."*
[45] EU. 2019. p.10 *"Fossil-fuel subsidies should end and, in the context of the revision of the Energy Taxation Directive, the Commission will look closely at the current tax exemptions including for aviation and maritime fuels and at how best to close any loopholes."*
[46] see European Green Deal (footnote 45) at 2.1.5 *Accelerating the shift to sustainable and smart mobility*
[47] EC. 2020. Consultation on the Renewed Sustainable Finance Strategy. (Opened 8.4.2020, to be closed by 15.7.2020).
[48] Launching the Just Transition Mechanism - for a green transition based on solidarity and fairness. Press release 15. January 2020. (16.3.2020)

4 Results of the literature review

This section presents the results of the literature review on existing economic incentives to promote investments in environmentally friendly maritime transport available in the countries of the Baltic Sea region. The material covers, and is grouped according to, the definition of economic incentives including: i) governmental and EU co-funding for environmental technology investments as well as a specific look at loans and guarantees, ii) charging measures such as taxes and environmentally differentiated fees (e.g. reduced port fees or fairway dues) as well as iii) other remaining measures. Environmental indexes, certifications and green labels will be covered in the context of environmentally differentiated fees.

A general finding of the literature review, and search of online resources, is that information on economic incentives for environmentally friendly shipping in the Baltic Sea region is not readily available in a compiled form. Even for specific topics, such as environmentally differentiated port fees, the overview of the situation in the Baltic Sea needed to be compiled manually from port websites and partial information included in (usually dated) project reports.

4.1 National co-funding for environmental investments

In general, national support schemes for environmentally friendly maritime transport include state aid for installations of environmental technology as well as research and development (R&D) grants for new innovations. Such schemes are commonly created in advance, or in the wake of new regulatory demands on environmental performance of maritime transport. These schemes are modified or discontinued as the policy context changes, and the technology matures.

In the case of EU member states, national state aid schemes have to comply with the relevant EU state aid guidelines.[49] These guidelines aim to enable supporting the achievement of environmental targets by reducing investment and operational costs of emerging technologies, while minimising market distortions by phasing out such support over time as the technology matures and costs fall. The national schemes are usually reserved to ships flying their flag, companies registered in the country, or both.[50] An example of national state aid type of support are the Finnish state aid aiming to fund installations of technology to enable meeting the stringent sulphur limits in marine fuels, which entered into force in 2015 (see Chapter 3.3).

Nevertheless, such direct state aid is relatively rare. A more common approach to promote new innovations for environmentally friendly maritime transport are the R&D projects funded by governmental or private foundations. Also, other governmental means, such as preferential tax treatment, are commonly used. Table 1 lists the national funding sources in the Baltic Sea region as identified in this study. Some more details on national arrangements are provided in the text below, which primarily focuses on support for piloting, demonstrations and full-scale investments of advanced technology.

National forms of conventional R&D funding are given less emphasis as this funding type is commonly based on a complex mix of governmental and private foundations, which rarely focus explicitly on maritime transport. In addition to public funding, private companies themselves make considerable investments in R&D as part of their regular activities.

[49] EU. 2014. Communication from the Commission — Guidelines on State aid for environmental protection and energy 2014-2020. OJ C 200, 28.6.2014, p. 1–55.
[50] Defined by being registered under the coastal state registry over a minimum qualifying period.

Table 1. A non-exhaustive list of the national funding sources for piloting/testing of new technology and investments on new environmentally friendly maritime technology as identified in this study.

Country	National maritime technology piloting funding (examples)	National maritime technology investment funding (examples)
Denmark	Energy Technology Development and Demonstration Programme (EUDP) The Danish Eco-Innovation Programme	The Danish Green Investment Fund (loans) Innovation Fund Denmark
Finland	Business Finland (e.g. Innovation aid for Shipbuilding)	Environmental investment support for vessels (2015–2020)
Germany	-	German LNG fuel programme for ships (2007–) Federal support program on the use of renewable electricity-based fuels (eFuels) in transport
Sweden	Sustainable shipping programme (Sjöfartsprogrammet)	Climate leap (Klimatklivet) Industry leap (Industriklivet) Ecobonus system (Ekobonussystemet)
Norway	-	ENOVA and the Norwegian Climate and Energy Fund NOx Fund 'Norwegian Ecobonus' (Tilskudd til godsoverføring fra vei til sjø)

4.1.1 Piloting and demonstration of green ship technology

Denmark

In Denmark, there is a rich ecosystem of support programmes for 'green' development and demonstration projects beyond regular R&D activities. Examples include the Energy Technology Development and Demonstration Programme (EUDP),[51] the Danish Eco-Innovation Programme,[52] the Danish Green Investment Fund[53] and the Innovation Fund Denmark.[54]

The Danish EUDP initiative aims to support private companies and universities to develop and demonstrate new energy technologies. Foreign project partners can also receive EUDP funding, but the lead applicant must be a company or university registered in Denmark. The support can be used for energy solutions such as renewable energy technologies or energy efficiency technologies.

The Danish Eco-Innovation Programme is explicitly designed for private sector applicants, therefore the public sector institutions are not eligible. Even if the scope of the programme is wide, ship technology projects are highlighted at least under the section for air pollution.[55]

[51] Information EUDP and other energy related support can be found from the site https://energiforskning.dk/en .(15.3.2020)
[52] Danish Eco-Innovation Programme (15.3.2020)
[53] The Danish Green Investment Fund (18.3.2020)
[54] Innovation Fund Denmark (18.3.2020)
[55] Luft (Description of the MUDP theme on air pollution in Danish) (15.3.2020)

The Green Investment fund provides public loans for financially viable green investments, whereas Innovation Fund Denmark promotes innovations with global success potential.

Other initiatives like the ShippingLab,[56] an innovation and project collaboration platform inked to the Blue Denmark policy initiative, and Green Ship of the Future[57] are also catalysing a sustainable transition in Danish shipping. Finally, private R&D funds, including the Danish Maritime Fund,[58] Orient's Fund[59] and Lauritzen Fonden[60] support maritime transport R&D initiatives.

Finland

A key Finnish public operator for sustainable shipping innovations is Business Finland[61] which provides innovation financing (lans and grants) and other services for Finnish businesses. Business Finland loans are intended for testing new innovative products or technologies or renewing existing ones. These loans for 7 or 10 years have an 1% interest rate and usually no collaterals and with the possibility of partial conversion to grant in the case of a failed project. Business Finland grants are intended for new, innovative research, which will not result in a finished product or service during project lifetime. The organization has a targeted programme on Innovation aid for Shipbuilding.[62] The aim of the programme is to enable innovative and advanced vessel or offshore solutions, partly by enabling market entry.

Sweden

The Swedish Transport Administration (Trafikverket) has invested on the research of sustainable and fossil-free shipping via the Sustainable shipping programme (Sjöfartsprogrammet). The programme is directed to pre-commercial procurement to create sustainable innovations within the transport system. From 2019 the Lighthouse Swedish Maritime Competence Centre manages the programme for research projects in 2019–2028.[63,64]

Vinnova[65], Sweden's innovation agency, does not have a dedicated programme for the maritime sector, but has provided funding for several projects on technological innovations for maritime transport.[66] The need for a dedicated Vinnova programme for maritime transport has been highlighted in a recent report in Sweden.[67]

4.1.2 Direct national investment aid for green ship technology

Germany

In Germany, the Ministry of Transport and Digital Infrastructure have since 2017 had in place a national program for the use of LNG as maritime fuel, covering both new ship and conversion of existing ships. The program is based on the federal government's Mobility and Fuel Strategy. By 2018 funds have been allocated to 17 ship conversions and new ships. The most recent call for the German LNG fuel

[56] ShippingLab (17.3.2020)
[57] Green ship of the Future (18.3.2020)
[58] Danish Maritime Fund (15.3.2020)
[59] Aktieselskabet Dampskibsselskabet Orient's Fond (17.3.2020)
[60] Lauritzen Fonden (17.3.2020)
[61] Business Finland (15.3.2020)
[62] Innovation aid for Shipbuilding (23.3.2020)
[63] Branschprogrammet Hållbar sjöfart. (15.3.2020)
[64] Sjöfartsprogram för 100 miljoner till Lighthouse. Press release 27.2.2019. (15.3.2020)
[65] Vinnova (23.3.2020)
[66] VINNOVA. 2011. Miljöinnovationer-Projektkatalog. Vinnova Information VI 2011:02. 51 pp.
[67] Anon. 2019. En hållbar framtid för sjöfart. p. 19

programme[68] for ships opened in 18 September 2019 and closed in 18 December 2019.[69] This call involved EUR 7 million targeted public funds.[70] This funding can be used to cover partially the extra investment required to enable the use of LNG as a marine fuel in new or existing ships. Both pure gas and dual-fuel solutions for main engine and in some cases also auxiliary engine projects are eligible. The program is open for ships operating mainly in EU waters and registered in Germany. The vessel may also be registered in another EU country, provided that the owner is German.

Besides the LNG program, also other federal government and federal state-level public funding programs are available in Germany for environmental measures in maritime transport. An example is the recent federal support program on the use of renewable electricity-based fuels (eFuels) in transport. Such eFuels refer to various fuels derived from hydrogen gas produced by renewable energy production via electrolysis. Hydrogen is transformed to fuels via methanization (methane) or synthetization (gasoline, diesel, methanol, kerosene).[71] Germany has also in place a federal program for innovative port technology, which has funded some environmental projects in ports.[72] Additionally, they are currently at the early stages of preparing funding measures for sustainable coastal shipping.

Finland

In Finland, a national regulation enables support on environmental investments on vessels during the period 2015–2020, [73] preceded by similar regulation covering the years 2010–2014. The co-funding related to this regulation must be applied via funding calls released by the relevant Ministry (dependent on the state budget and need). The current governmental act is in force until the end of 2020 and has not yet been fully analysed in terms of its final effectiveness. During the previous national state aid programme in 2010–2014, the Finnish Ministry of Transport and Communications granted in total EUR 60 million governmental state aid for environmental investments for ships.[74] The state aid was based on a national regulation issued in 2010 that targets new ships and on a revision from 2013 including also installations to existing ships (e.g. SO_X scrubbers) needed to meet the new regulations.[75] One underlying aim behind both of these initiatives was to buffer the Finnish maritime transport industry from the economic impact resulting from complying with the sulphur limit for fuel oil of 0.10% m/m of MARPOL Annex IV which entered into force 1 January 2015. During this period support was granted to cover extra costs from the elements of new ship and retrofit projects which were estimated to deliver higher level of environmental protection compared to the minimum requirements of all existing environmental regulations, including those emerging from IMO and EU frameworks.

[68] Richtlinie über Zuwendungen für Aus- und Umrüstung von Seeschiffen zur Nutzung von LNG als Schiffskraftstoff (15.3.2020)
[69] Zweiter Aufruf zur Antragseinreichung vom 18.09.2019 (15.3.2020)
[70] 11 Millionen Euro für IHATEC bis 2025 / 2. Förderaufruf für LNG-Antriebe bei Seeschiffen (15.3.2020)
[71] LBST & DENA. 2017. «E-FUELS» STUDY The potential of electricity-based fuels for low-emission transport in the EU.175 pp.
[72] Förderprogramm für innovative Hafentechnologien (IHATEC) (15.3.2020)
[73] Environmental investment support for vessels 2015-2020
[74] Gaia. 2017. Alusinvestointien ympäristötukien vaikuttavuuden arviointi. Loppuraportti Liikenne- ja viestintäministeriölle [*in Finnish, Consultancy report commissioned by the Finnish Ministry of Transport and Communications on the effectiveness of national state aid for environmental investments in Finland 2010-2014*].
[75] Anon. 2010. Asetus alusten ympäristönsuojelua parantavien investointitukien yleisistä ehdoista (946/2010) (a Finnish national regulation for the general terms of investment aid to improve environmental protection)

Sweden

In Sweden, governmental co-funding is available for companies and industry within different frameworks, such as Climate leap (Klimatklivet)[76] and the related Industry leap (Industriklivet)[77]. These co-funding frameworks are not specially directed to projects within the shipping industry but are open for application for shipping related projects.

The climate act framework Climate leap (Klimatklivet) has been established by the Swedish Environmental Protection Agency (Naturvårdsverket) to support local and regional actions to reduce GHG emissions.[76] Swedish parliament has granted a total of SEK 4.7 billion during the years 2015–2018 and has decided to allocate SEK 1.9 billion for investment aid for 2020. By 2 December 2019 the Klimatklivet framework has funded 3 167 climate actions.[76,78] So far, the shipping related projects funded via Klimatklivet have dealt with adding or improving the electricity and district heating connections at ports.

Additionally, the Swedish Government has initiated a 'Ekobonussystemet' programme based on the Italian ECOBONUS model[78] with the aim to encourage the shift of freight transport from road to sea to reduce emissions. The system was introduced in 2018 with a yearly budget of SEK 50 million for the period 2018–2020 allocated by the Swedish government. In Sweden, the Swedish Transport Administration (Trafikverket) manages Ecobonus and examines the applications. The funding targets shipowners with ships registered in a member state of the EEA and with at least some operation in a Swedish port. The support can be used to cover costs of operation or investment related to equipment for transhipments to provide the planned transport system.[79]

Norway

The key national source for investments in green ship technology is Enova[80] - a state enterprise owned by the Norwegian Ministry of Climate and Environment. One of the main tasks of Enova is to support energy and climate actions for GHG emissions reduction via the Climate and Energy Fund, with a budget of more than 3 billion NOK in 2019 out of which transport projects are roughly one third with a large share for maritime.[81] The aim is to support technologies and projects which may create permanent market change. They have own programmes for the onshore power investments and for electrification of maritime transport. Since 2015 Enova has funded NOK 1.6 billion worth of vessel projects, out of which 1.5 billion involved low-or zero emission vessels with battery technology. The support is only for companies owned in Norway but the vessel itself does not have to have Norwegian flag. The maximum support for innovative new technologies is 40% and for other investments 30%. [81]

Norway adopted in 2017 a support system, which follows the Ecobonus model also in use in Sweden (see above). The initiative is called *Tilskudd til godsoverføring fra vei til sjø* and aims to catalyse a modal shift from roads to ship traffic. It is administrated by the Norwegian Coastal Administration (Kystverket) under the

[76] Klimatklivet (16.3.2020)
[77] Regeringskansliet, pressmeddelande från Miljödepartementet, Infrastrukturdepartementet 6 September 2019 (20/03/2020)
[78] Ansök om ekobonus – miljökompensation för överflyttning av gods till sjöfart. (16.3.2020)
[79] EU 2019 State Aid SA.50217 (2018/N))– Sweden Swedish Eco-bonus scheme for short sea shipping and inland waterway transport in Authorisation for State aid pursuant to Articles 107 and 108 of the Treaty on the Functioning of the European Union — Cases where the Commission raises no objections (2019/C 14/01). Official Journal of the European Union Volume 62 (published 11.1.2019). p. 3
[80] Enova (16.3.2020)
[81] Anon 2019 The Government's action plan for green shipping. Norwegian Government. 71 pp. see also the related news release "The Norwegian Government's action plan for green shipping" (31.3.2020).

Ministry of Transport.[82] The support system can cover up to 30% of the operative costs for a maximum duration of 3 years or 10% of the investment costs of the equipment needed for transhipments.[83]

Norwegian authorities agreed on an innovative way to collect funds into a NOx Fund; those liable to pay the NO_X tax were given the option to join and donate to the NO_X Fund. The assets of this fund were open for applications by the fund members to enable their investments in technology for further NO_X emission reduction. [84] Via a link to the NO_X tax, the NOx Fund support for environmental investments does not infringe the EU state aid rules which oblige both EU and EFTA (e.g. Norway) member states.[85,86]

The NOx Fund linked to the NOx tax is also an important source of funding for green ship technology investments in Norway. During 2008–2019 the fund co-funded 1 330 projects to reduce NO_X emissions with a total sum of NOK 4 400 million. The Fund estimates that the cumulative reductions achieved with these projects are 39 000 tonnes NO_X and over 1 million tonnes CO_2.[87]

4.2 EU co-funding for environmental investments

There is a number of EU level mechanisms in place to support the development and adoption of environmentally friendly technologies within maritime transport.[88] These can be roughly divided to R&D funding[89,90], various EU co-funding instruments enabling green infrastructure developments[91], European Investment Bank (EIB) bank loans[92], and related arrangements for guarantees for green technology investments[93]. This kind of funding for maritime transport investments and research is generally limited to legal entities, vessels and installations based in EU member states.

4.2.1 European research and innovation funding

Horizon 2020 and Horizon Europe

Horizon 2020[94] was the first EU Research programme with a dedicated innovation component, with nearly EUR 80 billion of funding available over seven years (2014–2020). Horizon 2020 couples research and innovation with emphasis on excellent science, industrial leadership and tackling societal challenges.

[82] Tilskudd til overføring av gods fra vei til sjø (16.3.2020)
[83] cf. "8. Støttetak" in the regulatory instrument "Retningslinjer for tilskudd til godsoverføring fra vei til sjø" (16.3.2020)
[84] About Nox Fund (03/02/2020)
[85] Jordal-Jørgensen, J. (2012). Reducing Air Pollution from Ships. The Danish Environmental Protection Agency Environmental Project no. 1421. 121 pp.
[86] EFTA Surveillance Authority (05/03/2020)
[87] Historien om NOx-fondet -Hva har NOx-fondet oppnådd (16.3.2020)
[88] see e.g. Annex 1 of ESSF (2017) Document 5a Update to the Final Report Submission from ESSF Sub-Groups (ESSF sub-group on Financing). European Sustainable Shipping Forum 7th Plenary Meeting Brussels, 24 January 2017. 150 pp.
[89] e.g. Horizon 2020 and, in the Baltic Sea, the regional BONUS research funding
[90] based on Article 185 Treaty on the Functioning of the European Union, TFEU
[91] e.g. Connecting Europe Facility (CEF)
[92] e.g. Green Shipping Loan Programme
[93] Green Shipping Guarantee Programme (GSG)
[94] Horizon 2020 (15.3.2020)

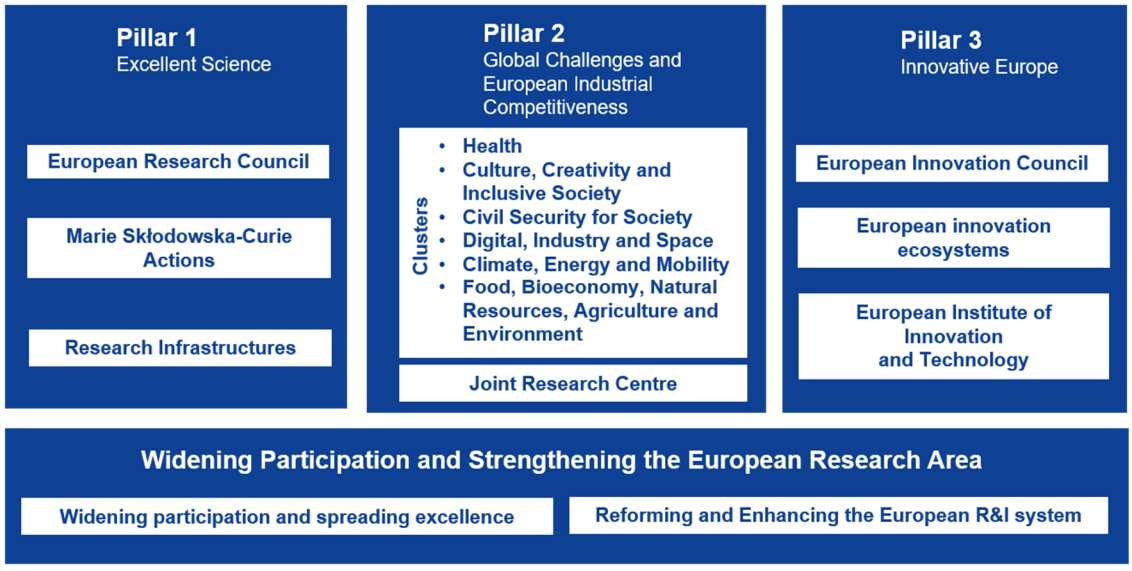
Example case: Norsepower Ltd

As a concrete example of technology mobilization via Horizon 2020[95] funding, the Finnish company Norsepower Ltd[96] received ca. EUR 1.58 million in grant funding from the SME instrument of the H2020 programme to implement their rotor sail solution in full scale on a RoPax vessel to validate the performance of the solution and receive type approval of the technology.[97] The system was installed on Viking Grace in April 2018[98], making it the first-ever global LNG/wind electric propulsion hybrid ship.

Already in 2014–2015, Norsepower had received national co-funding from the Finnish Funding Agency for Technology and Innovation (Tekes; later Business Finland) for installing rotor sails to M/V Estraden, a RoRo vessel of Bore Ltd. (Spliethoff group), to demonstrate the technology in commercial scale for the first time.[99]

The Commission's proposal for the next framework programme, named Horizon Europe, for the years 2021–2027 (Figure 5) is an ambitious EUR 100 billion research and innovation programme to succeed Horizon 2020.[101] The European Parliament and the Council of the EU reached in March and April 2019 a provisional agreement on Horizon Europe. The European Parliament endorsed the provisional agreement on 17 April 2019. Following the political agreement, the Commission has begun a strategic planning process based on global challenges and European industrial competitiveness.[101]

Horizon Europe is based on partnerships with EU countries, the private sector, foundations and other stakeholders. The aim is to deliver on global challenges and industrial modernisation through concerted research and innovation efforts. One of these partnerships is a co-programmed partnership for zero-emission waterborne transport,[100] establishing a continuous dialogue on maritime industry in Europe involving all relevant actors.



[95] The goal of Horizon 2020 is to ensure Europe produces world-class science, remove barriers to innovation and make it easier for the public and private sectors to work together in delivering innovation.
[96] Norsepower (17.3.2020)
[97] RotorDEMO H2020 project (17.3.2020)
[98] Fresh winds with the new rotor sail (17.3.2020)
[99] Business Finland (17.3.2020)
[100] Waterborne Technology Platform (15.3.2020)

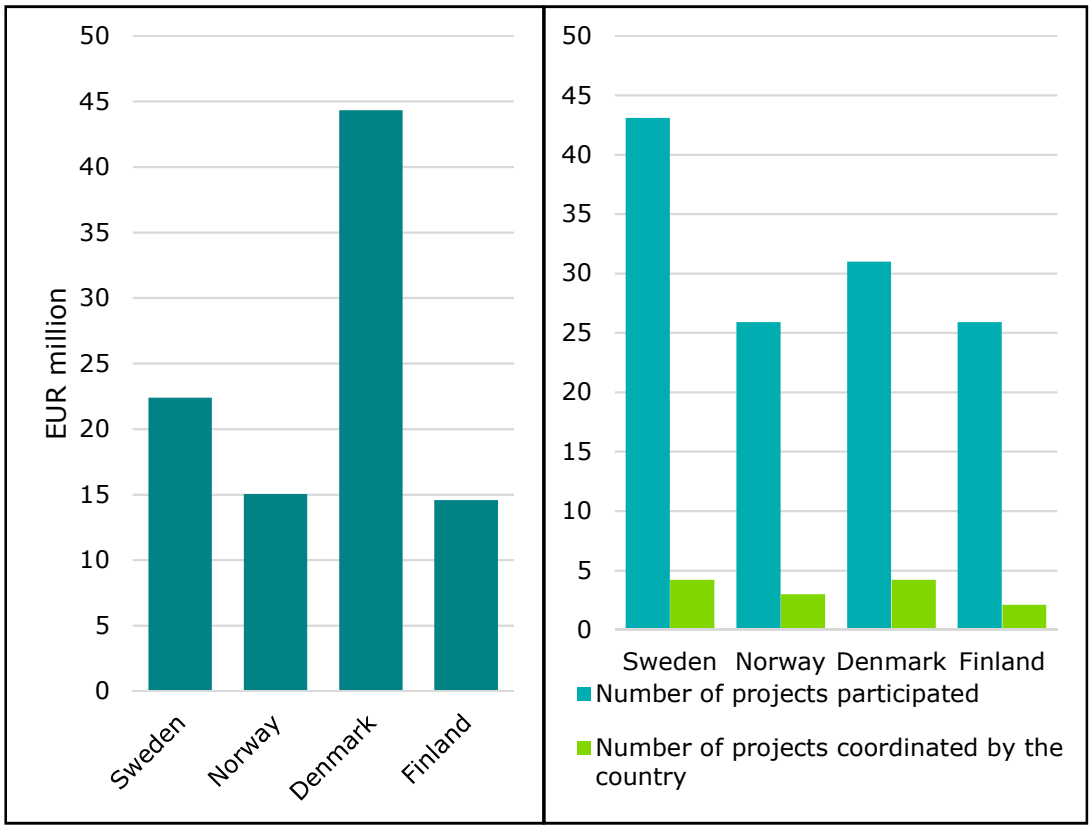
Figure 5. Preliminary structure of the upcoming Horizon Europe research funding programme.[101]

EIC Accelerator

The EIC Accelerator[102,103] is part of the European Innovation Council (EIC)[104] pilot that supports top-class innovators, entrepreneurs, small companies and scientists with funding opportunities and acceleration services. The EIC Accelerator supports high-risk, high-potential small and medium-sized enterprises (SME) and innovators to help them develop and bring onto the market new innovative products, services and business models that could drive economic growth. Selected companies receive funding and optional equity and are offered business coaching and mentoring to scale up their innovation idea. They get extra acceleration services to connect with investors, corporates and likeminded entrepreneurs.

Example case: Distribution of maritime funding in the Nordic countries (Kihlström et al. 2017)

In a report by the Swedish research network Lighthouse, Kihlström et al. 2017 presented data according to which the available resources of maritime research is very unevenly distributed even among Sweden, Denmark Finland and Norway, three countries with similar vested interests in maritime economy.[105] Even if comparable figures were not available, the differences in level of national funding would likely be even bigger in case other coastal countries of the Baltic Sea would have been included. The four mentioned countries are more similar in terms of the number of Horizon 2020 projects participated in and coordinated (Figure 6). Nevertheless, partners in Denmark had in total a significantly larger budges share in Horizon 2020 maritime projects compared to the other three countries.



[101] Horizon Europe research funding programme
[102] EIC Accelerator (15.3.2020)
[103] previously known as the SME instrument
[104] European Innovation Council (15.3.2020)
[105] Kihlström et al. 2017. Kartläggning och analys: Nordisk sjöfartsforskning, innovation, utveckling och demonstration 2015 – 2017. Lighthouse. 230 pp.

Figure 6. The total amount received for maritime research projects within the Horizon 2020 framework (left) and the number of secured Maritime related Horizon 2020 research projects during 2015–2016 (right). The red bars represent the number of projects coordinated from the country in question in the Nordic countries. Data from Kihlström et al. (2017).[105]

4.2.2 European co-funding for transport infrastructure: Connecting Europe Facility (CEF)

The Connecting Europe Facility (CEF)[106] is a key EU funding instrument to promote growth, jobs and competitiveness through targeted infrastructure investment at European level. It supports the development of high performing, sustainable and efficiently interconnected trans-European networks in the fields of transport, energy and digital services. CEF investments fill the missing links in Europe's energy, transport and digital backbone. CEF programme budget for 2014–2020 has been in total EUR 30.4 billion (EUR 23.7 billion for Transport, EUR 4.7 billion for Energy, and EUR 0.5 billion for Telecom). The CEF for Transport is the funding instrument to implement the European Transport Infrastructure Policy and the Trans-European Transport Network (TEN-T).

TEN-T is a network which comprises roads, railway lines, inland waterways, inland and maritime ports, airports and rail-road terminals throughout the member states. TEN-T policy aims to close the gaps between member states' transport networks and remove bottlenecks. It promotes and strengthens seamless transport chains for passenger and freight, while keeping up with future technology trends. TEN-T consists of two planning layers: core network to be completed in 2030 and comprehensive network in 2050.

CEF Transport aims at supporting investments in building new transport infrastructure in Europe or rehabilitating and upgrading existing infrastructure. The programme focuses on cross-border projects and projects aiming at removing bottlenecks or bridging missing transport links in the whole EU. The programme specifies European transport networks, both on the minimum level of core network and in terms of the more extended comprehensive network. CEF Transport includes also horizontal priorities such as Motorways of the Sea (MoS) which is the maritime extension of the TEN-T land corridors. As a horizontal priority, MoS promotes green, viable, attractive, and efficient sea-based transport links integrated in the entire transport chain. The EU’s goal is to achieve a clean, safe, and efficient transport system by transforming shipping into a genuine alternative to overcrowded land transport.

CEF Transport also supports innovation in the transport system in order to improve the use of existing infrastructure, reduce the environmental impact of transport, enhance energy efficiency and increase safety. CEF Transport has co-financed e.g. additional environmental investments of maritime vessels, piloting of innovative emission saving technologies and deployment of alternative fuels infrastructure.

The total budget for CEF Transport was EUR 24.05 billion for the period 2014–2020.[107] This funding is divided for four transport categories: rail, road, air and maritime with a major share of the grants allocated to rail traffic. However, the CEF transport programme has also included many maritime projects in the Baltic Sea region, some of which are presented in Table 2 and in Table 3.

Poland and Finland have received the most of the grants for CEF Transport Maritime within the Baltic Sea region, EUR 147.8 million and EUR 109.4 million, respectively from 2014 until July 2019 (Figure 7). The Maritime priority includes all maritime related projects e.g. port infrastructure development, ice breaking and

[106] Connecting Europe Facility (6.3.2020)
[107] INEA Connecting Europe Facilities (03/02/2020)

environmental investments of vessels. This includes also specific Motorways of the Sea (MoS) projects which involve always at least two member states and is either upgrading or establishing new maritime link between two maritime ports with an involvement of a shipowner or is having a wider benefit project with regional or EU value. The most of the MoS projects have been environmentally upgrading the existing maritime links including e.g. investments in emission abatement technologies, alternative fuels and OPS.

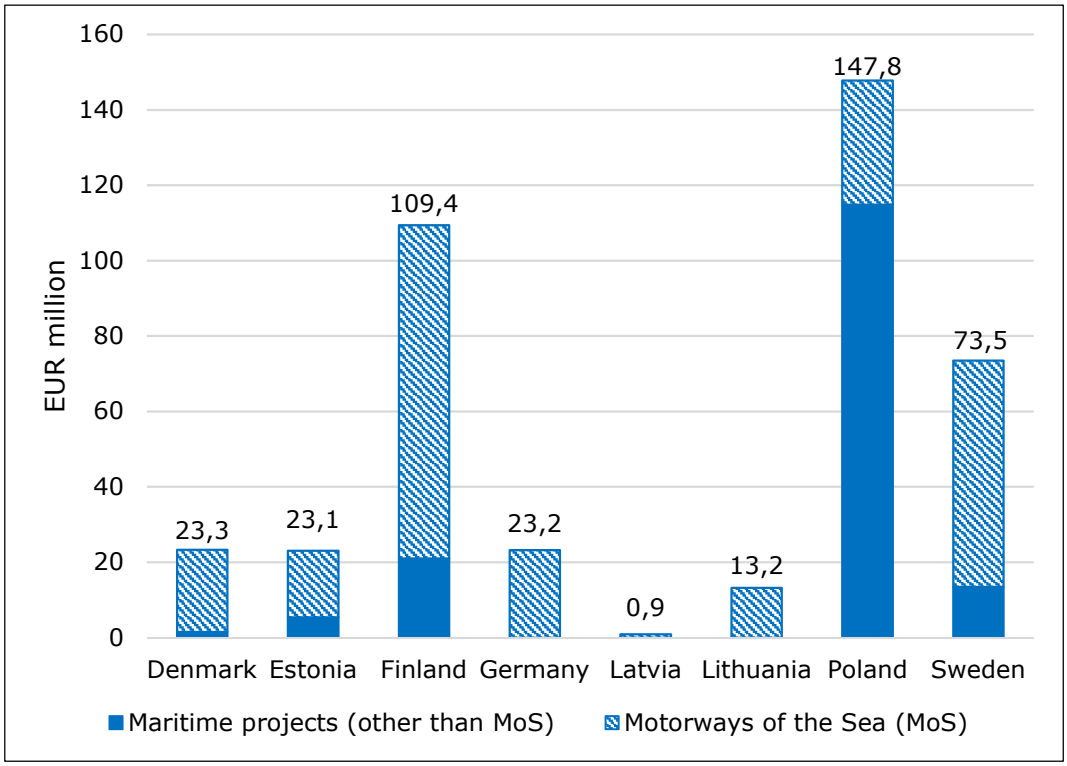


Figure 7. The total Connecting Europe Facility (CEF) funding for the maritime sector (EUR million) in the Baltic Sea region during 2014–2019. The striped area shows the share of Motorways of the Sea (MoS) projects, which is a priority under the general framework of CEF Transport grants.[108]

[108] CEF Transport projects by country (18/02/2020)

Table 2. Examples of maritime projects in the Baltic Sea region funded via the CEF transport programme in 2014.

Country Project number	Name	Co-funded vessel related investments	EU CEF co-funding in EUR
Finland, Germany 2014-EU-TM-0379-M	Back from Black - Study and deployment of the affordable scrubber retro fitting technology for SME shipowners	The project introduced to the market a new hybrid scrubber product to tackle exhaust gas abatement and wash water cleaning technology. The hybrid scrubber was piloted and installed onboard four vessels together with additional port infrastructure investments.	5 582 008
Finland, Germany 2014-EU-TM-0391-M	Upgrading and sustaining the competitive core Baltic MoS link Helsinki-Lübeck	Additional to the port infrastructure investments, the project included the installation of open-loop hybrid ready wet scrubber systems and new blades and rudder systems on board of the four very large RoPax ships.	7 781 805
Denmark, Sweden 2014-EU-TM-0489-S	Zero Emission Ferries - a green link across the Öresund	The Action covered the introduction of new and innovative concepts and technology by converting two existing complex RoPax ships - originally fuelled by heavy oil - to plug-in all electric powered operation using exclusively batteries. In conjunction with the ship conversion, the required power provision and charging installations in the ports/ferry terminals were realised.	13 150 000
Finland, Germany 2014-EU-TM-0507-M	Upgrading and sustaining the competitive Baltic MoS link Germany-Finland (RoRo multiple ports loop)	vessel was equipped with a wet-type open-loop hybrid ready emission abatement technology. In addition, energy efficiency measures were installed on the same vessels for optimising bunker consumption and minimising the emission of greenhouse gases from the ships.	4 939 846
Denmark, Germany 2014-EU-TM-0520-M	Motorway of the Sea Rostock-Gedser - Part 2	The Action upgraded and enlarged the maritime capacity of the Rostock-Gedser Motorway of the Sea link. It included conversions of two new RoPax vessels to ensure environmental and efficiency compliance and the required adjustment and improvement works in the TEN-T ports of Gedser (Denmark) and Rostock (Germany).	6 331 500

Table 3. Examples of maritime projects in the Baltic Sea region funded via the CEF transport programme in CEF Transport calls 2015–2017.

Country Project number	Name	Co-funded vessel related investments	EU CEF co-funding in EUR
Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Sweden 2015-EU-TM-0132-M	FAMOS Odin: Finalising Surveys for the Baltic Motorways of the Sea	The Action is part of a Global Project aiming to complete hydrographic surveying in an area of approximately 26000 km² of the Baltic Sea according to the BSHC-HELCOM scheme, thereby supporting sustainable and safe shipping in the Baltic Sea and contributing to Blue Growth in the region.	10 789 590
Finland, the Netherlands, Germany, UK 2015-EU-TM-0098-M	DOOR2LNG - Upgrade of the maritime link integrated in the multimodal container transport routes	Additional to the port infrastructure investments, the project is equipping four newly built, larger vessels with the latest innovations around dual-fuel LNG engine technology and energy efficiency.	16 958 000
Finland, Sweden 2015-EU-TM-0178-M	Bothnia Bulk - Environmental upgrade of year-round supply in the northern Baltic Sea	Additional to the port infrastructure investment, the project includes procurement of additional environmental efforts (LNG, onshore power) for two new build bulk carriers.	6 800 000
Finland, Sweden 2016-EU-TM-0092-W	NextGen Link - Upgrade of the maritime link with the port interconnection in the ScanMed Corridor	Additional to the port infrastructure investments, the project introduces LNG-powered RoPax vessels to the maritime link.	11 778 630
Denmark, Sweden 2016-EU-TM-0256-W	Nordic Maritime Link - Connecting the ScanMed Corridor via Integrated MoS	Additional to the port infrastructure investments, a hybrid electric battery package will be installed aboard Stena Jutlandica (works) which will replace the auxiliary engine of the RoPax ferry.	3 780 000
Estonia, Finland 2017-EU-TM-0135-W	TWIN-PORT 3	Additional to the port infrastructure investments, three shipping lines operating the route will retrofit 5 vessels enabling the use of Onshore Power Supply (OPS) in ports thus diminishing their environmental impacts.	18 357 255
Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Sweden 2015-EU-TM-0132-M	FAMOS Odin: Finalising Surveys for the Baltic Motorways of the Sea	The Action is one part of the long-term FAMOS project aiming to complete hydrographic surveying in an area of approximately 26000 km² of the Baltic Sea according to the BSHC-HELCOM scheme, thereby supporting sustainable and safe shipping in the Baltic Sea and contributing to Blue Growth in the region.	10 789 590

The CEF funding programme will enter its second generation, so-called CEF2, in 2021. EUR 30.6 billion has been earmarked for transport investments of the CEF.[109] Compared with the first CEF, the new proposal seeks to speed up the decarbonisation and digitalisation of EU economy by better integrating the transport, energy and digital sectors, and to help achieve EU climate objectives. It should also support the creation of jobs, economic growth and the deployment of new technologies. In transport, the focus shifts to decarbonisation and making transport connected, sustainable, inclusive, safe and secure. As a part of the next long-term EU budget (2021–2027), the European Commission proposed on 6 June 2018 that CEF should be renewed.

4.2.3 European structural and investment funds (ESIF)

European structural and investment funds (ESIF) have had ca. EUR 450 billion available for the member states and their regions in 2014-2020. ESIF invests in job creation and a sustainable European economy and environment via five funds: European social fund, Cohesion fund, European agricultural fund for rural development, European maritime and fisheries fund (EMFF) [110] and European regional development fund (ERDF).[111]

The EMFF has allocated in total EUR 6 400 million in 2014–2020 for implementing the EU's maritime and fisheries policies.[112] Member states manage 89% and the European Commission manages 11% of the funded projects. Furthermore, 98.8% of the EMFF is support for the implementation of various fisheries related actions and activities, the remaining 1.2% is funding for integrated maritime policy (including e.g. maritime transport). EMFF has launched a new call 'Blue Economy Window' supporting the blue economy SMEs with a total budget of EUR 22.5 million. The call was opened in November 2019 and closed in February 2020.[113] The BlueInvest Community will offer a new comprehensive service package of which the Blue Economy Window will be a part of and thus the grants are also branded as 'BlueInvest Grants' which covers also the topic of environmental ship technology.[114,115]

The most relevant instrument within the ERDF for maritime sector is Interreg[116], which is one of the key instruments of the EU supporting cooperation across borders through project funding. Its aim is to jointly tackle common challenges and find shared solutions in fields such as health, environment, research, education, transport, sustainable energy and more. 2014–2020 is the fifth period of Interreg, the Interreg V. In accordance with the new design of the EU cohesion policy and the targets set out in Europe 2020 strategy, Interreg has been significantly reshaped to achieve greater impact and an even more effective use of the investments. Key elements of the reform are concentration, simplification and result orientation. Interreg V is based on 11 investment priorities (thematic

[109] MFF -Proposal for a regulation establishing the Connecting Europe Facility "(…) In transport, the focus shifts to decarbonisation and making transport connected, sustainable, inclusive, safe and secure. The proposed transport budget consists of three parts. As in the first CEF, there is the general transport envelope of €12.8 billion and €11.3 billion earmarked in the Cohesion fund, to be implemented under the CEF on projects in EU countries eligible for cohesion funding. An additional €6.5 billion, earmarked in the security and defence budget, is also to be implemented under the CEF. (…)" (6.3.2020)
[110] European Maritime and Fisheries Fund fact sheet (15.3.2020)
[111] European structural and investments funds (06/03/2020)
[112] European Maritime and Fisheries Fund (EMFF) (06/03/2020)
[113] EU Blue Economy Window call (05/03/2020)
[114] BlueInvest Community platform (06/03/2020)
[115] EU 2020 2019 European Maritime and Fisheries Fund Info Day (15.3.2020)
[116] Interreg (15.3.2020)

objectives); e.g. Interreg Europe[117], Interreg Baltic Sea Region[118] and Interreg Central Baltic[119] programmes for regional projects.

4.2.4 Funding for environment and climate action: LIFE

LIFE programme is EU's funding instrument structured in two sub-programmes: environment and climate action. The funding period 2014–2020 has a budget of EUR 3.4 billion, of which 75% is directed for the environment and 25% for the climate action sub-programmes[120]. The sub-programme for environment supports projects on biodiversity conservation, environmental protection and resource efficiency, and environmental governance and information. The sub-programme for climate action funds projects on climate change mitigation and adaptation as well as climate governance and information.

Maritime transport projects are eligible for LIFE funding, especially within the climate action sub-programme. LIFE funding support primarily solution-oriented projects involving technologies that are close to market in industrial or commercial scale.

4.2.5 Regional instruments

The Baltic Sea Action Plan (BSAP) Fund, a regional funding mechanism established to finance the implementation of the HELCOM BSAP, supports a wide scope of concrete initiatives with smaller grants. The BSAP fund portfolio includes also some sustainable shipping projects. The BSAP fund is managed jointly by two international financial institutions in the region: The Nordic Environment Finance Corporation (NEFCO)[121] and the Nordic Investment Bank (NIB).[122]

BONUS is a special type of regional EU co-funded research and development programme, which is based on Article 185 of the Treaty on the Functioning of the European Union (TFEU).[123] It has been established as a joint venture by the national research funding agencies in the Baltic Sea coastal countries, supported by the EU. Several recent BONUS projects, such as STORMWINDS[124], BALTIMARI[125] and SHEBA[126], have focused on improving the environmental performance and safety of maritime transport in the Baltic Sea region.

The EU Strategy for the Baltic Sea Region (EUSBSR) and its policy areas (PAs), such as PA SHIP for the Baltic Sea region to become a model region for clean shipping, support projects by awarding flagship status for specific regional priority initiatives. This has included the SHEBA project, which assessed the environmental impacts of shipping in the to an unprecedented detail.[127]

4.3 Loans and guarantees for ship investments

Replacing old ships with new tonnage is an effective way to cut emissions from maritime transport. However, new ships require a strong economy as well as long

[117] Interreg Europe (15.3.2020)
[118] Interreg Baltic Sea Region (15.3.2020)
[119] Interreg Central Baltic (15.3.2020)
[120] LIFE programme 09/03/2020
[121] Nordic Environmental Financing Corporation NEFCO (16.3.2020)
[122] Nordic Investment Bank NIB (16.3.2020)
[123] Article 185 TFEU allows the EU to participate in research programmes jointly undertaken by several EU countries.
[124] Stormwinds (9.3.2020)
[125] BONUS BALTIMARI-Review, Evaluation and Future of Baltic Maritime Risk Management. (9.3.2020)
[126] Sustainable Shipping and Environment of the Baltic Sea region (SHEBA). (9.3.2020)
[127] Information on the completed BONUS SHEBA project (30.3.2020)

term commitments spanning several decades. Further, building new ships require often financing from banks, which can be very challenging to receive today due to the existing overcapacity in the world commercial fleet. Other developments influence as well, for example, the upcoming more stringent international capital requirements of banks, as part of the work on the Basel Framework on regulation of banks.[128]

At the same time, public and private banks worldwide are increasingly required to include environmental considerations in their lending policies and accordingly have started to investigate the environmental responsibility of a shipowner. As a related development the needed criteria for projects qualifying for such green financing considerations have been increasingly specified in global initiatives and standards. These include for example Equator principles[129], Poseidon principles (2019–)[130], the Green Loan principles[131] and Sustainability-Linked Loan Principles[132] of the Loan Market Association (LMA). Customers of banks financing maritime transport projects are also making their own proactive steps to support their green transition efforts.

Example case: Maersk syndicated credit facility 2020

A prominent example is the Danish shipping company Maersk, which has recently linked the interest rates of a syndicated credit facility to the progress in reaching its own emission reduction plans with a goal of carbon neutral shipping by 2050. Maersk has negotiated this deal with a group of private sector banks.[133] As the world's largest container shipping company its decisions are of importance for the whole sector.

The relatively ambitious EU environmental policy has also been visible in the lending policy of the European Investment Bank (EIB) for maritime transport projects. EIB provides financial support to the commercial shipping sector and its transition to sustainable transport solutions based on the evolving policy agenda. As an example, until recently LNG ship projects were identified as fully compliant in terms of EIB and EU Commission policies.[134] However, according to the EIB's new energy lending policy from November 2019, financing the production and infrastructure of all fossil fuel (including LNG) will end by 2021 and the relevant instruments will be reserved to accelerating clean energy innovation, energy efficiency and renewables.[135]

The EIB support is provided via two main instruments: loans and guarantees. Targeted financial instruments for sustainable shipping in both categories were

[128] Changes to the Basel Framework agreed in 2016 & 2017 and foreseen to enter into force by 2022 (sometimes called "Basel IV"). The Based Framework is a set of international standards on regulation of banks agreed by the Basel Committee on Banking Supervision (BCBS), consisting of a group of national banks worldwide.
[129] Equator Principles website (15.3.2020)
[130] Poseidon principles website (15.3.2020)
[131] Green Loan Principles, International Capital Market Association (IMCA), December 2018 (15.3.2020)
[132] Sustainability Linked Loan Principles, International Capital Market Association (IMCA) (15.3.2020)
[133] Maersk credit facility linked to environmental performance , Lloyds list intelligence (3.3.2020)
[134] ESSF (2017) Document 5a Update to the Final Report Submission from ESSF Sub-Groups (ESSF sub-group on Financing). European Sustainable Shipping Forum 7th Plenary Meeting Brussels, 24 January 2017. 150 pp.
[135] EIB. 2019. EU Bank launches ambitious new climate strategy and Energy Lending Policy. Press Release 14 November 2019 (15.3. 2020)
e.g. §19 on p.15: "(…) this means that the Bank will not support upstream oil or natural gas production, coal mining, infrastructure dedicated to coal, oil and natural gas (networks, liquefied natural gas terminals, storage).(…) "

developed within the financing working group of the European Sustainable Shipping Forum (ESSF).[136]

The Green Shipping Guarantee (GSG) programme[137] was initially launched in 2016 and aims to facilitate investments in environmental technologies, which enable surpassing EU and IMO regulatory requirements. Eligible projects include both new ships and retrofits with developments, such as LNG engine systems, ballast water treatment related equipment and energy efficiency improvements. The GSG is not based on grants but provides guarantees for loans which the shipowner applies from commercial banks, up to a total sum of 750 million euro. It is based on framework partnership agreements between EIB and banks, first of which was signed in 2016.

The GSG operates within the economic framework of CEF, the TEN-T guidelines and the European Fund for Strategic Investments (EFSI).[138] EFSI is an initiative launched jointly by the EIB Group – the European Investment Bank and the European Investment Fund – and the European Commission to help overcome the current investment gap in the EU. EFSI is one of the three pillars of the Investment Plan for Europe that aims to revive investment in strategic projects around the continent to ensure that money reaches the real economy.

An EIB instrument closely related to GSG is the Green Shipping Programme Loan (2016–)[139] which refer to loans for smaller ship projects. These should fulfil the criteria of falling under EIB transport policy, having significant European value and contributing to a transition for sustainable shipping.

Larger maritime projects can also get regular EIB financing based on the general transport criteria. Maritime examples of such regular EIB loans include projects for port developments such as the 2020 decision for a loan to a Ferry terminal project in Ystad, southern Sweden,[140] as well as for ships such as the 2019 loan of EUR 110.4 million for the installation of exhaust gas cleaning systems and ballast water management systems on-board 42 vessels by the Dutch shipowner Spliethoff.[141]

In addition to the EIB there exists also other similar public sector banks active in the Baltic Sea region, including the Nordic Investment Bank (NIB) which is based on agreement between Nordic and Baltic countries. NIB has similar aims to provide green financing as EIB. Besides lending, NIB is also involved in administering regional grants such as the NEFCO BSAP fund which funds smaller environmental initiatives to implement measures of the HELCOM Baltic Sea Action Plan.

4.4 Taxation as a means of environmental policy

Environmental taxes are financial charges imposed on taxpayers by a governmental organization in order to promote more environmentally friendly behaviour. This includes tax categories, such as emission taxes (taxation of measured or estimated pollution emissions) and fuel/energy tax (a tax on the use of fuel or energy, a proxy of emissions). Other types exist as well, such as the environmentally differentiated tonnage tax, which in Portugal and Norway base on the environmental performance

[136] ESSF. 2017. Document 5a Update to the Final Report Submission from ESSF Sub-Groups (ESSF sub-group on Financing). European Sustainable Shipping Forum 7th Plenary Meeting Brussels, 24 January 2017. 150 pp.
[137] Green Shipping Guarantee Programme (15.3.2020)
[138] EFSI-European Fund for Strategic Investments (15.3.2020)
[139] Green Shipping Programme Loan (15.3.2020)
[140] Port of Ystad Infrastructure (15.3.2020)
[141] EIB. 2019 Netherlands: Investment Plan for Europe - ING and EIB provide EUR 110m for Spliethoff's Green Shipping investments. Press release 28.2.2019 (15.3.2020)

of the fleet.[142] In addition, targeted reductions to these and other taxes can be used to create incentives. This includes measures such as a reduced energy tax for the use of OPS as an alternative to power generation with auxiliary engines when berthed. Fuel taxes are not applied in EU countries for maritime transport as direct taxation of marine or aviation fuel is currently not allowed within the EU.[143]

4.4.1 Norwegian NO_X emission tax

An example of emission taxes in the context of maritime transport is the Norwegian NO_X emission tax introduced in 2007. The tax applies to all NOx exhaust gas emissions whether on land or at sea[144] and is calculated based on kg NO_X emitted (Table 4). Even if Baltic Sea coastal countries such as Sweden and Denmark have similar taxes on NO_X emissions in place, the Norwegian version is different as it also covers both maritime transport and aviation. At sea the Norwegian NO_X tax covers all maritime transport (domestic and foreign) within the territorial waters of Norway, traffic between Norwegian ports as well as traffic of Norwegian flagged vessels in traffic within the Norwegian Exclusive Economic Zone (EEZ).[145]

Besides working as an overall incentive to reduce emissions, the Norwegian NO_X tax system is also an example of 'tax and funding', also called Refundable Emission Payment (REP),[218] as it enabled the establishment and operation of a dedicated fund for environmental technology, the NO_X Fund (see Chapter 4.1.2. The members of the NOx Fund can pay a fee into the NOx Fund instead of a NOx tax. This fee to the NOx Fund is an attractive alternative as it is lower than a tax, but it has also gradually increased during the years. In addition to the lower fee, NOx Fund is using the payments to award grants for specific NO_X reducing investments for the vessels calling Norwegian ports. The achieved NO_X emission reductions need to be verified and reported afterwards.

Table 4. The 2019 & 2020 rates of the Norwegian NOx tax and the NOx Fund. The NOx Fund contributions have two categories: a lower fee (paid by shipping, fishing, land industry, train traffic and aviation) as well as a higher fee paid (by the oil and gas industry on the Norwegian continental shelf). Based on information published 2019 by the NOx Fund.[146]

	2019	2020
NOx tax (NOK per kg NO_X)	22.27	22.69
NOx Fund fees: lower fee (NOK per kg NO_X) higher fee (NOK per kg NO_X)	 8.50 14.50	 10.50 16.50

[142] ITF. 2019. Maritime Subsidies: Do They Provide Value for Money?, International Transport Forum Policy Papers, No. 70, OECD Publishing, Paris.
[143] Energy Taxation Directive (2003/96/EC) Article 14(1)(c)
[144] Also other countries such as Denmark have similar NOX taxes in place but these do not include maritime transport and aviation.
[145] 250 NM from the Norwegian baseline according to the 1982 United Nations Convention on the Law of the Sea (UNCLOS).
[146] Nye innbetalingssatser fra 2020 (11.3.2020)

4.4.2 Tax exemption for onshore power supply (OPS)

Preferential tax treatment of OPS[147] can be considered as a specific case of energy taxation. Electricity production within powerplants on the shore is potentially less polluting than generation on-board, naturally depending on the technologies used. The currently valid EU ETD (2003/96/EC) does not provide for preferential treatment of OPS compared with that generated on-board. In fact, OPS is currently disadvantaged due to the valid taxation exemptions to electricity produced on board a craft[148] as well to the marine fuel used in such generation.[118] Nevertheless, derogations are possible according to Article 19 of the ETD and by 2019 four members states have agreed to temporarily apply a reduced tax rate to OPS.[149] The ETD is currently under revision to better support the efforts to reduce CO_2 emissions.

Several ports in the Baltic Sea region are currently in the process of installing OPS, both due to recent EU regulation as well as voluntary initiatives. According to the EU directive on Alternative Fuels Infrastructure (2014/94/EU) shore-side electricity shall be installed as a priority in ports of the TEN-T core network, and in other ports, by 31 December 2025, unless there is no demand and the costs are disproportionate to the benefits, including environmental benefits. Also the European Green Deal includes a proposal to make OPS mandatory, if available, when the ship is berthed.[42] As part of an effort to proactively improve the availability and use of OPS, the ports of Helsinki, Stockholm, Tallinn and Turku signed a Memorandum of Understanding (MoU) focusing on a common approach for OPS in 2016.[150] In the MoU the ports agreed to provide newly built connections with a same joint standard voltage of 11 kV and a frequency of 50 Hz. The MoU encourages further other ports and shipping companies to do the same and commit the signatories to continue the work to reduce the environmental impact of port operations in the Baltic Sea region.

OPS require infrastructure investments both in a port and onboard a vessel. Estimated typical investment of one OPS enabled berth costs approx. EUR 0.5 million for ferry/roro berth, EUR 1.5–2 million for container berth and EUR 3–4 million[151] or even more[152] for a cruise berth. Even if a standard for OPS has been developed and in available since 2012 and recently revised in 2019,[153] older vessels are less likely to have the necessary facilities for onshore electricity connections. Vessels equipped with OPS get port fee reduction in ESI member ports.

Even when OPS is available, and the ship has the necessary equipment available, there is currently an environmentally counterproductive incitement in place to use on-board power generation. This is because the fuel used in onboard energy production is tax-exempt. As part of the revision of the EU Energy Tax Directive (2003/96/EC), exemption from energy taxes for onshore power is under discussion

[147] Onshore Power Supply (OPS), also called "Cold Ironing" or "Shore-to-ship power", "Shore Side Electricity" or "alternative maritime power", refers to the use an electricity connection between ship and land to replace power generation with auxiliary engines when a ship is at berth. OPS have the potential to considerably reduce the local environmental impact of the electricity use of a berthed vessel due to the higher efficiency and environmental measures of power plants on land. The main targeted emissions are air pollution (e.g. SO_X, NO_X, particulates, CO_2) and noise.
[148] Energy Taxation Directive (2003/96/EC) Article 15(1)(f)
[149] Mentioned on page 37 of EU 2019: Evaluation of the Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity (Commission Staff Working Document, SWD(2019) 332 final) 90 pp.
[150] Four Baltic Sea ports signed a Memorandum of Understanding and set a common approach for the new on-shore power supply for vessels. Press release 9.9.2016. (16.3.2020)
[151] HELCOM (2018) Background material of the existing incentives in the Baltic Sea region (document 3-1 GREEN TEAM 2-2018). at p. 2
[152] DNVGL (2018) Onshore Power Supply for Cruise Vessels– Assessment of opportunities and limitations for connecting cruise vessels to shore power. Green Cruise Port report. 67 pp. (cf. Appendices A1-A5 at pp. 37-68)
[153] IEC/IEEE. 2019. 80005-1-2019 - IEC/IEEE International Standard - Utility connections in port.

at EU level. While waiting for the revision of the EU ETD some countries in the Baltic Sea, namely Sweden, Germany and Denmark have countered this incitement by granting a tax exemption for the electricity provided to vessels through OPS (see Table 5).

Table 5. The granted tax exemptions for the electricity provided to vessels through onshore power supply (OPS).

Country	in force	tax rate
Sweden	2011–25.6.2020	5 SEK/MWh (without reduction 185–293 SEK/MWh)
Germany	2011–16.7.2020	0.50 EUR/MWh (without reduction 20.50 EUR/MWh)
Denmark	07.2015–06.2021	4 DKK/MWh (without reduction 878 DKK/MWh)

4.4.3 Tonnage Tax

The third type of environmental tax is related to the fact that in several European countries, shipping businesses are not taxed with a regular corporate tax based on reported income. Instead, a 'tonnage tax' is applied which is a special form of taxation based on net tonnage of the operated fleet.[154] In many ways, it functions as a subsidy to the shipping sector to avoid flagging out of the merchant fleet. Most countries apply this tonnage tax by using an estimated profit ('tonnage tax profit'), calculated from the operated tonnage. Another approach used by some countries[155] is to apply a different tax rate to each ship based on its tonnage. In the Baltic Sea, all coastal countries except the Russian Federation will have a tonnage tax in place by 2020[156].

As any other taxes and fees, tonnage taxes can be differentiated based on environmental performance. While still a relatively rare approach, Norway and Portugal include environmental rebates to their tonnage tax schemes.[142] The Norwegian tonnage tax system is environmentally differentiated in the sense that it recognises a tax reduction from the tonnage tax for especially advanced ships defined based on the environmental rating of the ship.[157] This environmental rating is a number between 0–10 and derived based on criteria set by the Norwegian Maritime Authority. It is calculated based on different parameters for different vessel types, as an example the environmental rating of tankers is calculated based on NO_X emissions, SO_X emissions, fuel used, hull structure and redundant machinery/propulsion device.[158]

4.5 Environmentally differentiated operational fees

Environmentally differentiated operational fees include systems for environmental discounts to port, fairway and pilotage fees. While Sweden is the only country in the world with an operational system of environmentally differentiated fairway dues, environmentally differentiated port fees are a relatively common

[154] BlueInvest Community platform (06/03/2020)
[155] Greece, Cyprus, Malta, Norway and Croatia.
[156] State aid: Commission approves maritime transport support schemes in Cyprus, Denmark, Estonia, Poland and Sweden (9.3.2020) The Russian Federation uses a system with corporate tax modified by targeted incentives. see e.g. PWC (2015) Choosing your course- corporate taxation of the shipping industry around the globe, p. 28. March 2015.
[157]Anon. 2020. V. Beregning av tonnasjeskatt *in* Rettledning til RF-1197 Rederibeskatning 2019 Fastsatt av Skattedirektoratet. p. 7.
[158] Anon. 2020. Tankers: Calculation of environmental rating (10.3.2020). See also other environmental rating formula provided on page Form Services of the Norwegian Maritime Administration (10.3.2020).

phenomenon. In fact, today differentiated port fees are among the most common type of economic incentives for more environmentally friendly maritime transport globally and particularly in Europe.[159]

Environmentally differentiated port fee systems provide port charge discounts to ships with emissions below regulatory levels, commonly for exhaust gases (e.g. SO_X, NO_X and CO_2), noise, and waste. This kind of discounts to regular charges have been adopted by ports worldwide on a voluntary basis. The adoption of such environmentally differentiated port fees has been catalysed by regional work such as that within the Baltic Ports Organization (BPO)[160] or HELCOM cooperation on ports, European work by organizations such as European Sea Ports Organisation (ESPO, especially its Ecoports initiative) and global cooperation initiatives on environmentally friendly port activities. Global examples include the World Ports Climate Initiative (WPCI, launched in 2008)[161] and World Ports Sustainability Program (WPSP, launched in 2018).[162]

Despite their relatively high frequency today, environmentally differentiated port fees are still a recent development with many initiatives in Europe and worldwide initiated only during the last ten years.[5] Ports in the Nordic countries, particularly Sweden, are exceptions to this general pattern as they introduced environmentally differentiated port fees already in the 1990s and early 2000s. As an example, Stockholm has had a voluntary scheme in place already since 1991[5] and also 17 other Swedish ports had implemented environmentally differentiated port fees in 1998.[163] The fee system of Mariehamn established in 2000 was among the first of its kind in Finland.[164]

In Europe, many of these environmental discount schemes use environmental indexes / certifications as a criterion for awarding a reduction to an environmentally differentiated fee. The section below provides a quick recap of such environmental indexes for shipping.[5] However, also other criteria such as use of more environmentally fuels are used as criteria for environmental discounts from operational fees (see Table 6).

4.5.1 Voluntary indexes of ship environmental performance

Several voluntary indexes, certified by third parties, are today available for comparing the environmental performance of vessels. Three such indexes commonly used in the Baltic Sea area are described below: i) the Environmental Ship Index (ESI)[165], an index focused on air emissions; ii) the Clean Shipping Index (CSI)[166], a more holistic index; and iii) the Green Award certificate[167], one of the first indexes available. While the three indexes above are the ones most frequently used in the region (see Table 6), numerous other indexes with similar aims are obviously available worldwide. An example is the German ecolabel "Blue Angel" which is also shortly described below.

The notion of 'green ships' included in the new EU directive on PRF for the delivery

[159] Christodoulou, A., Gonzalez-Aregall, M., Linde, T., Vierth, I. and Cullinane, K. (2019), Targeting the reduction of shipping emissions to air: A global review and taxonomy of policies, incentives and measures, Maritime Business Review, Vol. 4 No. 1, pp. 16-30.
[160] Baltic Ports Organization, BPO (05/03/2020)
[161] Discontinued initiative with no working website available (05/03/2020).
[162] World Ports Sustainable Program (WPSP) (05/03/2020)
[163] Sjöbris, A. Flodström, E. Behm, E. 1999. Utvärdering av miljödifferentierade avgifter för sjöfarten. MariTerm AB. at p.4
[164] T&E 1999 Economic instruments for reducing emissions from sea transport. AIR POLLUTION AND CLIMATE SERIES NO. 11 / T&E REPORT 99/7. p. 13
[165] Environmental Ship Index (25.02.2020)
[166] Clean Shipping Index (20.02.2020)
[167] Green Award Certificate (05/03/2020)

of waste from ships adopted in June 2019[41] is also a concept related to these indices. In Article 8.5 the directive specifies that the details of the criteria for discounts to the port fees, and thus the green ship concept, will be included in an implementing act of the EU Commission. Even if the Directive includes an initial release date in June 2020, delays are likely.[168]

Environmental Shipping Index (ESI)

ESI is a voluntary environmental certification system that is maintained by the International Association of Ports and Harbors (IAPH) and is a part of WPCI. The ESI works as a tool to encourage ports and other maritime organizations to promote environmentally friendly marine traffic. The ESI identifies the sea going vessels that have better environmental performance in terms of exhaust gas emissions (CO_2, SO_X, NO_X and particulate matter) and utilisation of Onshore Power Supply (OPS) than the current IMO regulatory requirements. The ESI also acknowledges efforts to reduce GHG emissions via improvements of energy efficiency as well as readiness to use onshore energy supply while berthed.[169]

The ESI was established in 2010 by a group of ports in Germany, the Netherlands, Belgium, and France. In late 2017, 47 ports, of which 35 in North-Western Europe, awarded port fee discounts based on ESI scores.[170] ESI ranges from 0 (when ship meets the IMO regulations) to 100 (with zero emissions to air). ESI accounts for the NO_X, SO_X and CO_2 emissions and of the presence of an OPS installation.[165] The ESI score is calculated by ESI formulas and the baselines are set according to IMO Annex VI regulations.[171] The index is automatically calculated and maintained, and it is free of charge for shipowners. The measurements and the resulting data used in the calculation of ESI should be audited by a third party.[165]

Clean Shipping Index (CSI)

Clean Shipping Index (CSI)[166] was originally a tool for cargo owners and transport purchasers to select environmentally well-performing shipping services. CSI provides a ranking system for vessels, carriers, and ship operators based on their environmental performance. As ESI, the CSI accounts for the measures that go beyond the existing environmental regulations.

CSI was launched in 2007 by the maritime industry in the Gothenburg region in Sweden. It is primarily an overall quality label and not specifically designed for differentiated port fees. Nevertheless, some ports (e.g. Swedish ports under the Swedish Maritime Administration) grant discounts based on high CSI scores. Since January 2018, CSI is also used as the basis for calculating environmentally differentiated fairway dues in Sweden.

CSI covers the following parameters: CO_2, NO_X, SO_X, chemicals, particles as well as the operational discharges. CSI is verified by accredited third parties with online documentation. CSI is governed by a non-profit organisation.[172] In order to receive CSI, ship-owners are required to complete a questionnaire consisting of 25 questions on each vessel's environmental performance. CSI allocates a positive compensation for the use of biofuels when calculating CO_2 emissions for distance travelled/cargo tonne (EEOI) or distance travelled/TEU (CCWG).[173]
The maximum CSI score of 150 points is divided into five CSI classes. Filling out

[168] e.g. due to the 2020 covid-19 pandemy
[169] Environmental Ship Index (25.02.2020)
[170] Becqué, R., Fung, F., & Zhu, Z. (2018). Incentive Schemes for Promoting Green Shipping - Discussion Paper. January. The Natural Resources Defense Council (NRDC). p.3
[171] ESI: IMO Annex VI Regulations and ESI baselines (03/02/2020)
[172] Clean Shipping Index, 2020. Methodology and Reporting Guidelines 2020. Clean Shipping Index, Gothenburg, Sweden.
[173] Winnes, H., Fridell, E., Hansson, J. & Jiven, K. 2019. Biofuels for low carbon shipping. Triple F project Report number 2019.1.21c. (contribution by IVL). 54 pp.

the CSI questionnaire is free of charge but the CSI class certificate costs EUR 500 per certificate (in 2020). As a member (EUR 2 800 per year) of the CSI network, one can issue 10 certificates per year without an additional fee among other membership benefits. The CSI certificate is valid for 3 years.[172]

Green award Certificate

The Green Award is a classic environmental label for ships launched already in 1994.[167] It is overseen by the Green Award Foundation, an independent organization originally established by Rotterdam Municipal Port Authority and the Dutch Administration. In 2018, around 34 ports around the world, of which 14 in Europe, awarded port fee discounts based on the Green Award.[170]

Green Award Certificate addresses issues related to quality, safety, environment and technical areas related to the ship and the ship manager's office. It is based on a survey of the vessel. The vessel will be certified if the Green Award requirements are met and the verification is successful. Green Award will publish the vessel in the list on the website[174] and will inform the incentive providers on a monthly basis. The certificate is valid for three years, during which annual checks will be carried out.

Blue angel (Eco-Friendly Ship Design)

The Blue Angel[175] is a general German ecolabel which includes specific certification labels targeting ship design and ship operation (until 2020). These certifications are recognised by some European ports, at least Hamburg. The entire green label system was initiated by the German government and awarded by an independent Jury to products that are environmentally friendlier than others serving the same use. Two certifications, the 'Environment-Conscious Ship Operation'[176] and the 'Eco-Friendly Ship Design'[177] are directly relevant for commercial vessels.

4.5.2 Environmental notations of international classification societies

In addition to the dedicated environmental certifications described above, many international classification societies such as Lloyds´ Register and DNV GL offer the possibility to include voluntary notations[178] on superior environmental performance in the classification certificates.[179] As an example the notations of DNV GL certify that the vessel fulfils all MARPOL requirements (notation *Clean*), MARPOL requirements with additional criteria (notation *Clean Design*) as well as additional notations on compliance of the main engine with MARPOL Annex VI Tier III requirements on NO_X emissions (e.g. *Clean(Tier III)*).[180] The ECO Notation service of Lloyds' Register[181] and similar notations by many other Classification societies certify likewise the fulfilment of MARPOL as well as environmental performance exceeding such requirements.

[174] List of Green Award certified ships (16.3.2020)
[175] Blue Angel (29.3.2020)
[176] Environment-Conscious Ship Operation (29.3.2020), Note that this certification is valid only until the end of 2020.
[177] Eco-Friendly Ship Design (29.3.2020)
[178] A notation in a classification certificate refers to additional information beyond the regular requirements. These can be specific for the vessel type or performance beyond the minimum classification requirements.
[179] Stuer-Lauridsen, F., Bergstrøm, M., Boes Overgaard, S. Kristensen, D. (2014) Environmental Classifications of Ships. Environmental project No. 1579, 2014
[180] Environmental Class Notations (19.3.2020)
[181] ECO Notation (19.3.2020)

4.5.3 Environmentally differentiated fairway dues

Sweden, Finland and Estonia are the only EU member states which have dedicated system fairway dues of significance. Even if also other countries have similar fees related to fairways,[182] these are either relatively small (Latvia, Denmark) or combined with port fees (Lithuania). Sweden is the only country in the region which a system of environmentally differentiated fairway dues.

In Sweden, the fairway dues are administered by the Swedish Maritime Administration (SMA) and determined by a basic pilot readiness fee, type of ship, cargo quantity in net tonnage, number of passengers and number of port calls in Sweden during a month.[183] The Swedish fairway dues have been environmentally differentiated since 1998, from 2018 according to the CSI score of each vessel. The current reduction is applied to the vessel-based part of the fairway due, based on the vessel's CSI scores and the reduction is divided into five different classes (A–E).[184] If the verified score is less than 75 (D) or if the vessel has no scoring at all (E) they pay 100%. Vessels which scores between 75–99 (C) pay 90%, 100–124 (B) pay 30% and 125–150 (A) pay 10% of the fees for calls.

In Finland, the fairway dues are determined based on the ship type, size in net tonnage, ice classification, and the number of port calls during a calendar year.[185] The fairway dues were halved in 2015 to mitigate the costs of the SO_X regulations for the Finnish industry[186] and the relief will continue at least until the end of 2020.[187]

In Estonia, the fairway due system resembles the Finnish system, but the classification of ship types differs and instead of net tonnage the dues are determined based on ship's size in GT.[188]

4.5.4 Environmentally differentiated port fees

This study found more than 20 ports in the Baltic Sea coastal countries which offer environmentally differentiated port fees (Table 6). A study from 2017 commissioned by the European Commission[5] lists 30 ports in the EU using an environmental charging scheme, 11 in the Hamburg – Le Havre port range, seven in the Baltic Sea, one in the North Sea, six in the Mediterranean Sea and five in the South-Atlantic Ocean. As many ports in Europe are private companies, they have the autonomy to set their own tariffs.

4.5.5 Environmentally differentiated pilot readiness fee (Norway)

Also pilotage fees, more specifically pilot readiness fees, can be environmentally differentiated. In Norway, the ships with an official ESI score of 50 or higher are admitted 100% discount on the pilot readiness fee. The Norwegian Coastal Administration checks the ESI score of ships four times a year.[189]

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[182] e.g. The Russian Federation has similar fees which are related to the use of icebreaking services, Aids to Navigation as well as VTS. These are based on tonnage and time of the year of the visit (MERLOG raportti 2020 citing Rosmorport 2019)
[183] Swedish Maritime Administration (19.02.2020)
[184] SMA 2019 SMA Code of Statues SJÖFS 2019:3
[185] Finnish Customs (19.02.2020)
[186] Särkijärvi, J. & Giordani, T. (eds). 2018. Väylämaksu ja muuttuva merenkulku: Työryhmän raportti merenkulun väylämaksujärjestelmän kehittämisestä ja siihen liittyvistä selvitystarpeista. Liikenne- ja viestintäministeriön julkaisuja 7/2018. (A report on development of the fairway due system in Finland)
[187] Finlex 904/2018 Laki väylämaksulain muuttamisesta ja väliaikaisesta muuttamisesta annetun lain voimaantulosäännöksen muuttamisesta. (a Finnish law on fairway dues)
[188] Republic of Estonia Maritime Administration (19.02.2020)
[189] Norwegian Coastal Administration – Rates of fee 2020 (26/02/2020)

Table 6. Ports in the Baltic Sea countries which implement environmentally differentiated port fees as well as the basis for the rebates. See section 4.5.1 on page 44 for more detailed information on the indexes (ESI, CSI, Green Award & Blue Angel). More information on the port fee discounts can be found in the Appendix III: Port fees in the Baltic Sea region.

Country	Port	Basis of discount
Denmark	Århus	ESI[165]
Estonia	Tallinn incl. Paldiski	ESI
Finland	Helsinki	ESI, noise-reduction, environmental investments
	Långnäs	NO_X emission based
	Mariehamn	NO_X emission based
	Rauma	LNG, waste reduction
Germany	Bremerhaven (the Ports of Bremen/Bremerhaven)	ESI, LNG, methanol
	Niedersachsen ports (Cuxhaven, Brake, Emden, Stade, Wilhelmshaven)	ESI, eco fuels
	Rostock	ESI
	Hamburg	Shore power discount, ESI, Green Award[167], Blue Angel[190]
Latvia	Riga	Green Award
Lithuania	Klaipeda Seaport	Green Award
Russia	Primorsk & Ust LUga	LNG (bulk vessels)
Sweden	Gothenburg	ESI, CSI[166], LNG
	Gävle	ESI, CSI
	Stockholm	ESI, CSI, shore power subsidy
	Brofjorden	CSI, LNG
	Norrköping	based on offer
	Nynäshamn	ESI, CSI
	Piteå	ESI, CSI, LNG
	Stenungsund	ESI, CSI, LNG
	Sundsvall	ESI, CSI, LNG
	Södertälje	(by end of 2020)
ESI=Environmental Ship Index, CSI= Clean Shipping Index, LNG= Discount from main engine using Liquified Natural Gas as fuel, methanol= Discount from main engine using methanol as fuel, eco-fuels= Discount from main engine using LNG, methanol or ethanol as fuel (including dual fuel systems), based on offer=discount depending on agreement with port.		

[190] See above and more on their general website and detailed information on their Eco-Ship Ship Design award.

4.6 Cargo owner-demand, green transport labels and vetting

In addition to the indexes and certification of environmentally friendly shipping described in sections 4.5.1 and 4.5.2. there are also other specialized forms of environmental certification which have the primary aim to certify a cargo owner that the transport service, provided by the operator, is especially environmentally friendly. Tools used to this end include dedicated green transport products by shipping companies but also voluntary holistic ship performance assessments. The latter includes new forms of environmentally oriented third-party *vetting*, referring to a form of voluntary and holistic risk assessment traditionally used in tanker transports.

Such proof of green transport may be required due to national or internal rules or used as a factor of the final product. Using such green transport services may also be used as a proof of achieving relative emission cuts compared to a business as usual scenario, in some contexts even reusable as emission credits.

As some customers pay a voluntarily premium for use of alternative fuels, shipping companies are awakening to the latent market demand for environmental transport products. One example is the Finnish shipowner Meriaura which launched recently its *ECOvoy* contract, promising 92–96% lower life cycle CO_2 emissions compared to a regular transport product.[191] Another example is the *ECO Delivery* product of Maersk, promising to deliver cargo with a 84% reduction in carbon emissions by using addition of sustainable biofuel, generated from recycled biomass, in the transport chain.[192] A third example is D/S Norden, another Danish shipowner, which has a similar service is under development in cooperation with the technology provider Kvasir.[193]

A more unusual example of environmental transport products includes the cargo services provided by small scale shipping companies using traditional sailing vessels.[194,195] These have their own labeling[196] which can be used to market the final merchandise such as foodstuffs and beverages. One example is the Netherlands-based company Fairtransport, which has since 2007 operated two engineless ships on a regular sail cargo route across the Atlantic.[197]

The GHG emissions rating of the Rightship is an example of an accreditation service related to vetting, which can be used to compare the relative efficiency of a vessel with vessel of similar size and type in terms of CO_2 emissions.[198] The rating is given on a scale from A to G, used to compare energy efficiency of e.g. home appliances. Much like the environmental indexes described above it can be used to grant discounts from port fees.[199] This GHG rating work has supplemented earlier activities of the company in the field of vetting/risk assessment on ship safety.

[191] Meriaura EcoVoy Contract – a small step for a company but a giant leap for the shipping industry . Meriaura company blogpost 9.10.2019 (17.3.2020)
[192] Maersk Eco Delivery (16.3.2020)
[193] Norden to test new biofuel in partnership with Kvasir Technologies. Press Release 6.12.2019 (17.3.2020)
[194] Sail Cargo Alliance (16.3.2020)
[195] Armanto, J.2019. Shall we be sailing again? Sail Cargo – The future of Sail Shipping. Novia. Bachelor's thesis Degree Program, Sea Captain, Turku, 2019. 51 pp.
[196] Anemos sail cargo label (16.3.2020)
[197] Fairtransport (16.3.2020)
[198] GHG Emissions Rating (16.3.2020)
[199] However, Rightship GHG rating discounts are currently limited to two ports worldwide (Vancouver Port and Prince Rupert Port).

4.7 Other topics

4.7.1 Emission trading for the marine sector

Some authors include emission trading under the general category of economic incentives.[1] Emission trading includes many different variations ranging from voluntary schemes (e.g. trading based on progress against a business as usual scenario), benchmarking of emission rates (trading with allowances generated by applying emission rates better than a set/benchmarked standard) as well as complete cap-and-trade systems (involving a defined cap for total emissions and transferable quotas for individual polluters).

An example of the last type of emission trading framework is the EU Emission Trading System (EU ETS) which is currently not applied to maritime traffic.[200,42] However, as mentioned above in Section 3.5, the EU Commission has recently proposed to extend the European emission trading system to cover emissions from ships, an initiative which will be coordinated with action at the IMO level.[43]

4.7.2 Economic incentives for responsible ship recycling

The scrapping of an end-of-life ships is mainly carried out in developing countries in Asia where various factors, including a pressure to reduce costs, have in many cases led to substandard environmental practices.[201] Even if there exists a global agreement on ship recycling, the 2009 Hong Kong Convention, it is still not in force and does not introduce substantial measures reflecting the polluter pays principle.

The EU has also been active in proposing measures for more environmentally responsible ship recycling, including the 2013 EU Ship Recycling Regulation.[202] The EU regulation defines criteria for environmentally sound and safe ship recycling for shipowners and recycling facilities. However, as this regulation is currently very easy to circumvent, by flagging out end of life ships, economic incentives applied in the whole EU have been proposed as tools to catalyse more environmentally responsible ship recycling. Various proposals have been aired, one of which the EU Ship Recycling Fund which was included in the proposal of the EU Commission for the EU Ship Recycling Regulation but rejected in the European Parliament.[201]

The economic incentive proposal on ship recycling which seems to attract most of the current interest from the EU Commission[203] as well as academia [204] is the concept of a Ship Recycling Licence (SRL) which was proposed by the ECORYS et al. study[201] from 2016. This SRL would impose an obligatory license, to be acquired by a one-time fee, to be carried by all ships visiting an EU port. This fee would be invested in a fund and the share (with interest) would eventually be payable to the last owner of the ship in case a series of responsible ship recycling criteria would be met in the scrapping process.[201,203]

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[200] EU has highlighted that GHG emissions from ships should be included in the EU ETS system in the case that IMO fails to agree on sufficient global measures by 2021.
[201] ECORYS et al. (2016) Financial instrument to facilitate safe and sound ship recycling. p. 25-27 https://ec.europa.eu/environment/waste/ships/pdf/financial_instrument_ship_recycling.pdf
[202] EU. 2013. Regulation (EU) No 1257/2013 of The European Parliament and of The Council of 20 November 2013 on ship recycling (…).
[203] EU. 2017. Report from the Commission to the European Parliament and the Council on the feasibility of a financial instrument that would facilitate safe and sound ship recycling. COM(2017) 420 final. Brussels, 8.8.2017. 6 pp.
[204] e.g. Devaux, Caroline; Nicolaï, Jean-Philippe. 2019. Designing an EU ship recycling licence: A roadmap, Economics Working Paper Series, No. 19/323, ETH Zurich, CERETH - Center of Economic Research, Zurich

5 Results of the questionnaire and interview study

The questionnaire was sent to national administrations, shipowners and shipowners' associations in the Baltic Sea region (See Appendix I: Questionnaires). The overall response to the survey was good. In total 17 replies to questionnaires were received and 8 shipowners were further interviewed. The responded national administrations were from Denmark, Estonia, Germany, Lithuania, The Russian Federation and Sweden. Information from the Finnish administration was provided during the report preparation. The shipowner associations which responded were from Finland, Sweden, Denmark and Germany. The contacted shipowners were selected among those companies known to have fleets which operated frequently in the Baltic Sea area as well as those with a known interest in investing in environmental performance. A complete list of actors who responded to the questionnaires can be found in the Appendix II: Respondents.

Overall, the attitudes of the respondents toward economic incentives were judged as positive, or at least neutral. However, it was clear that different respondents had different interests when it comes to economic incentives. The questionnaire responses from national administrations focused on specific themes of priority. The replies of the shipowners and their national umbrella organizations often covered a wider range of economic incentives. It is likely that the comprehensive answers of the shipowners resulted from the supplementary semi-structured interviews, enabling for further reflection on each theme.

The shipowner respondents could be divided into two groups: shipowner operators and tonnage provider shipowners offering time-chartered vessels. Both groups often had up-to-date information on the investment aids and financing topics but shipowners in the latter group were not aware of the environmentally differentiated fees, as these are payed by the charterer.

This section provides summaries of identified challenges and recommendations extracted from the answers of the questionnaire and the semi-structured interviews. It should be noted that the results have been rephrased and grouped thematically by the authors of the report. Thus, there are no direct quotations from the responses.

5.1 General remarks

When asked about economic incentives, shipowners and their associations shared the view that any system should be designed in long-term to allow for adjustment, investment, changes in operational routines and optimising the performance of the fleet in long run. It was highlighted that the shipowner evaluates the profit of each step towards improved environmental performance in relation to the ship's life cycle (up to 35 years). Concerns were expressed about the probably increasing administrative burden compared with the gain from new systems. Nevertheless, the overall attitude towards the economic incentives was positive and the incentives were found to incite the improvement of environmental performance.

General feedback about economic incentives and recommendations

- Currently, available information on the various economic incentives in the region is dispersed and often outdated. A simple improvement would be an easily accessible information platform about the different economic incentives available for shipping in the Baltic Sea region.
- A regional way to push the agenda for GHG emission reductions from ships could be to introduce economic incentives for CO_2 reductions and thereby maybe test new solutions operationally, for the benefit of the future, when global regulation is in place.

- If emission trading would be extended to maritime transport the environmental impact of the entire transport chain should be considered. Such an approach would benefit the cargo owner if they could exploit emission rights in their operations.
- The respondents pointed out that some cargo owners have started to ask and look for green transport services. However, the willingness to pay extra seems to remain relatively small.
- Some respondents argued that the emphasis should be in improving and creating the economic incentives at IMO level to decrease the environmental impact of maritime transport more effectively. At best, the economic incentives would regulate the maritime transport globally.

5.2 Co-funding for technology investment and research & development (R&D)

Many respondents mentioned that EU co-funding, national state aid and private funding for investments in environmental performance of vessels are important. Some shipowners found the co-funding for investments crucial for their investment decisions and they would not have made some of their investments without the received co-funding. Other shipowners argued that the received co-funding speeded up their investment decisions by sharing the total risk of their investment, but they would have made the investment in any case. Most of the interviewed shipowners had utilised some form of EU co-funding in their investments, often via the CEF programme. The R&D funding for a technology supplier could also benefit a shipowner who could pilot new technology with a reasonable investment risk. In general, the national R&D funding was found to involve less administrative burden than EU co-funding of projects.

Comments and recommendations of EU co-funding and R&D funding

- As the criteria of eligibility for public co-funding are modified relatively frequently it is challenging to stay up -to date about the current requirements and provisions.
- There are good examples of technology development with a combination of national and EU co-funding, first for R&D followed by support for piloting and investing. This kind of continuity of support have enhanced the technology suppliers and further environmental investments onboard vessels.
- The application process and reporting requirements of national R&D funding sources involves in general less administrative burden than EU R&D co-funding.
- Only a small number of respondents brought up private funding, when asked about the R&D funding. However, it should be noted that the question was directed towards national and EU co-funding possibilities.
- Shipowners can benefit from EU co-funding received by technology suppliers who can in turn provide for forerunners better prices for new environmentally friendly technologies. However, one must be among the first customers, and thus be ready to take some technological as well as financial risks, in order to have access to such piloting prices.
- It would be worth considering supporting more those willing to pilot new advanced environmental technology in operation. The purchaser of new technology takes technological and financial risks today without any support.

- Some co-funding instruments have too strict defined criteria for the use of the funding, which may lead to a reduced flexibility within operation of a co-funded vessels and a fleet.
- Nearly all the industry respondents had utilised some form of EU co-funding for technology investments usually via the CEF programme. From this perspective EU co-funding is, and has been, a very important enabler of sustainable shipping investments in the region.
- As the present EU co-funding programmes are being phased-out, the Baltic Sea countries should make efforts to ensure the availability of EU funding also in the upcoming programming period in 2021–2027. One way to do this would be to channel the possible European Green Deal funding to pilot new technologies and to catalyse environmentally friendly ship projects -both new ships and retrofits to existing ships.
- The future of EU R&D funding, Horizon Europe and its Waterborne Partnership related to environmental ship projects, should also be secured as an important source of new technologies for green shipping.
- EU project co-funding is considered as taxable income in Denmark but not in the other Baltic Sea countries. Harmonization of taxation practices of EU grants would be preferable to provide a level playing field.
- Some respondents argued that public aid distorts competition between the different modes of transport.

National state aid

- The national support programs for environmental ship investments has had a significant impact to promote the investments in alternative fuels on new ships at least in Finland.
- It was proposed that in Finland the marine sector should be included in national foundations for climate action, such as the funds of the Finnish state development company Vake.
- The Swedish Eco-bonus scheme is co-funding a shift of transport from trucks to ships but according to responds eligible routes are not easy to find in Sweden.

5.3 Ship financing (Loans and guarantees)

The importance of replacing old ships with new ships was a recurrent theme in the responses and in the semi-structured interviews, when the possibilities of cutting emissions were discussed. Some respondents emphasised that efforts should also focus on facilitating environmentally friendly technology on the current fleet. Ensuring the financing of new ship was an urgent concern for many shipowners and they had several recommendations for improving the ship financing system.

- Some interviewees emphasised that the availability of financing and the related instruments have the greatest impact on their decision-making, and further to their overall environmental performance.
- Today, ship financing is very challenging. Both the terms of loans and guarantees are central factors to enable investments also in advanced environmental technology. Only a minority of respondents, often with solid economy, did not consider ship financing challenging.
- A concrete challenge is that private financing, if available, is granted in Europe for short (five years) periods, while the lifetime of a vessel is 25

years (35–40 years for ice strengthened tonnage). Chinese banks are currently among the only available providers of longer repayment periods (15 years or more).

- Another challenge is that banks accept only a low collateral value of the vessel used as a guarantee for loan, often only a fraction of the vessel's total value.
- Applying financing from the European Investment Bank (EIB) and its Green Ship Programme have been relatively challenging for smaller companies.
- Guarantees are required by the shipyard during shipbuilding process, but the current financing system gives guarantees for ship financing after the delivery, not during the ship building process.
- The current export credit system is seen as relatively expensive and stiff for the purposes of ship financing. The export credit agencies in the Baltic Sea region have different guarantee systems and thresholds to support vessel investments. The insurances and guarantees of some national export credit agencies are currently not awarded for investments involving vessels registered under a flag of convenience.
- New banking principles (e.g. Poseidon Principles) promoting environmentally responsible private financing are not yet to materialize to be as an integral part of concrete financing decisions. However, such considerations were seen to be gradually coming to be business as usual in the Nordic and European banks.

Recommendations for ship financing and guarantees

- As have been highlighted in recent regional HELCOM discussions,[205] no bank with headquarters in Nordic countries have yet signed the EIB's Green Ship Guarantee programme[206] or have other similar preferential arrangements for environmental ship investments. Even if banks in other countries of the region (e.g. Poland and Germany) have the necessary arrangements in place with EIB they seem to prefer their existing customers. It would be a great improvement if banks in all the coastal countries would sign the Green Ship Guarantee programme.
- Public initiatives could ensure that also SME shipowners could afford to improve their fleets environmental performance. These initiatives could increase the collateral value of ships used as a guarantee for a loan as well as longer repayment periods for environmentally advanced ship investments.
- The Swedish governmentally owned bank *Svenska Skeppshypotek*[207] which ensures financing of environmentally advanced new ships was brought up as a good example of a national initiative. The bank's only task is to fund ship projects of Swedish shipowners, particularly SME shipowners, who lack the access to financing, compared with big enterprises. Its loans are subject to regular interest rates, but the repayment period may be up to 15 years which is considerably longer than is currently typical for commercial banks. In addition, it grants a collateral value of 70–80% of the new ship. As guarantees ships as well as other governmental and bank guarantees are accepted.
- Systems for more accessible ship guarantees could also be implemented as part of national export credit agencies activities. Further, it was pointed out

[205] cf. outcome of the HELCOM GREEN TEAM 3-2019 meeting.www.helcom.fi (16.3.2020)
[206] cf. §6.4 at p.4 outcome of the HELCOM GREEN TEAM 3-2019 meeting.www.helcom.fi (16.3.2020)
[207] Svenska Skeppshypotek (23.3.2020)

that decisions about national export credit guarantees should be independent from where the ship is built.

- Relaxing the export credit requirements for green investments for a flag of convenience would increase the available market for green technology providers in the Baltic Sea region.

5.4 Environmental taxation

Taxation came up as an important economic incentive for environmental performance although the topic was not brought up in the questionnaire. The Norwegian NOx tax and NOx Fund model, with an emission tax and an alternative fund supporting investments in green technology, was perceived as a potentially very effective way to cut emissions and improve the environmental performance of maritime transport. Another identified good practice was tax exemptions on OPS energy provided by Sweden, Germany & Denmark, with potential to reduce the price of energy provided to vessels at berth.

Tax exemption on OPS (Sweden, Germany & Denmark)

- OPS is today uneconomical for shipowners as ships have auxiliary engines on board and relative price of OPS is high. Baltic Sea coastal countries could enable lower prices by provide tax relief to OPS energy in line with the current practice of EU ETD exemptions by Sweden, Germany and Denmark. On the longer time perspective, it would be important to work for the revision of the EU ETD to permanently exempt OPS from energy taxation.
- The interviewees highlighted that, despite the obvious environmental advantages and recently improved availability, OPS electricity and other similar shore-based energy distribution (district heating) had currently a very disadvantaged pricing without tax relief and compared to that possible to generate on board ships. The high price of OPS is a combination of high initial mobilization fees as well as a high price per energy unit.

Other recommendations of taxation

- A similar model to the Norwegian NOx tax and the alternative NOx Fund would be beneficial in the Baltic Sea region as it would both directly reduce emissions and fund investments in environmentally friendly technology.
- A proposal that a vessel investment reservation in taxation should be possible for any of the affiliated companies in a larger concern, not only the ship owning entity as it is today. It was also proposed that a such concern tax wide taxation reservations could only concern green investments.

5.5 Environmentally differentiated fees

The environmentally differentiated operational fees were in general welcomed in the shipping field, at least as a supplementary incentive. As was commented also in general for economic incentives (see 6.1), the respondents highlighted that environmentally differentiated fee systems should be developed with a long-term perspective by which both the criteria and the fee discounts should be stable and predictable in order to realistically drive for better and long-term environmental performance. A common view amongst the respondents was that a simple and fair system is required to evaluate ships' environmental performance for the purpose of discunts. The third-party verification was found equitable, despite the added administrative burden and cost. The majority of the interviewees emphasised, however, that the present level of discounts is too low to drive investments into better technology. Two discrete aspects emerged from this. Firstly, the costs from

fairway dues and port fees constitute only a minor share of the total operational costs of a vessel. Secondly, in the case with the tonnage provider, the discount, i.e. the benefit, is directed to the ship operator instead of the shipowner who not only decides to update the technology but also made the investment into improved environmental performance.

Comments and recommendations of differentiated fees

- Environmentally differentiated fee systems should be developed with a long-term perspective. Both the criteria and the fee discounts should be stable and predictable to realistically drive for better and long-term environmental performance. Currently the discounts have been withdrawn or made more stringent in few years after costly and risky investments. Even if this makes sense from a regulatory side this practice means also that differentiated fees cannot be seriously considered as a factor in return-for-investment calculations.

- Current levels of discounts in operational fees in the Baltic Sea region is generally too low to drive investments. The providers of environmentally differentiated fees should also consider that shipowners of chartered vessels are not directly benefiting from the discounts in operational fees even if bearing the cost of installation of technology.

- The number of port calls in each time period is often a parameter that is often considered in calculated fairway dues. Currently, port calls by a certain ship by a certain shipowner is counted individually also in the liner traffic which leads to inflexibility in optimising the fleet's operation. A more holistic approach considering the operation of the entire fleet of a shipowner would be more flexible and better. The number of port calls could account for a ship type, size and score of the environmental index instead of counting for individual ships.

Indexes of ships' environmental performance

- Environmental indexes were found valuable as such as the certificates can be used to improve company's image, even if the direct profitability of environmentally differentated operational fees was critised.

- Environmental indexes (like CSI and ESI) should be further developed to consider the latest development in the environmental technologies and alternative fuels.

- Harmonisation of the discount schemes on environmentally differentiated operational fees in the Baltic Sea area would be important. Either the score thresholds that entitle for environmentally differentiated fees could be harmonised among harbours and ports or the index itself could be common for the region.

- Ports should introduce environmentally differentiated fees and also encourage the use of OPS. An idea to facilitate the use of OPS would be to work toward the availability of self-service OPS installations. This could perhaps reduce mobilization fees by enabling the ship crew to connect a vessel to a OPS facility of the designated berth without the help of port personnel.

- The differentiated fee systems and the related certification should be as administratively light as possible. Concerns were expressed about additional administrative burden with stricter criteria for index certificates. CSI certificate, for example, requires an annual external audit. Some shipowners currently utilise consultant help to manage the administration of certificates.

- According to shipowner respondents, the new system of environmental differentiation of the Swedish fairway dues, based on CSI, is not as good economic incentive as the old system.
- There is currently an ongoing discussion within the SMA regarding the weighing of the CSI categories. The current model rates all CSI categories the same and does not consider the different costs each category requires in order to get a high CSI score. For instance, with measures related to recycling and reduction of waste it is a fairly easy to achieve a high score in the waste category to a low cost, whereas reductions in NO_X emissions can be quite costly in comparison
- Specific coefficients for biogas or biofuel should be introduced to IMO DCS and EU MRV systems. As some environmental indexes, for example ESI, use these calculation methods as part of their indexing they do not reward the usage of biogas or biofuels.

6 Discussion

This section will discuss the economic incentives in the context of environmental measures in maritime transport in the Baltic Sea area as identified in the literature study (Chapter 4) as well as in the questionnaires and interviews (Chapter 5).

As the scope of this study was to collect the views of stakeholders and compile available information on economic incentives for sustainable shipping in the Baltic Sea region, modelling or other quantitative tools have not been used. Below discussion and assessment of the effectiveness of the available options for future instruments is thus qualitative.

6.1 General

Research points out that there remains considerable potential to reduce ship emissions worldwide, also in a profitable way. For example, Bouman et al. (2017) concluded that the GHG emissions per freight transport unit can be reduced by more than 75% by 2050 through determined policies, regulations and legislation.[208] Schwartz et al. (2020) recommend solutions for achieving this goal and conclude that even 50% of the CO_2 reduction is economically profitable, and thus a prime target for economic incentives. They highlight the importance of investing in new technologies and improving the operational measures in cargo vessels.[209] The ship operator could according to their study, for example, improve fuel efficiency and further reduce their environmental impact by voyage optimisation and route planning including enhanced use of weather forecasts and local information.[209] Also Rantanen et al. (2019) point out that this kind of measures involving digitalization have unutilized potential as abatement measures for greenhouse gas emissions.[210]

Economic incentives, such as those covered in this study, enable more efficient use of such existing potential for profitable emission reductions but may also generating and mainstreaming new technological innovations. This study has identified several ways how economic incentives can be, and have been, used as tools to improve the environmental performance of ships in the Baltic Sea region and nearby areas. Some of the instruments such as public co-funding and other support can also be considered as economic incentives working as push factors, while less direct incentives such as market demand, differentiated operational fees and taxation could be considered as pull factors.

A general finding of the literature review part of the study was that information on economic incentives for environmentally friendly shipping in the Baltic Sea region is not readily available in a compiled form. Even for specific topics, such as environmentally differentiated port fees, an overview of the situation in the Baltic Sea needs to be compiled manually from port websites and partial information included in (usually dated) project reports. A compilation of the available incentives would make their utilization easier for many shipowners without the capacity to do the research required in the current state of affairs. The need for this kind of information was also an outcome in the discussions within the European Sustainable Shipping Forum (ESSF) group on financing.[88]

Carefully designed incentives have better prospects to lead to the intended result,

[208] Bouman, E. A., Lindstad, E., Rialland, A. I., & Strømman, A. H. (2017). State-of-the-art technologies, measures, and potential for reducing GHG emissions from shipping – A review. Transportation Research Part D: Transport and Environment, 52, 408–421. DOI: 10.1016/j.trd.2017.03.022

[209] Schwartz, H., Gustafsson, M., & Spohr, J. (2020). Emission abatement in shipping – is it possible to reduce carbon dioxide emissions profitably? Journal of Cleaner Production, 254, 120069. DOI: 10.1016/J.JCLEPRO.2020.120069

[210] Rantanen, A., Berg, N. & Kanto, E. 2019. Digitalization as a tool to reduce GHG emissions in maritime transport. Traficom Research Reports 28/2019 (7.11.2019)

such as a reduction in the environmental impact of shipping. Consequently, several studies point out that it is essential to analyse the impact of economic incentives thoroughly prior to implementing it into the regulation and legislation.[e.g. 209,211] One important element in the process of designing good incentives are the experiences of stakeholders, such as the shipowners interviewed for this study.

General findings arising from the questionnaires and interviews is that the attitudes of the respondents to economic incentives could be interpreted as positive, or at least neutral, and that a more long term approach to their development would be preferable. Incentives designed with a long-term perspective, would likely be more suitable to accommodate the necessary adjustments, investments, changes in operational routines and optimizations of performance done continuously by all shipowners. The different phases of the long lifetime of a ship requires different incentives.

One aim of environmental investments is to attract environmentally conscious cargo owners, for short term engagements but also for long term engagements, and in this way secure market shares in a changing environment. In addition to being in line with the environmental values of the cargo owner, the lower carbon (and general environmental) footprint can also have economic value, including brand effects of the final merchandise or in the form of emission credits.

Poulsen et al. (2016) conducted an interview study about the drivers in improving the environmental performance of maritime transport.[212] They concluded that even if voluntary or buyer-driven environmental upgrading is ongoing, a substantial change is not likely to happen without a clear, stable and enforceable global regulation.[212] In line with the findings of Poulsen et al. (2016), response to the questionnaires of this study pointed out that while customers have started to ask and look for green transport services, the premium they are prepared to pay is still relatively small. As the findings of Poulsen et al. (2016), this could indicate that at the moment key decisions are made elsewhere than in the customer end, either as regulation or as service provider innovations. As a sign of the latter, we found that several maritime transport providers have launched green shipment services.

The interviews highlighted two groups among the shipowner respondents: shipowners-operators and those shipowners offering time-chartered vessels for other operators. While both are responsible for eventual investments in new environmentally friendly technology only the first group benefits directly from environmentally differentiated operational fees as these are payed by the operator. In order to incentivise technological investments, the gain of high environmental performance should be directed to those operators that made the investment or operational changes. For instance, fuel price reduction benefits directly the operator instead of the shipowner who invested in the clean technology.[209]

Besides the technological improvements of vessels, also operating the vessels should be targeted by economic incentives to reduce the total environmental impact of maritime transportation. If the regulation aims at reducing the air emission, it is essential to recognise the main sources of emissions and address the regulation to the relevant stages of operation.[213] Time spent at port, especially generation of energy with auxiliary engines during hotelling (also known as berthing), has a significant impact on the amount of air emissions to populated areas in the

[211] Svindland, M. (2018). The environmental effects of emission control area regulations on short sea shipping in Northern Europe: The case of container feeder vessels. Transportation Research Part D: Transport and Environment, 61(2018), 423–430.
[212] Poulsen, R. T., Ponte, S., & Lister, J. (2016). Buyer-driven greening? Cargo-owners and environmental upgrading in maritime shipping. Geoforum, 68, 57–68. DOI: 10.1016/j.geoforum.2015.11.018
[213] Tichavska, M., Tovar, B., Gritsenko, D., Johansson, L., & Jalkanen, J. P. (2019). Air emissions from ships in port: Does regulation make a difference? Transport Policy, 75, 128–140. DOI: 10.1016/j.tranpol.2017.03.003

proximity of ports.

If emission trading would be implemented for maritime transport in the future, customers (cargo owners) should be able to exploit emission rights generated via e.g. the use of green transport in their own operations. Some interviewees further highlighted that, if implemented, GHG emission trading for maritime transport should cover CO_2 emissions of the entire transport chain (not only maritime transport). This kind of trading should also incorporate GHG emissions from the entire production chain of fuel used. Specific coefficients should be introduced for biogas or biofuel to be used in IMO DCS and EU MRV as currently no such coefficients for biogas and biofuels are available.

6.2 Co-funding for technology investment and R&D

National co-funding for sustainable shipping technology investments

The explicit forms of dedicated national co-funding for environmental ship technology investments in the Baltic Sea region identified in this study include the Finnish Environmental Investment Support for vessels (2015–2020) as well as the German LNG fuel programme for ships (2007–). As no German shipowners were participating in the questionnaire or interviews organised for this study it is only possible to reflect on the experiences of the Finnish co-funding initiative.

During 2010–2014, the Finnish state aid for environmentally friendly new ships supported the building of four ships based on alternative fuel technology. These included a new LNG -fuelled RoPax ship (built in Turku) and three cargo ships fuelled by biodiesel (built in Turku and in the Netherlands). According to a 2017 study on this co-funding this form of support was perceived as significant for the entire cluster of shipbuilding industry in the Turku in addition to these particular ship projects.[74] These ship projects functioned also as important references for Finnish providers of green maritime technology.[74]

However, based on the same 2017 study the Finnish state aid 2010–2014 did not catalyse the development of new technology. [74] This inconsistency may be partly due to the narrow focus of the state aid on measures on-board existing ships.[74] The aid for existing ships was originally targeting the installation of scrubbers, which would have had some technology development potential, but in the end all the funded projects were about switching to the use of Marine Gasoil (MGO). One reason for this was that, due to EU regulations, all installations on ships had to be completed before 1 January 2015, i.e. before the regulations for 0.10% sulphur content of fuel oil entered into force of the Baltic Sea Sulphur Emission Control Area (SECA) under MARPOL Annex VI. Due to this reason, and because installation of scrubbers requires a long period of time for design and installation, the shipowners did not have enough time to carry out these investments. Nevertheless, the state aid for existing ships seem to have promoted better know-how and awareness of available solutions to improve the environmental performance. [74]

The 2017 study on the Finnish case concludes that new ship projects are better targets for co-funding compared to those funding modifications to existing ships. The study also points out that national co-funding instruments should be planned well in advance of the anticipated release date[74] and that this planning is done together with the representatives of the industry - as it enables reaching a mutual understanding on the aims and limitations of the programme. Also ensuring a sufficient application period from release of call to its submission deadline would be important. The study aligns with other studies which are of the opinion that in order to avoid market distortions, the core focus should be on projects involving technology in a relatively early phase, i.e. as piloting before or during the formation of a regular market for a given solution. Further, the study emphasises the importance of combining the state aid with different types of environmentally

differentiated fees for operational activities (e.g. port and fairway fees)[214] and emission trading (if implemented).

The observations that national investment co-funding should focus on emerging technology would indicate a strong link to R&D funding. This seems also to be a common strategy among most countries in the region, with diverse ecosystem of innovation funding available, with Denmark as a prominent example in the maritime field also highlighted in 4.1.

The respondents also point out that shipowners can also benefit from EU funding received by technology providers who can in turn provide better prices for new environmentally friendly technologies. In order to have access to such piloting prices, one has to be among the first customers and thus be ready to take some risks. One idea would be to consider if it would be possible to support more those willing to test new advanced technology. In the system of today the purchaser of new technology takes a major risk.

The respondents expressed a general view that national R&D funding has the benefit that the application process and reporting requirements involve less administrative burden compared to EU co-funding.

National support for modal shift from land to sea

Sweden and Norway provide co-funding for initiatives to shift transport from land to sea, but these are not always easy to implement in practice. As an example, a 2019 study by the Swedish Transport Analysis highlights the challenges related to the kind of intermodal freight transport which is catalysed by the Ecobonus initiative.[215] The study points out that the different business terms and models as well as competition and development opportunities of the different transport modes make it challenging to develop intermodal freight. More specifically, they point to the lack of access to loading terminals, capacity limitations of rail network and the lack of companies coordinating the market transport as concrete bottlenecks. Similar challenges were highlighted by those respondents of this study who pointed out that a challenge of utilising the funding of Ecobonus type programmes is the general scarcity of eligible connections involving transhipments.

EU co-funding

Nearly all the industry respondents had utilised some form of EU co-funding for technology investments, usually via the CEF programme. EU co-funding appears thus to be an important enabler of sustainable shipping investments in the region. It was further highlighted that as the current EU co-funding programmes ends the Baltic Sea countries should make efforts to ensure the availability of EU funding also in the future.

One way to do this would be to channel European Green Deal funding to catalyse environmentally friendly technology projects -both new ships and retrofits to exisisting ships. The EU Commission is currently preparing a new environmentally friendly cargo transport initiative with planned proposal launch in 2021. This new development includes multimodal transport instruments, revision of the TEN-T Regulation as well as targeted measures to promote rail transport.[216] Related developments include also the recent focus of EU funding for developing technology for batteries and hydrogen fuel cells to enable low CO_2 emission ship propulsion.

The future of R&D funding, Horizon Europe and its Waterborne Partnership related to environmental ship projects, should also be secured as an important source of

[214] called "market pull measures" in the Gaia study.
[215] Trafik Analys, En breddad ekobonus, Report 2019:1, Stockholm, Sweden
[216] How the EU funds Green Shipping (18.3.2020)

new technologies for green shipping.

Respondents mentioned also that EU projects co-funding is currently considered as taxable income in Denmark while this is not the case in the other Baltic Sea countries. Harmonization of taxation practices of EU grants would be preferable to provide a level playing field.

6.3 Ship financing (Loans and guarantees)

The importance of replacing old ships with new ships and the difficulties in securing the required financing was a recurrent theme in the responses. Industry moves to self-incentivise GHG emission reductions such as the syndicated credit facility of Maersk, the world's largest container shipping company, published in 2020 are of importance for the whole sector. However, at least for SME shipowners the more stringent requirements emerging from the related new green banking principles (e.g. Poseidon Principles) might also contribute the other way in the short, making ship financing even more challenging even if potentially catalysing green investments in the long run.

Based on the responses collected in this study, new public financing initiatives, either EU wide, regional or national, would be important for green technology investments particularly for smaller shipowners in the Baltic Sea region. Such initiatives would enable higher guarantee rate for ships as well as longer loans for environmentally advanced ship projects. These initiatives include the further development and continuation of the EIB's Green Ship Investment and Guarantee programmes also as an element of the European Green Deal implementation, regional initiatives via actors such as NIB as well as the development of national financing initiatives for environmental ship investments based on examples such as the Swedish Skeppshypotek bank. An immediate challenge related to EIB financing is that a relatively few banks in the region have signed agreements with the EIB, which slows access to certain financing instruments.

The insurances and guarantees of export credit agencies are currently not awarded for investments involving vessels registered in certain countries outside the EU. Relaxing these export credit requirements for Greentech investments would increase the available market for green technology providers in the Baltic Sea region. Particularly the vessels of single ship shipowners worldwide as well as in the region are included in these registers.

6.4 Taxation as a means of environmental policy

Some respondents of the study highlighted the Norwegian NO_X tax-NO_X fund combination as a successful example of an economic incentive by, supporting earlier impact studies commissioned by the fund.[217] This general approach, also called *Refundable Emission Payment (REP*), [218] was perceived as a potentially effective way to cut emissions and improve the environmental performance of maritime transport also in the Baltic Sea. At least for the NO_X, this kind of instrument has been recommended as an effective regional measure also by earlier studies.[218] A REP system would naturally be also applicable for reducing other ship emissions than NO_X, but would likely require an EU level decision for all the other coastal countries except for the Russian Federation.

Interestingly, a legislative initiative for such an EU level REP decision has recently

[217] Ibenholt, K. Skjelvik, J.-M. & Myhrvold-Hansen, T. 2014. Næringseffekter av Miljøavtalen om NOx. Rapport 2014/36. Vista Analyse. ISBN 978-82-8126-177-8

[218] e.g. IVL (2019) NO_X Abatement in the Baltic Sea An Evaluation of Different Policy Instruments. No. C 247 May 2017. 66 pp.

been launched within the European Parliament with a focus on EU wide CO2 emissions from ships. The draft report of the European Parliament Committee on the Environment, Public Health and Food Safety to amend the EU MRV regulation (24.1.2020)[219] includes a proposal to establish a *Maritime Transport Decarbonisation Fund.* [220] The proposed fund seems to function in a similar way as the Norwegian NO_X Fund, even if aiming to reduce CO_2, instead of NO_X, emissions.

As another topic in the field of taxation the interviewees highlighted that, despite the environmental advantages and recently improved availability, OPS electricity and other similar shore-based energy distribution (district heating) is currently a disadvantaged alternative in terms of pricing. Disregarding port investment costs, important elements of the current high price of OPS was perceived to be high initial mobilization fees of an OPS connection, in part due to the need to mobilise port personnel, as well as the price per energy unit which was higher than that of electricity generated on board ships. A reduction in the OPS energy price is possible to incentivise via energy taxation. In the short-term Baltic Sea EU member states could apply for an exemption from energy taxes for OPS, following the approach already taken by Sweden, Germany and Denmark, while working for a more permanent solution via a revision of the 2003 EU Energy Tax Directive.

Environmentally differentiated tonnage tax (Norway)

It is interesting to note that environmentally differentiated tonnage tax was not mentioned by any of the respondents, even if all the coastal countries except the Russian Federation apply a tonnage tax regime. It might provide for one alternative way to incentivise technology investments of shipowners. This would also incentivise the owners of time-chartered environmentally advanced ships which do not generally benefit from operational incentives such as fuel efficiency or environmentally differentiated operational fees.

6.5 Environmentally differentiated operational fees

In many of the countries in the Baltic Sea region, vessels fulfilling pre-defined criteria are entitled to environmentally differentiated operational fees i.e. discounts to fairway, pilotage and port fees. At least in the Baltic Sea region, these discounts are the instrument which has perhaps been most closely associated with the concept of economic incentives.

Even if environmentally differentiated fees have an important role they have also some inherent limitations. One is that the costs from ports and fairway charges are only a minor share of the total operational costs of a ship and, specifically, the costs of installing new technologies are usually so large that the investments cannot be covered by discounts alone. In addition, the effectiveness of differentiated operational fees are also hampered due to the fact that the owner and operator of a ship are not always the same. In order to improve their fleet's environmental performance, it is the shipowner who should invest in better technologies in new ships and retrofits. However, several of the interviewed shipowners whose vessels are time-chartered argued that as they do not pay for the operational fees, possible discounts do not have a direct impact on their decision making. Thus, the environmentally differentiated fees are not the optimal driver for those measures requiring technical investments.

[219] EP. 2020. Draft Report on the proposal for a regulation of the European Parliament and of the Council amending Regulation (EU) 2015/757 in order to take appropriate account of the global data collection system for ship fuel oil consumption data (COM(2019)0038 – C8-0034/2019 – 2019/0017(COD)) Committee on the Environment, Public Health and Food Safety Rapporteur: Jutta Paulus. (dated 24.1.2020)

[220] See "Article 3gc Maritime Transport Decarbonisation Fund" as included within the draft report referred to under footnote 219 above.

Nevertheless, some respondents highlighted that besides being small, the discounts for new technology are usually only valid for a very short time period in the Baltic Sea region. It was reported that usually the requirements for discounts are tightened with a few year intervals, or simply removed, as regulations and technology develop. Even if this makes sense from a regulatory side this practice means also that differentiated fees cannot be seriously considered as a factor in return-for-investment calculations.

Nevertheless, the responses indicate that the indexes could direct the improvement of the fleet's environmental performance in the design phase. This is because usually all available published criteria for environmental performance are carefully considered when designing new ships.

Overall, the response collected supports the assumption that the current level of discounts from operational fees given for environmental performance in the Baltic Sea region do not compensate for the investment required to achieve the defined level of environmental performance. Thus, environmentally differentiated operational fees in the region do not work as strong economic incentives at least for new technological investments.

However, not all criteria of environmental performance require technical installations as for example the green ship concept of the 2019 EU PRF directive includes criteria on operational measures to reduce amount of waste generated as well as sustainable waste handling practices. Some ports grant discounts to waste fees already now if ship-generated wastes have been sorted in a specific way or the ship has ISO 14001 certification.

Based on the questionnaire response the discounts for port and pilot readiness fees were found to be more significant in Norway where they were thus a better incentive for improving the environmental performance of the fleet. Environmental discounts to port fees were reported to be up to nearly half of the regular costs which is much higher than the maximum discounts awarded by Ports in the Baltic Sea region (up to, but usually much lower than, 20%). However, Mjelde et al. (2019) concluded that, also for the relatively generous discounts for LNG given in Norwegian ports, the main impact of environmentally differentiated port fees is their long-term function as a catalyst for the adoption of new technologies when commissioning new ships.[221]

In general, the application processes of different certificates and awards that entitles for the environmentally differentiated fees was found to add administrative burden and costs to companies. However, only one of the interviewed companies mentioned evaluating the burden against the gain before deciding to apply for the certificate, while others considered the outcome worth of the effort.

Some shipowner companies brought up that their score of the environmental index is in the highest level and further improvements in their environmental performance would not further reduce fees based on indexes, while others found the required improvements too expensive against the gain. This would suggest for a need to actively update the requirements of environmental indexes in order to drive for more improvements in the vessel's environmental performance. For example, the ESI does not consider a usage of biogas and biofuels at the moment.

The interviewees found the application process of the CSI score straightforward, but the third-party verification added administrative burden and costs annually. Although, compared with the certification of ESI, the CSI certification was described less complicated. It was highlighted that the third-party verification of CSI notably adds credibility of the certification system (compared with the self-evaluation of

[221] Mjelde, A., Endresen, Ø., Bjørshol, E., Wang Gierløff, C., Husby, E., Solheim, J., Mjøs, N. & Eide, M.S. 2019. Differentiating on port fees to accelerate the green maritime transition. Marine Pollution Bulletin, Volume 149

ESI). The audit process was also found to advise the company about the profitable next steps in improving their score. Another positive feature in the CSI verification process was the fact that the CSI score was shown for application before payment, while in ESI the score will be revealed only later in the process. This 'preview' feature of CSI allowed for the company to evaluate the benefit of the certificate and the required investments to reach a next level.

The application process of the index certificates generally adds an administrative burden and thus, the interviewees recommended a harmonisation of the discount schemes in the Baltic Sea. Either the score thresholds that entitle for environmentally differentiated fees could be harmonised among harbours and ports or the index itself could be common for the region. Concerns were expressed about additional administrative burden with stricter criteria for index certificates.

Environmentally differentiated fairway dues

Some of the respondents clearly preferred the old (1998–2017) Swedish fairway due system which was abandoned with the introduction of the new CSI-based system on 1st of January 2018. They stressed that the new system for fairway dues in Sweden has increased administrative burden and resulted in a substantial rise in fairway dues even for the most environmentally advanced fleets. Some respondents highlighted that even if CSI related discounts to the Swedish fairway dues are in theory very high, they are much lower in practice even for an advanced ship and were in general critical to the new framework.[222]

The old system of environmentally differentiated fairway dues in Sweden seems to have been a success both in terms of emission reductions as well as industry acceptance. The achieved reduction of SO_X and NO_X emissions during 1998–2017 from vessels in Swedish waters have been estimated by Linde et al. (2019) as 50 000 and 11 000–17 000 tonnes per year, respectively.[223] This is a significant achievement which they attribute at least in part to the differentiated fairway dues.[223] Linde et al. (2019) also assessed that the old fairway due system as economically beneficial for the society, with benefits far exceeded the costs, based on public health improvements associated with the estimated emission reductions.[223] The ship owners/operators participating in the present study and with history of regular operations in Swedish waters, considered also that the level of discounts granted by the old system were large enough to catalyse investments leading to reductions of SO_X and NO_X emissions. However, it was also recognised that the old system had its weak points e.g. as it had set cargo vessels and passenger vessels to unequal status due to fee reductions based on the number of passengers.

However, the successes of the old fairway due system in Sweden should be considered within its historical context. This includes particularly the fact that Annex VI of MARPOL, the first global regulatory framework for air pollution from ships entered into force only in 2005. This followed nearly two decades of persistent work at IMO in which Sweden and the other Baltic Sea countries were providing key momentum.[224] Despite being a major regulatory step, the first version of the new Annex VI was not particularly stringent. As an example, even if the Baltic Sea was the world's first SECA area the limit for sulphur content in fuel oil within it was as

[222] Some industry respondents even questioned the dual role of Swedish Maritime Administration as a business enterprise with a profitability target and as a public body collecting obligatory fairway dues.
[223] Lindé, T., Vierth, I., & Cullinane, K. (2019). Evaluating the effects of Sweden's environmentally differentiated fairway dues. Transportation Research Part D: Transport and Environment, 70, 77–93.
[224] Svensson, E. 2011. The regulation of global SO_X emission from ships-IMO Proceedings 198-2008. Phil. Lic. Thesis Chalmers University of Technology. 112 pp., for a HELCOM and Baltic Sea perspective see also Backer, H. 2018. Regional work on prevention of pollution from ships in the Baltic Sea-a paradox or a global forerunner? Marine Policy 98. p. 257.

high as 1.5% during the initial 2005-2009 period.

Within the old system SMA granted fairway due reductions for sulphur content in fuel oil, for which the criteria were made more stringent with advancing regulatory requirements. Initially (1998-2007) reduction was granted for ships using fuel with sulphur content of less than 1% – a criterion which was later revised to less than 0.5% for 2008-2014. Finally, the fee discounts based on sulphur content in fuel oil were removed completely in 2015, with the entry into force of the currently valid 0.1% limit for the whole Baltic Sea (revision of SECA regulations).[225] The limits for NO_X emission deductions were been similarly revised over time, in line with the developing global and EU regulatory framework.[226]

Besides environmentally differentiated fairway dues, the pioneering role of agreements concluded already in 1990 between the Cities of Stockholm and Gothenburg and certain ropax ferry lines should also recognised as a factor in achieving the early cuts in the emissions of exhaust gases from ships in Sweden. In these agreements, certain operators with central berthing attractive for passenger vessels, committed to use fuel with a sulphur content of 0.5% or less,[227] two decades before entry into force of a global regulation. Based on the respondents of the current study, the recent requirement on the use of OPS in the Port of Stockholm has had a similar catalysing effect in taking this technology to full operational use.

As Mickwitz et al. (2008) [228] have pointed out the old Swedish environmentally differentiated fairway due system and differentiated port fees, had also a crucial role in boosting the early adaptation of SCR (urea catalysator) for marine applications. The resulting availability of technology was an important factor facilitating the negotiations at IMO on what would become the Tier III standard of MARPOL Annex VI, and could also promote the agreement on Baltic Sea NECA in 2016. [229]

Even if some of the criticism of the current CSI-based fee system is difficult to address within the current regulatory framework the system can naturally be improved. Based on the questionnaire response, some moves in this direction have already been made. There is currently a discussion within the SMA regarding the weighing of the CSI categories. The current model rates all CSI categories the same and does not consider the different costs each category requires in order to get a high CSI score. For instance, with measures related to recycling and reduction of waste it is a fairly easy to achieve a high score in the waste category to a low cost, whereas reductions in NO_X emissions can be quite costly in comparison.

In Finland the availability of ice-breaking services, similar to the described catalysing effect of port regulations for certain ropax operators in Sweden, is likely a more important driver than the differentiated of fairway dues based on ice class. As only ships with ice classes IA and IA Super are offered ice-breaker services during the ice season, these ice classes become indirectly a requirement for year-round operations in Finnish ports. The fairway due discounts have thus a lesser role when choosing the ice class for a vessel intended for year-round operations in Finland.

[225] In port of the EU countries the 0.1% sulphur content for fuels was applied already from 2010 based on the EU Sulphur Directive.
[226] More details on the temporal development of the Swedish environmentally differentiated fairway due system is provided by Lindé et al. 2019 (see footnote 223)
[227] Sjöbris, A. Flodström, E. Behm, E. 1999. Utvärdering av miljödifferentierade avgifter för sjöfarten. MariTerm AB. 19 pp. (available online e.g. as an attachment of SMA. 2000. Översyn av farledsavgifterna. see pdf page 67)
[228] Mickwitz, P., Hyvättinen, H. & Kivimaa, P. 2008. The role of policy instruments in the innovation and diffusion of environmentally friendlier technologies: popular claims versus case study experiences. Journal of Cleaner Production. Volume 16, Issue 1, Supplement 1. pp. S162-S170. cf. p.S167.
[229] Kämäräinen, J. personal communication (18.3.2020)

7 Summary and conclusions

The scope of this study was to evaluate, based on interviews and available literature, the current status of economic incentives for environmental measures of maritime transport in the Baltic Sea region. The aim was to discuss their effect both on green investments and further on maritime transport and to recognise the best practises for future regional incentives. In addition to the below text, providing a summary and conclusions of the main findings, the best practices and possible next steps identified in this study is synthesised to Table 7 on page 69 at the end of this section.

In this report, the concept of economic incentives was considered to encompass three broad categories of policy instruments: i) public sector co-funding (grants state aid) ii) ship financing (loans and guarantees), iii) environmentally differentiated operational fees and taxes. The economic incentives identified in this study can be conceptualised to include instruments, which are applicable in different phases of a ships life-cycle, from research innovations through the ship's investment, building and operational phases and ending up with sustainable ship recycling (see Figure 8). In this perspective, the long lifetime of ships makes it necessary to incentivise also retrofit projects for existing ships and an environmentally responsible operation phase, even if new ships are outfitted with the latest environmental technology.

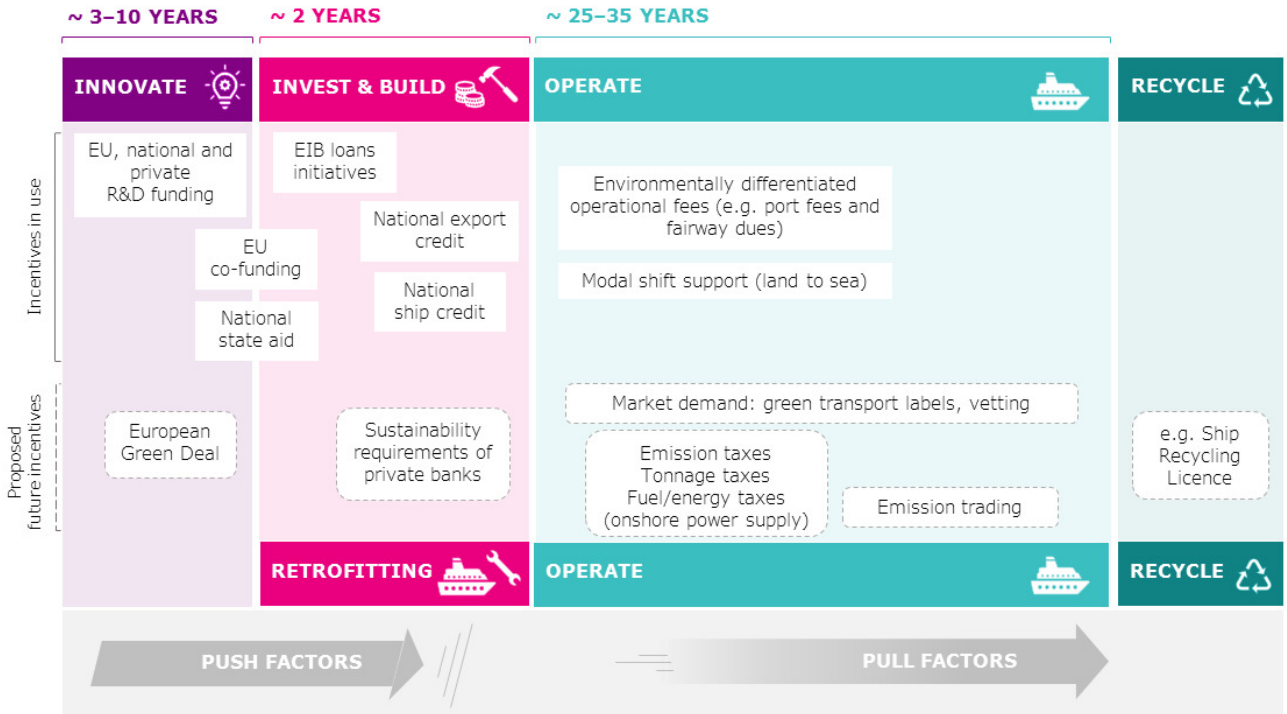

Figure 8. A schematic overview of the economic incentives for environmentally friendly maritime transport during a vessel's lifecycle from innovating to recycling. Public co-funding and other support can also be considered as economic incentives working as push factors, while less direct incentives such as market demand, differentiated operational fees and taxation could be considered as pull factors.

A general finding was that information on economic incentives in the Baltic Sea region for environmentally friendly shipping is not readily available in a compiled form. Even for specific topics, such as environmentally differentiated port fees, an overview of the situation in the Baltic Sea regionneeds to be compiled manually from port websites and partial information included in (usually outdated) project

reports. Consequently, identification of the right instruments requires considerable research effort, which may not be easy for smaller companies. A compilation of the available incentives would make their utilization easier for many shipowners without the capacity to do the research required in the current situation.

A general finding arising from the questionnaires and interviews is that the attitudes of the respondents to economic incentives could be interpreted as positive, or at least neutral, and that a more long-term approach to their development would be preferable. Incentives designed with a long-term perspective, would likely be more suitable to accommodate the necessary adjustments, investments, changes in operational routines and optimizations of performance done continuously by all shipowners. The different phases of the long lifetime of a ship requires different incentives.

Further, based on the replies from the informants of this study, co-funding and financing (loans and guarantees) for investments in new more environmentally friendly technology has a major role in improving the environmental performance of vessels, particularly in new ships but also in retrofits to existing ships. National state aid, EU co-funding and financing tools are relevant instruments and direct the industry into better environmental performance. Besides investing in better technology, the environmental impact of shipping can be reduced by incentivising changes in ship operation. In addition to these methods, also taxation was found as an important tool for implementing environmental policy.

A fairly clear ranking of the incentives in terms of importance for shipowners emerged from the responses. In the light of this study the most important measures to promote green investments are related to ship financing (loans and securities). The second topic in terms of importance was co-funding instruments, including European Union (EU) funding instruments and national grants for technology investments as well as innovation. The third topic was environmentally motivating taxation. Environmentally differentiated fees, including port and fairway dues, were perceived as less influential at least for shipowner investment decisions.

Financing new ships appears to be a challenge for shipowners. The collateral value of the new vessel under construction is either not considered, or low, and the period of repayments is relatively short. There were several suggestions about how the system could be improved by various public sector initiatives at national or EU levels. The most critical issues being enabling higher ship guarantee rates and longer timeframes for loans. Even if also private sector initiatives with similar spirit, such as green banking principles, are emerging they seem to remain at initial stages in terms of practical deployment or reserved for bigger actors. In the short term, banks in the region could be encouraged to sign agreements with the EIB to facilitate access to its green ship financing instruments.

Compared to financing and co-funding, the systems of environmentally differentiated operational fees in the Baltic Sea region were found to have less influence on the investments on more environmentally friendly technology. One fundamental hurdle is that the costs of installing new technologies are so high that the investments cannot be covered by environmental discounts alone. Recommendations for improving the effectiveness of differentiated operational fees included guaranteeing discount eligibility for longer timeframes, increasing the level of discounts, reducing the administrative burden involved as well as further development of, and harmonisation between, the different environmental indexes used. As the investing agent may be other than the ship operator it should be ensured that the benefit of high environmental performance from differentiated fees should directly or indirectly benefit the entity that made the investment or operational changes that led to better performance.

Environmental taxation emerged also as an important instrument to enable sustainable shipping in the Baltic Sea region. Some respondents of the study highlighted a Norwegian-style NO_X tax and NO_X fund as a potentially very effective

way to cut emissions and improve the environmental performance of maritime transport also in the Baltic Sea region, even if such a system would be challenging to implement in practice due to decision making dimensions within the EU. In the field of taxation the interviewees highlighted also that, despite the environmental advantages in terms of reduced emissions in ports and recently improved availability, OPS electricity and other similar shore-based energy distribution (district heating) had currently a very disadvantaged pricing which is possible to address via energy tax reliefs, at least in part. A third taxation related proposal was that a vessel investment reservation in taxation should be possible for any of the affiliated companies in a larger concern, not only the ship owning entity as it is today.

Naturally, R&D funding is also a key factor enabling a sustainable shift to environmentally sustainable shipping in Baltic Sea maritime transport. EU co-funding was used by many of the respondents but also national funding sources, which were perceived to involve less administrative burden. A maritime focus and a good level of funding should be enabled in future research programmes in the EU and nationally.

One aim of environmental investments is to attract environmentally conscious cargo owners, for short term engagements but also for long term engagements, and in this way secure market shares in a changing environment. In addition to being in line with the environmental values of the cargo owner, the lower carbon (and general environmental) footprint can also have economic value, including brand effects of the final merchandise or in the form of emission credits.

Consequently, several maritime transport providers have launched green shipment services to meet the increasing market demand, but the premium customers are prepared to pay seems to remain relatively small. Therefore, the market demand does not seem to work as a sufficient driver for a sustainable transition in shipping, and an enforceable regulation and economic incentives are required to support it.

Table 7. A summary table with a selection of best practices and themes emerging from the study as well as possible next steps in terms of regional work. The topics, except three general points, have been ordered based on decreasing degree of priority according to the overall results of this study. EU=European Union, EU CEF= EU Connecting Europe Facility, EIB= European Investment Bank, R&D= Research & Development, SME=Small and Medium-sized Enterprises, OPS= Onshore Power Supply, EU ETD= EU Energy Taxation Directive, NO_X=Nitrogen Oxides, HELCOM GREEN TEAM= A regional body in the Baltic Sea working with green technology and alternative fuels in shipping.

Topic	Highlight/Best Practice	Possible regional Next Steps
1. Loans and Securities for new ships	Further public initiatives enabling 15+ years loans and guarantees for new environmentally friendly ships	Consider dedicated national and EU initiatives on long term financing for new environmentally friendly ships.
2. EU co-funding for investments	EU CEF Blending Facility call, as well as some EIB instruments, require arrangements with banks, which are not in place in all countries.	Promote conclusion of agreements between EU institutions (EIB) and banks in the region.
3. National co-funding for R&D	National R&D funding is more accessible for SMEs by involving less administrative burden compared to EU projects.	If not already available, develop national R&D initiatives for green shipping including piloting and demonstrations.
4. EU co-funding for R&D	EU funding is an important catalyst of green shipping innovations.	EU member states of the Baltic Sea region could work to ensure maritime transport component of emerging new CEF, Horizon Europe as well as proposed European Green Deal related EU funding.
5. Environmental taxation	Onshore Power Supply (OPS) is currently an uneconomic alternative due to unfavourable energy taxation and not widely available	Consider promoting more favourable pricing of Onshore Power Supply (OPS) services in the Baltic Sea ports via reliefs from energy taxation. For EU member states this would indicate exemptions for OPS from the 2003 EU Energy Taxation Directive, as well as looking for more permanent solutions via ETD revisions.
	Norwegian NO_X tax and NO_X fund	Consider supporting proposals in the EU framework for an EU wide refundable emission payment scheme for shipping, inspired by the Norwegian approach.
6. Environmentally differentiated operational fees	Ports and fairway charges are only a minor share of the total operational costs of a ship and do not always work as an incentive for the ship builder/owner.	Consider stronger environmental differentiation of operational fees with larger discounts for the most advanced vessels.
	Harmonisation of the discount schemes on environmentally differentiated operational fees in the Baltic Sea area would be important.	Consider further harmonization and development of Environmental indexes used in awarding environmental discounts.
7. Customer demand & Green labels	Service providers are leading the way in green labelling of maritime transport but operate largely in the absence of a regulatory framework	Advance regulatory frameworks supporting and enabling increased customer demand for green transport products.
General	A compilation of economic incentives for maritime transport in the Baltic Sea is not available.	Initiate a mechanism to regularly share up-to date information on economic incentives in the Baltic Sea area. This could be a task for HELCOM GREEN TEAM of another similar arrangement.
		Consider a regional follow-up study on economic incentives with a particular focus on financing.
	Economic incentives need to be designed and applied with a long-time perspective	Consider the element of predictability and time in economic incentives for sustainable shipping in the Baltic Sea

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Appendix I: Questionnaires

I. Questions for administrations

1: Which types of governmental support or any other economic incentives are, or have been, in use in your country to improve the environmental performance of maritime transport?

2: Can you share any experiences on the use of economic incentives to improve the environmental performance of maritime transport? Have the incentives been effective? What has been the impact?

3: Are there any types of economic incentives to improve the environmental performance of maritime transport currently under consideration in your country? If yes, specify.

4: Do you have any suggestions regarding the future development of economic incentives or financing to improve the environmental performance of maritime transport in the Baltic Sea?

II. Questions for shipowners' associations

1: Can you share any information on the utilisation, and main sources of, public sector financing (national or EU) by your members for technological investments to improve the environmental performance? If yes, please specify.

2: Can you share any information on the utilisation of any environmentally differentiated fees by your members to reduce their operational costs? If yes, please specify.

3: Can you share any views on the utilisation of any types of economic incentives? Have the incentives been effective? What has been the impact?

4: Do you have any suggestions regarding the future development of economic incentives or financing to improve the environmental performance of maritime transport in the Baltic Sea? If yes, please specify.

III. Questions for shipowners (used in a questionnaire & subsequent interviews)

1: Which different types of economic incentives for environmentally friendly shipping are you aware of?

2: Has your company utilised any forms of public sector financing (national or EU) for investments to improve the environmental performance of your fleet? If yes, please specify.

3: Has your company utilised any environmentally differentiated fees to reduce the operational costs of your fleet? If yes, please specify.

4: Have you faced challenges while trying to utilise economic incentives or have you considered the process to be difficult? Have you decided not to utilise economic incentives due to heavy administrative burden or any other reasons? If yes, please specify.

5: Can you share any experiences on the utilisation of any types of economic incentives to improve the environmental performance of your fleet? Have the incentives been effective? What has been the impact?

6: Is your company considering the utilisation of economic incentives in the future to improve the environmental performance of your fleet? If yes, specify.

7: Do you have any suggestions regarding the future development of economic incentives or financing to improve the environmental performance of maritime transport in the Baltic Sea?

Appendix II: Respondents

Respondents from administrations

Country: Agency
Denmark: Danish Maritime Authority / Søfartsstyrelsen
Estonia: Maritime Administration / Veeteede Amet
Germany: Federal Ministry of Transport and Digital Infrastructure / Bundesministerium für Verkehr und digitale Infrastruktur BG Verkehr Verkehrswirtschaft Post-Logistik Telekommunikation /
Lithuania: Lithuanian Transport Safety Administration / Lietuvos transporto saugos administracija
Russian Federation: Ministry of Transport of the Russian Federation / Министерство транспорта Российской Федерации
Sweden: Swedish Maritime Administration / Sjöfartsverket

Shipowners' association respondents

Association
Suomen Varustamot/ Rederierna i Finland Finnish Shipowners' Association
Svensk Sjöfart Swedish Shipowners' Association
Danske Rederier Danish Shipowners' Association
Verband Deutscher Reeder VDR German Shipowners' Association

Shipowners respondents/Interviewees

Company
Eckerö Shipping
Finnlines
Langh Ship
Meriaura / VG Shipping
Bore
Tallink Group
Terntank Rederi
Viking Line

Appendix III: Environmentally differentiated port fees in the Baltic Sea region

Country	Port	Discount basis	Discount	Source	Accessed
Denmark	Århus	ESI	ESI 30 p or more .5% discount of ship dues		
Estonia	Tallinn incl. Paldiski	ESI	ESI 65–79 p 93%, 80 p or more 8% Other discounts from tonnage charge are calculated based on the tonnage charge rate, which is reduced by the ESI discount.	Price list 2020	05/03/2020
Finland	Helsinki	ESI, OPS, noise-reduction, environmental investments	Discount of the vessel charge based on ESI scores: 80 p: 6% and 65 p: 4%. ESI points granted for the installation of OPS systems (10 p) are included only if the vessel uses OPS. Discount can also be applied for based on other certifications that describe the environmental impact of the vessel (i.e. CSI). If the vessel's total noise emissions, while docked at the passenger harbour is > 105 dB, a 4% of vessel charge. A discount of a max. 6% on the vessel charge may also be granted based on investments or innovations that improve a vessel's environmental or energy efficiency, reduce emissions or improve noise abatement in the Port of Helsinki's area.	Price list 2020	05/03/2020
	Långnäs	NO_X emission based	For vessels with NO_X emissions less than 8 g/kWh of the effect of the ship's auxiliary and main engines at 75% load, port fee is reduced as follows: 7–8 g/kWh, 0.5% 6–7 g/kWh, 1.0% 5–6 g/kWh, 2.0% 4–5 g/kWh, 3.0% 3–4 g/kWh, 4.0% 2–3 g/kWh, 5.0% 1–2 g/kWh, 6.0% < 1 g/kWh, 8.0%. Discounts applicable only for shipowners that can confirm that the reduction equipment is continuously in use.	Price list 2020	05/03/2020
	Mariehamn	Other (NO_X emission based)	For vessels with NO_X less than 10 g/kWh of the effect of the ship's auxiliary and main engines at 75% load, port fee is reduced as follows: Rebate according to NO_X content/kwh: 6.0–9.9: 4.0%, 5.9–2.0: 8%, 0–1.9: 16%	Price list 2020	05/03/2020
	Rauma	Other (LNG) and waste reduction charge	Vessels using LNG in port, will receive a discount of 20% the vessel charge. Vessels with an ISO 14001 certified environmental system the charge of oily waste per unit of net tonnage discounted by EUR 0.02.	Price list 2020	09/03/2020
					1/4

Country	Port	Discount basis	Discount	Source	Accessed
Germany	Bremerhaven (The ports of Bremen/Bremerhaven)	ESI and LNG/methanol	A total of 25 ships with the best ESI score (≥ 40 p) receive a discount of 15% per port call up to a maximum of EUR 4 500. Vehicles powered solely by LNG or methanol and which have an ESI SO_X score of > 98, receive a discount of 20% up to a max. of EUR 6000. If an ESI discount is granted, no LNG discount will be granted.	Pricelist 2020	05/03/2020
	Cuxhaven (applies also for Brake, Emden, Stade, Wilhelmshaven) *(not in the Baltic Sea)*	ESI and ecofuels	Discount on harbour dues to with ESI ≥ 20 p. Maximum of 20 ships' calls for each shipowner can receive a discount. ECO-Fuel Rebate on Shipowners whose ships are exclusively propelled or equipped with dual fuel propulsion powered by LNG, methanol, or ethanol, receive a discount on the harbour dues. Only one of the discounts pursuant to ESI or ECO-Fuel can be granted.	Price list 2020	05/03/2020
	Hamburg *(not in the Baltic Sea)*	Shore power discount, ESI, Green Award, Blue Angel	Shore power discount, if ship relies on shore power while berthing, 100% renewable energy reduction 80%, non-renewables reduction and on-board shore power equipment 60%, non-renewables reduction 30% max. up to EUR 2 000. ESI 10%, Green Award 3%, Blue Angel 2%.	Fees and charges, effective as of 1 January 2019	16/03/2020
	Rostock	ESI	ESI ≥ 40 p 5.0% discount, ≥ 50 ESI p 7.5% discount, 60 p 10.0% discount of the Port fees based on GT.	Price list 2020	09/03/2020
Latvia	Riga	Green Award	10% reduction of port fees (Oil tankers)	Introduced in 2010	05/03/2020
Netherlands *(not in the Baltic Sea)*	Rotterdam	ESI	Seagoing vessels scoring ≥ 31 p on ESI, 10% discount on port dues based on GT. The discount only applies to the first 20 calls per single ship per quarter. If the vessel also has an individual ESI-NO_X score ≥ 31 p, the discount will be doubled. Green Award LNG tankers, Chemicals/Gas tankers and Oil/Product tankers 15% discount on the port dues based on GT.	General terms and conditions 2020	09/03/2020

Country	Port	Discount basis	Discount	Source	Accessed
Norway *(not in the Baltic Sea)*	Fredrikstad (also applies to Hvaler and Sarpsborg)	ESI	Reductions of port fees based on ESI scores as follows: 30 p 10%, 40 p 15%, 50 p 20%, 60 p 25%, 70 p or more 30%.	Price list 2020	05/03/2020
	Kristiansand	ESI, EPI	Rebates according to ESI: 25–50 p, 20%, 50–100 p, 30% of port fees. Reductions also for cruise ships.	Port fee regulations 2020	05/03/2020
	Larvik	ESI	With ESI: 25–50 p a discount up to 20% on normal rates. Ships with ≥ 50 p are entitled to a 40% on normal rates. Total discounts on quay charges may not exceed 60%.		
Russia	Primorsk & Ust Luga	LNG	Reduction factor of 0.9 when calculating port fees for bulk vessels using LNG as the main fuel (15.8.2018-).	RU Ministry of Transportation	
Sweden	Brofjorden *(not in the Baltic Sea)*	CSI, LNG	Vessels using LNG will receive 20% discount in port fees. Vessels are entitled to a discount based on their CSI: class 3 to 5% discount, class 4 to 10% discount.	Martin Persson/ Ferm & Olsson Stenungsund AB	26/02/2020
	Gävle	ESI, CSI	With a minimum of 30 ESI points or CSI class 4, receive a 10% discount on the port fee, based on GT. Vessels that use LNG for fuel during the port call receive a 20% discount on the port fee, based on GT.	Price list 2020	06/03/2020
	Gothenburg	ESI, CSI, LNG	Vessels with at least 30 ESI points at least CSI class 4 receive a 10% discount on the port tariff based on GT. Vessels powered by LNG receive an additional discount of 10%. Vessels operated by LNG with a mixture of at least 10% LBG receive an additional 10% discount.	Price list 2020	05/03/2020
	Kapellskär	*See Stockholm			
	Luleå	NO_X emission based	Discount based on national Maritime Administration procedures. Vessel's NO_X emissions give discount as follows: < 5 g/kWh SEK 0.20 per GT, 5–10 g/kWh SEK 0.10 per GT and > 10 g/kWh will be charged a supplement of port dues of SEK 0.20 per GT.	Price list 2020	17/03/2020
	Norrköping	based on offer		Martin Persson/ Ferm & Olsson Stenungsund AB	26/02/2020

Country	Port	Discount basis	Discount	Source	Accessed
Sweden	Nynäshamn	*See Stockholm			
	Piteå	ESI, CSI, LNG	Vessels using LNG will receive 20% discount and vessels with a minimum of 30 ESI points or at least CSI class 4 will be granted a 10% discount on the vessel dues based on GT.	Price list 2020	31/03/2020
	Södertälje	(by the end of 2020)			
	Stenungsund *(not in the Baltic Sea)*	ESI, CSI, LNG	Vessels using LNG and vessels with a minimum of 30 ESI points or at least CSI class 4 will receive a discount of SEK 0.50 per GT.	Martin Persson/ Ferm & Olsson Stenungsund AB	26/02/2020
	Stockholm (Ports of)	ESI, CSI, shore power subsidy	Rebate bases on the CSI and ESI scores	Price list 2020	05/03/2020
	Sundsvall	ESI, CSI, LNG	Vessels using LNG will receive 15% discount and vessels with a minimum of 30 ESI points will be granted a 10% discount on port fees based on GT.	Price list 2020	31/03/2020
					4/4

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