

BPO

BALTIC PORTS  
ORGANIZATION

The Baltic Sea as a model region for  
green ports and maritime transport

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WE ARE PAVING THE WAY



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The **Baltic Ports Organization** is a regional ports organization inspiring and supporting its members while cooperating pro-actively with relevant partners. BPO was established on October 10, 1991, in Copenhagen, with an aim to facilitate cooperation among the ports and to monitor and improve the possibilities for shipping in the Baltic Sea region.

Development over the past years has proceeded very quickly and at present BPO has entered new, challenging and exciting phases. Currently, included in BPO are 45 of the most significant ports in the nine countries surrounding the Baltic Sea as well as seven friendship members. BPO is well-recognized within the BSR, in EU bodies and other European regions.

The organization's mission is to contribute to economic, social and environmental sustainable development of maritime transport and the port industry in the Baltic Sea region, thereby strengthening its global competitiveness.

BPO is registered in Estonia (Port of Tallinn headquarter) and operates according to the Estonian Law on Non-profit Associations.

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**BPO represents** the interests of the Baltic Sea ports towards EU institutions and other relevant organizations.

**BPO contributes** to the clean environment of the Baltic Sea, promotes environmental management in the ports and plays an active role in international dialogs where the environment is concerned (BPO Environmental Working Group).

**BPO organizes** dedicated conferences, seminars, study visits, dealing with questions in the area of port operation and management, and the environmental impact of port activities.

**BPO supports** and plays an active role in research, science and training which lead to a better understanding of the transport sector in the region and to study future challenges.



# Sharing the standards and know-how with all of Europe

The aim of this review is to show the Baltic ports' proactive work towards making ports and maritime transport more environmentally-friendly. It concentrates on issues of special importance that have emerged from changes in the environmental regulations. Environmental regulations are indeed a challenge, but may also create an opportunity; they are demanding, but may spur innovation and development in regional cooperation. We also believe that they may enhance our competitiveness in the long-term.

A clean Baltic Sea is the common goal of all Baltic Sea Region (BSR) countries. Baltic ports' activities in the field of environmental management can serve as a set of good practices and a model for cooperation that can be followed by other European ports and the shipping industry. BPO would like to promote the Baltic ports' standards more widely, simply because Baltic ports have already paved the way for future green European ports and maritime transport.

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Protection and sustainable growth of the Baltic is the unquestioned goal and a common understanding among the BSR countries as well as various stakeholders of the shipping industry. Baltic ports have even gone a step further than today's regulations. Our experiences show that environmental regulation, often perceived as a costly nuisance, may also increase the demand for innovative solutions, which transform into new, applicable technologies.

**Indeed, we have the technology at our fingertips to start efficiently dealing with the environmental concerns at hand.** Many of these technologies not only help protect the environment and obey the law but may also have a positive impact on the costs, especially in the long-term. Some Baltic ports and ship operators are already committed to taking advantage of green solutions.

It must not be overlooked that the number of new regulations and responsibilities arising therefrom cause a substantial administrative and financial burden on both shipping and ports in regions where these regulations were imposed. It disturbs the competitiveness and creates unfair market conditions for maritime transport in the BSR compared to other regions in the EU. There is no rationale for double standards for the EU seas and double standards for the shipping business and ports in the EU.

BPO wants to share our experiences and know-how with ports and shipping in the rest of Europe, but we also want to operate on a level playing field in all of Europe. Therefore, the BPO is of the opinion that the same rules should be applied in all of the EU's seas and ports.

There is a real potential for cleaner seas and air in whole Europe, but European policy makers, regulators as well as all European ports and stakeholders should take responsibility to improve the environmental performance. No one can be exempt from contributing to sustainable maritime transport in Europe. Everything that we do for the sake of the environment will in turn have a positive impact on all of us.

## The Baltic – the sea for all

The Baltic Sea is a semi-enclosed sea that measures about 415 000 km<sup>2</sup> (Kattegat included) in area, and is regarded as one of the largest body of brackish water in the world, despite being a rather small sea in a global perspective. It is also a relatively shallow sea with mean depth of only 53 m. A very narrow and shallow connection to the North Sea and the Atlantic Ocean limits the water exchange, which is intermittent and very slow – in fact, the water remains in the Baltic Sea for about 30 years. Many rivers flowing into the sea additionally contribute to its brackish character. All of these features have a negative impact on the Baltic's ability to rejuvenate and make it highly sensitive and vulnerable to external factors. The Baltic Sea is surrounded by nine countries: Sweden and Finland to the north, Russia, Estonia, Latvia and Lithuania to the east, followed by Poland in the south, Germany and Denmark in the west. The catchment area extends over 1.7 million km<sup>2</sup> and is home to about 85 million people.

The Baltic is an important economic area for BSR countries, which takes advantage of such a neighbourhood. The sea provides us with a variety of benefits for free, which contribute to our welfare. It accommodates intensive traffic of cargo ships as well as enables people to move between cities and countries in the Region. It also serves as a recreation area and provides us with food resources.

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Algal bloom in the Baltic Sea  
Source: ESA (European Space Agency).

Unfortunately, a combination of the Baltic's sensitivity and intensive human activity on both land and water results in progressive deterioration of this unique body of water. Over the past 100 years the Baltic has changed and its natural environment has degraded significantly. Together with the stagnation of the deeper water, pollution of the Baltic Sea has now become a threat to its flora and fauna.

The Baltic's ecological state and biodiversity are threatened by eutrophication resulting from excessive nutrient input, direct pollution, growing ship traffic increasing the risk of spills and accidents, climate change, and direct human actions including overfishing and over-exploitation.

The environmental challenges facing the Baltic have been known for a long time and are very well researched. There is strong scientific evidence identifying the factors causing these problems. One of these factors, though not dominant, is extensive trade between well-developed surrounding countries, which creates a demand for transport services, mainly shipping. Increasing maritime transportation, besides land-based pollution, threatens fragile ecosystems and the livelihoods of the many people who depend on the sea.

## Shipping and ports at the Baltic Sea

The BSR is a very prosperous region and maritime transport has contributed to its prosperity. The Baltic Sea is one of the most heavily trafficked seas in the world, accounting for up to 15% of the world's cargo transportation. According to the HELCOM Automatic Identification System (AIS) for monitoring maritime traffic,



established mid-2005, there are about 2,000 ships in the Baltic marine area at any given time, and each month around 3,500-5,000 ships ply the waters of the Baltic (HELCOM, 2009). In 2014, the overall transport work increased by 2.2% year-on-year, while the total travelling distance of IMO-registered vessels decreased 1.2%. The simultaneous increase in transport work and the decrease in travel amount indicates an increase in average vessel transport capacity (HELCOM, 2015a).

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Baltic ports have become crucial nodes in the international flow of goods and significant wealth generators. About 200 ports (excluding small recreational ports), which are different with regards to ownership, size, traffic, turnover, infrastructure, etc., are settled along the Baltic coastline. The Baltic seaports' turnover has developed steadily. The decade 2005-2014 brought double digit growth (+14.3%) to the entire Baltic ports sector; however, it does not mean that disruptions on global and regional markets have passed unnoticed.

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In 2015 the total figure in BSR countries' port turnover amounted to 870.0 mln tonnes, with Russia leading in total port handlings since 2011, leading also in liquids and dry bulk turnovers. Sweden still remains the leader in general cargo handlings.

BSR countries' seaports turnovers  
Source: Baltic Port Yearbook 2014/2015, Baltic Transport Journal 2/2016.

BSR countries' seaports turnovers	2010 (mln tn)	2014 (mln tn)	2015 (mln tn)	2010/2015 (%)	2014/2015 (%)
total freight	814.1	871.1	870.0	+7.0	-0.13

The rankings of the Top 10 Baltic ports in 2015 show the domination of Russian ports, especially with regards to the total freight turnovers, where only one port of the western Baltic is present (Gothenburg).

Top 10 Baltic seaports in 2015 in terms of cargo turnover (in millions of tonnes)  
Source: Baltic Transport Journal, 2/2016.

	Total freight	Liquids	Dry bulk	General cargo
1	Ust-Luga	Primorsk	Ust-Luga	St. Petersburg
2	Primorsk	Ust-Luga	Riga	Gothenburg
3	St. Petersburg	Gothenburg	Klaipeda	Lübeck
4	Riga	Sköldvik	Gdańsk	Trelleborg
5	Klaipeda	Brofjorden	Szczecin-Świnoujście	Klaipeda
6	Gothenburg	Gdańsk	St. Petersburg	Helsinki
7	Gdańsk	Ventspils	Luleå	Rostock
8	Ventspils	Tallinn	Rostock	Gdańsk
9	Tallinn	Vysotsk	Gdynia	Szczecin-Świnoujście
10	Sköldvik	Klaipeda	Ventspils	Gdynia
<b>Total in 2015</b>	<b>414.7</b>	<b>245.7</b>	<b>120.3</b>	<b>134.8</b>

However, the ports' standings in the ranking change around a little bit each year. Ports in Sweden and the Baltic states as well as the Port of Rostock have considerable importance in the BSR. The Polish Port of Gdańsk is among the Top 10 ports in every ranking.

## CONTAINER MARKET

Container turnover in BSR ports constitutes approximately 1.2% of the global and 9.9% of the European container markets. The importance of the Baltic container market rose after global operators' direct services began to call Baltic ports in 2010 (e.g. Maersk AE-10 from Busan to Gdańsk). In 2011-2014 Baltic ports handled almost 10 million TEUs yearly. A substantial decrease in container volumes was experienced in 2015, when, compared to the year before, a total loss of 1.23 million TEUs was recorded. The majority of ports suffered from declining container turnovers and only Finnish and Danish ports recorded a positive result in the BSR.

		2014	2015	yoy
1	St. Petersburg	2,375.0	1,715.1	-27.8%
2	Gdańsk	1,212.05	1,091.2	-10.0%
3	Gothenburg	836.6	820.0	-2.0%
4	Gdynia	849.1	684.8	-19.4%
5	HaminaKotka	575.0	553.4	-3.4%
6	Aarhus	424.0	445.0	+5.0%
7	Helsinki	401.0	430.4	+7.5%
8	Klaipeda	450.4	392.7	-12.8%
9	Riga	387.6	355.2	-8.3%
10	Rauma	275.7	263.0	-5.5%

Top 10 Baltic container seaports in 2015 (TEU turnover in thousands)  
 Source: A (rather) quiet year. Baltic transport 2015 highlights, BTJ 1/2016.

## RO-RO AND FERRY MARKET

The Baltic is known for its ferry and ro-ro shipping intensity and the majority of the intra-BSR trade passes through Baltic ports. In 2015 there were 34 shipping operators sailing their ferries and ro-ro ships (including some con-ro) as well as car carriers to, from and within the Baltic Sea area.

Cargo (thousands tn)			Passengers (thousands)		
1	Trelleborg	10,910	1	Helsinki	11,169
2	Lübeck-Travemünde	10,471	2	Stockholm	10,657
3	Gothenburg	8,181	3	Tallinn	9,295
4-5	Puttgarden	6,674	4	Helsingborg	7,670
4-5	Rødby	6,674	5	Helsingør	7,643
6	Helsinki	6,577	6	Puttgarden	6,141
7	Stockholm	5,949	7	Rødby	6,139
8	Rostock	5,858	8	Turku	2,705
9	Śzczecin-Swinoujście	5,160 (estimated)	9	Odden	2,690
10	Helsingborg	4,526	10	Hirtshals	2,600

Top 10 ferry/ro-ro Baltic ports (cargo/passengers) in 2015  
 Source: Baltic Transport Journal, 3/2016.

Currently, there are approximately 109 single services, with 63 ro-pax connections and 46 freight lines (including nine feeder services by car carriers). Finnlines and Stena Line provide 11 services each, whilst DFDS operates nine services. Ro-ro and ferry traffic goes through 71 ports within the borders of the BSR, with more than half of them in Sweden,

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Denmark and Finland. The Baltic is linked directly with at least 30 ports located in the rest of Europe.

## CRUISE SHIPPING MARKET

The Baltic Sea Region offers an impressive array of UNESCO World Heritage Sites, ready to be admired. Passengers of cruise lines are willing to explore them during short visits in Baltic ports. Although the number of vessel calls has remained rather stable over the last 15 years, the number of passengers has increased more than four times: from 1,072,000 passengers in 2000 to 4,297,000 in 2015 with an average annual growth rate of 9.7%.

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Passengers			Ship calls		
1	Copenhagen	677,000	1	St. Petersburg	285
2	Stockholm	530,229	2	Copenhagen	283
3	St. Petersburg	505,359	3	Tallinn	280
4	Tallinn	500,622	4	Helsinki	254
5	Helsinki	436,500	5	Stockholm	249

Top 5 Baltic cruise ports in 2015 (by passengers and by ship calls)  
Source: Cruise Baltic Market Review 2016

In the same timespan the number of port calls increased from 1,479 to 2,174, with an average annual growth rate of 2.6%. It is estimated that in 2016 the BSR region will be visited by about 4.4 million cruise passengers.

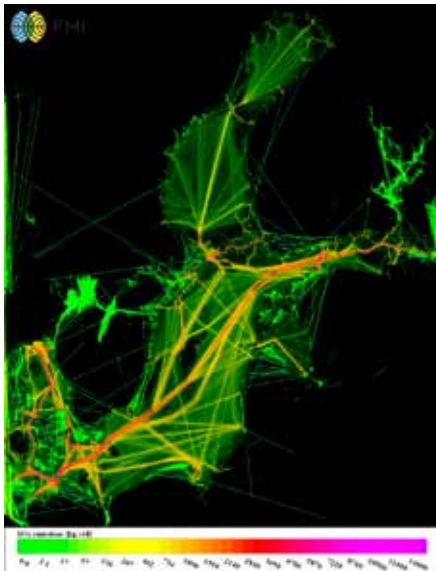
However, the dynamic growth in maritime trade over the last decades has resulted in increased emissions and pollution from shipping – a phenomenon, which must not be overlooked. Growth in transshipment, handling, storage and further processing of cargo (logistics) directly translates into rising air and water pollution levels as well as other externalities such as noise, accidents, etc.

# Impact of ports and shipping on the environment and human health

Shipping is the most environmentally-friendly mode of transport in terms of emissions per tonne of cargo. However, research confirms that the marine transport sector contributes significantly to air pollution, especially along the coastal areas near busy shipping lines, causing the exposed population adverse health effects (Corbett et al., 2007). It is estimated that nearly 70% of ship exhaust emissions occur within 400 km of the coastline (Endresen et al., 2003).

Emissions are also generated in seaports and come from a variety of sources: ships calling in a port (while manoeuvring and at berth), loading/unloading operations, storing and warehousing, and the industry located within the port area. Another crucial source of pollution is a port's connections with its hinterland. Even though ports can play an important role in promoting regional economic development, in many cases they become a significant source of pollution in their host cities as a lot of seaports are still located near densely populated areas.

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Emission from BS shipping 2015  
Source: HELCOM

The major air pollutants related to shipping and port activities that can affect human health and the environment include carbon oxides (CO<sub>x</sub>), particulate matters (PM), volatile organic compounds (VOCs), nitrogen oxides (NO<sub>x</sub>), sulphur oxides (SO<sub>x</sub>) and ozone. Other air pollutants from port operations such as formaldehyde, heavy metals, dioxins and pesticides used to fumigate produce, can also be a problem. These pollutants, especially PM and VOCs, have a profound negative impact on health and the climate. They can contribute to human health issues such as lung cancer, asthma, cardiopulmonary diseases (Corbett et al., 2007), as well as damage vegetation, the built environment and cultural heritage.

It is worth noting that during the last two decades emission of air pollutants from land-based sources has been substantially reduced across Europe. In the same time span modest regulations have been introduced for emissions from maritime transport, which uses residual fuel oil that can no longer be used in land-based facilities due to environmental restrictions.

The sector's environmental impact on European air quality and climate change is significant. The total incoming and outgoing ship traffic in EU-27 ports from both national and international shipping can amount to 10-30% CO<sub>2</sub>, 10-20% NO<sub>x</sub>, 10-25% SO<sub>x</sub>, and 10-25% of PM<sub>2.5</sub> global shipping emissions (EEA, 2013). Effectively reducing ship emissions in European waters, either through international or EU environmental legislation, can have a significantly impact on a global scale as well.

Looking solely at the Baltic Sea, according to HELCOM, the annual emissions of ships plying its waters in 2014 (HELCOM, 2015a) were 320 kt of NO<sub>x</sub>, 81 kt of SO<sub>x</sub>, 16 kt of PM, 34 kt of CO and 15.0 Mt of CO<sub>2</sub>. The CO<sub>2</sub> amount corresponds to 4,750 kilotonnes of fuel, of which 22% was associated with auxiliary engines. One vessel during 8 hours at a port emits an amount of NO<sub>x</sub> equivalent to that of 10,000 cars driving 1,000 km each. Ferries and ro-ro vessels make the most significant contributions to emissions, followed by tankers, cargo ships and container ships.

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Pollutant	Impact
<b>SO<sub>x</sub></b> <b>Sulphur oxides</b>	react with water molecules to produce acids and acid rain; harmful to plants, aquatic animals, buildings, infrastructure; as a precursor for PM may cause respiratory, cerebrovascular and cardiopulmonary diseases
<b>NO<sub>x</sub></b> <b>Nitrogen oxides</b>	contribute to eutrophication of the sea; cause acid deposition, similarly to SO <sub>x</sub> ; contribute to ground ozone and PM formation; may cause respiratory, cerebrovascular and cardiopulmonary diseases
<b>PM</b> <b>Particulate matters</b>	may be emitted directly from a ship's exhaust system or formed from SO <sub>x</sub> and NO <sub>x</sub> (secondarily formation); small enough to penetrate into the alveolar gas exchange region of the lungs; associated with detrimental effects on human health: respiratory, cerebrovascular and cardiopulmonary diseases; carcinogenic
<b>O<sub>3</sub></b> <b>Ozone (ground level)</b>	formed in the atmosphere through chemical reactions involving volatile organic compounds (VOCs) and NO <sub>x</sub> and VOCs; responsible for damages to crops, plants, forest
<b>CO<sub>2</sub></b> <b>Carbon dioxide</b>	one of the greenhouse gases (i.e. heat-trapping gas); contributes to global warming and climate change; poses the risk of irreversible changes if it continues to accumulate unabated in the atmosphere; for the period 2007-2012, on average, shipping accounted for approximately 3.1% of annual global emission of CO <sub>2</sub> (IMO 2016)

The emission of all pollutants except CO has decreased 2.2% to 2.8% compared to the year 2013 and have decreased gradually since 2006, thanks to the tightened SO<sub>x</sub> emission regulations of the MARPOL and the EU.



All of these air and water emissions from port activity and shipping have strong repercussions for human health and life expectancy as well as for terrestrial and marine ecosystems.

In the past few years we have observed considerable accumulation of new, compelling evidence on the health effects of air pollution as well as their economic cost (e.g. lost productivity, cost of medical care, cost of pain, suffering). According to EEA (2015) every year more than 400,000 EU citizens die prematurely due to air pollution. Air pollution is a significant risk factor, which can be attributed to a number of causes of death, especially cardiovascular and cerebrovascular (WHO, 2015). Premature deaths translate into a substantial number of years of life lost (YOLL). In the 40 European countries assessed by the EEA, 4,804,000 YOLL are attributed to PM<sub>2.5</sub> exposure, while 828,000 YOLL and 215,000 YOLL are attributed to NO<sub>2</sub> and O<sub>3</sub> exposure, respectively (EEA, 2015).

Another equally important albeit underrepresented problem is the issue of water pollution by sewage from passenger ships as well as accidental and deliberate oil spills and the spreading of harmful aquatic organisms and pathogens (e.g. microbes, small invertebrates, bacteria, eggs, cysts and larvae of various species) through the exchange of ballast water between different aquatic ecosystems.

Sewage is generated on-board all ships, sometimes in large quantities, especially in the case of large passenger vessels. For example, a medium-sized passenger ship generates 50 tonnes of blackwater daily. Discharges of such waste into port waters may include organic, biological, chemical and toxic pollutants. Nitrogen and phosphorous loads from a ship's sewage contributes to the nutrient pollution of the Baltic Sea, thereby to eutrophication. Even though the total nutrient load from ship sewage is much lower than from land-based sources, it still constitutes a significant amount.

Sewage together with NO<sub>x</sub> emissions from ships contribute to the eutrophication of the Baltic Sea. The effects of eutrophication are most likely the single greatest threat to the unique and fragile environment of the Baltic Sea (HELCOM, 2010). Nitrogen and phosphorus are the primary nutrients that in high concentrations stimulate the growth of algae, which in turn upset the balance of the ecosystem and cause eutrophication (HELCOM, 2009). Harmful algal bloom is the most evident problem of the Baltic and is dangerous to both animals (fish, birds and mammals) and humans (children in particular). It was estimated that 71% of the EU Natura 2000 area was exposed to eutrophication in 2010 (EC, 2013).

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Other port and shipping externalities such as noise emission, land use, dust and odours connected with cargo handling as well as accidents and congestion on access roads of a port, should not be omitted. Moreover, in ports and their inlets, dredging may sometimes cause environmental problems as well.

There are still some insufficiently investigated environmental challenges, such as marine litter or underwater noise; however, their negative impact is still under discussion as they are believed to cause environmental damage in the future (HELCOM, 2014).

It has become clear that a regulatory framework on an international as well as regional level is essential to combat problems arising from the negative environmental impact of shipping and seaports.

# Regulations and policy aiming at a cleaner Baltic

In order to limit the pollution from worldwide shipping, a number of environmental regulations cover areas where shipping leaves its mark: air emissions, sewage, garbage, oil, noxious liquids and harmful substances as well as ballast water and ship recycling.

The International Maritime Organization (IMO) was leading the development of global regulations to minimise the negative impact of shipping on the environment, which resulted in MARPOL 73/78 (The International Convention for the Prevention of Pollution from Ships) and its six annexes that govern the shipping industry's environmental performance.

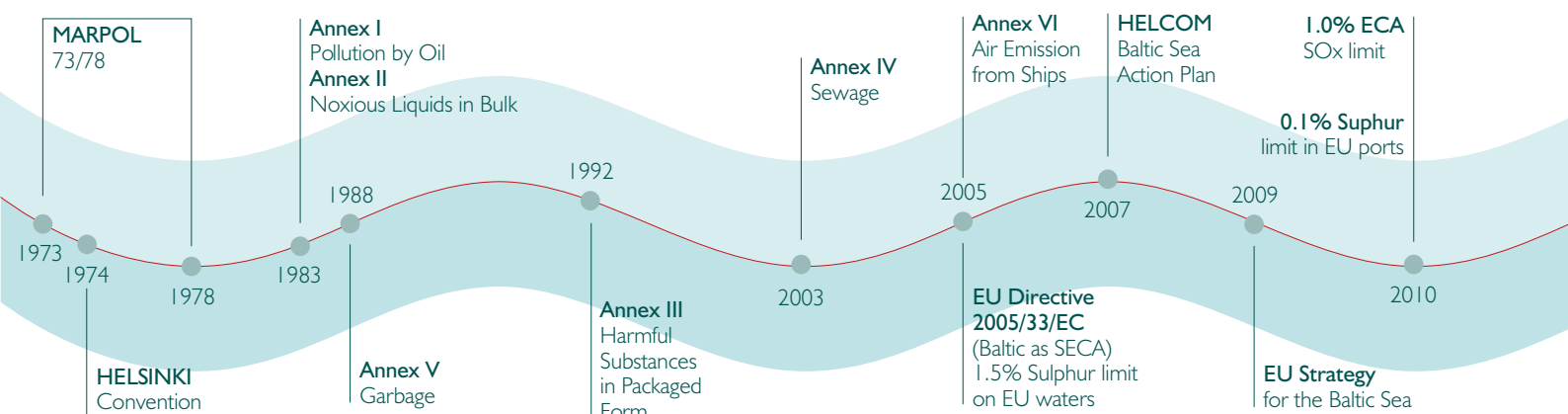
Despite the global regulation provided by the IMO, **the EU and BSR countries have developed a policy framework at their own pace, often being ahead of the global environmental regulations for shipping.** Since the early 1970s the BSR countries have undertaken joint efforts aiming at stopping the deterioration of the Baltic. This resulted in the signing of the Convention of the Protection on the Marine environment of the Baltic Sea Area, also known as the Helsinki Convention.

**The Helsinki Commission (HELCOM) as a governing body plays an invaluable role in the Baltic's protection, has led to significant environmental improvements in many areas and has enhanced the coordination among BSR countries.** In order to further stimulate the work towards a cleaner Baltic, the HELCOM Baltic Sea Action Plan was adopted in 2007. Its ambitious aim is to restore the good ecological condition of the Baltic marine environment by 2021.

Subsequently, in October 2009, the EU Strategy for the Baltic Sea (EUSBSR) was adopted by the European Council to address "the urgent environmental challenges arising from the increasingly visible degradation of the Baltic Sea," being the first EU macro-regional strategy. One of its policy areas is for the BSR "to become a model region for clean shipping," coordinated by the Danish Maritime Authority.

## AIR EMISSION

Reducing air emissions from shipping has been a hot topic in the maritime industry over the last decade. A discussion took place within the context where emission and fuel standards for international shipping lag behind those of land-based transport modes. Indeed, a wide range of regulatory measures has been adopted in recent years to curb air pollution from land-based sources, whereas shipping





emissions remained untouched.

The regulatory framework for tackling the issue of reducing exhaust gas emissions from ships was developed by the IMO, as well as on an EU level. The IMO is addressing air pollution through MARPOL 73/78 Annex VI, which entered into force in 2005 and its revised version with significantly tightened emissions limits adopted in 2008 and entered into force on 1 July 2010. On an EU level, the problem is addressed through different EU directives, however focussing exclusively on SO<sub>x</sub> reduction.

SO<sub>x</sub>

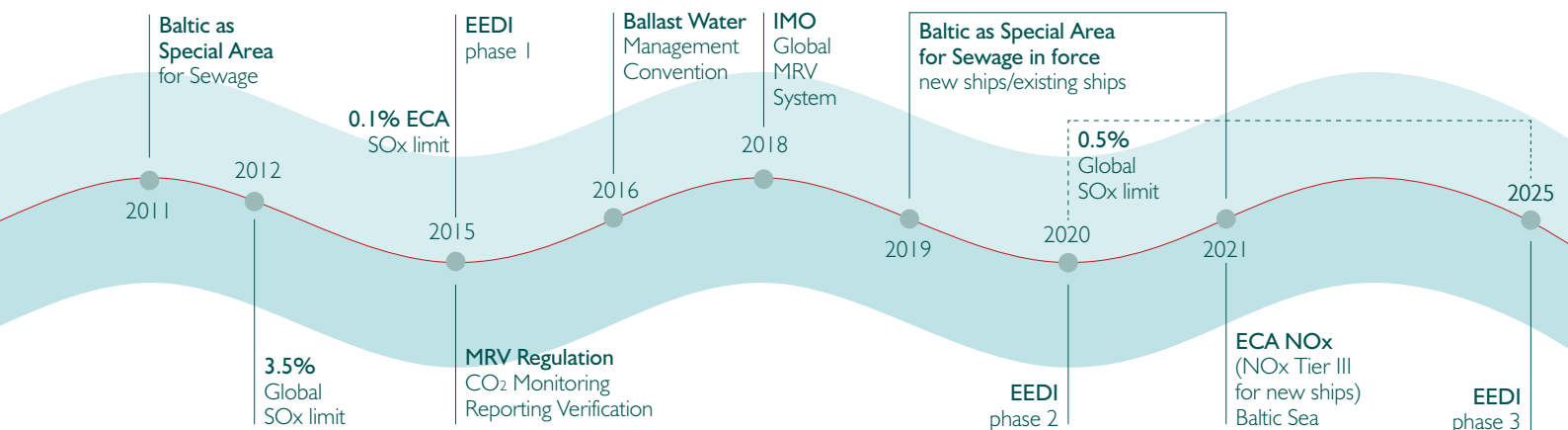
The first EU regulation concerning a reduction in the sulphur content in certain liquid fuels was Council Directive 1999/32/EC. This directive was amended by Directive 2005/33/EC of the European Parliament and of the Council that designated the Baltic Sea, the English Channel and the North Sea as Sulphur Emission Control Areas (SECAs) and limited the maximum sulphur content in fuels used by ships operating in these areas to 1.5% of total mass. This fuel standard also applied to passenger ships operating regular services outside SECAs. In addition, it also introduced a 0.1% by mass maximum sulphur requirement for fuels used by ships at berth in EU ports, effective from 1 January 2010.

The maximum sulphur level of 0.1% in ships' fuel currently imposed in European SECA came into force to mirror the requirements of the 2008 IMO amendment to MARPOL Annex VI. This limit was introduced by Directive 2012/33/

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EU and since 1 January 2015 all ships navigating in SECA have been obliged to comply with it. Furthermore, the directive schedules the 0.5% by mass fuel standard to be introduced in 2020 irrespective of the possible postponement by the IMO, and sets a 3.5% by mass cap for the sulphur content in fuel for ships equipped with a scrubber, except for scrubbers operating in closed mode. As a result, there are currently three standards on European waters: low sulphur fuel (0.1% sulphur) applied within SECAs and at berth in EU ports, 1.5% fuel for passenger ships plying outside SECA and 3.5% fuel outside SECA for other ships.

The northern parts of Europe have, willingly or not, become a testing ground preceding the introduction of the stricter 0.5% sulphur limits, which should come into force worldwide in 2020 (or 2025, pending review of fuel availability).



## NO<sub>x</sub>

The MARPOL convention and its Annex VI, Regulation 13 provides for the control of NO<sub>x</sub> emissions from marine diesel engines of over 130 kW output power (excluding ships used solely for emergency purposes). Different levels (Tiers) of control apply based inter alia on the ship's construction date and within each Tier the engine's rated speed determines the actual limit. NO<sub>x</sub> Tier III applies only to specified ships operating in areas designated as Emission Control Areas (ECA). Tier I and Tier II limits apply globally regardless of ECAs for NO<sub>x</sub> being established or not. So far, the North American ECA and United States Caribbean Sea ECA are the only NECAs designated by the IMO.

The Baltic Sea has not been established as an ECA for nitrogen oxides yet; however, according to the HELCOM Roadmap a proposal to do so will be submitted at the IMO MEPC 70 meeting, scheduled for autumn 2016. The initiative for a Baltic Sea NECA emerges from the above-mentioned HELCOM Baltic Sea Action Plan. The process is going to be synchronized with NECA designation in the North Sea. The effective date in the proposed roadmap has been fixed to 1 January 2021. Once the regulation enters into force, only ships constructed (engines installed) on or after the effective date will have to comply with the new standards.

## CO<sub>2</sub>

Shipping is treated by the Kyoto Protocol in a different way, primarily due to the international nature of maritime transport and the complexity of allocating ownership of the CO<sub>2</sub> emissions. In order to tackle the problem, a global approach to CO<sub>2</sub> reduction was developed by the IMO, which in 2011 adopted "Regulations on energy efficiency for ships" (a new chapter in Annex VI). It introduced technical and operational measures: the Energy Efficiency Design Index (EEDI), which sets compulsory energy efficiency standards for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) – a management guide for shipowners. They aim at enhancing ships' efficiency and require that all ships constructed from 2025 must be 30% more efficient compared to those from the year 2000.

*They aim at enhancing ships' efficiency and require that all ships constructed from 2025 must be 30% more efficient compared to those from the year 2000.*

International shipping is also not covered by the EU's current CO<sub>2</sub> emissions reduction targets. However, important steps for integrating maritime emissions into the EU's policy for reducing its domestic GHG emissions have been taken. The first step is the MRV Regulation adopted in 2015, which from 2018 will oblige shipowners to monitor and report the verified amount of CO<sub>2</sub> emitted by their large ships (over 5,000 GT) on voyages to, from and between EU ports.

Recently, the possibility of agreeing on a global MRV system has opened up. At the 69th session of the IMO's Marine Environment Protection Committee (MEPC), draft amendments to MARPOL Annex VI were approved, establishing a mandatory system for the collection of data on fuel consumption from ships of 5,000 GT and above. The intention is to adopt it formally at MEPC 70, which would lead to entry into force in 2018; data collection would commence in 2019. This is the first step in the IMO's three-step approach of tackling GHG emissions from shipping (the second step would be an analysis of the collected data and the third – deciding what market-based-measures, if any, need to be taken). It is reasonable to expect that the IMO's global data collecting system should replace the EU's MRV one.

This is the basis for a discussion on shipping's "fair share" of the international

community's efforts to curb GHG emissions, taking into account the UNFCCC COP 21 Paris Agreement.

## SEWAGE

Sewage discharges from merchant ships are regulated globally by Annex IV to MARPOL 73/78, which entered into force in 2003; its revised version was adopted in 2004 and entered into force one year later. It applies to ships of 400 GT or above or those certified to carry more than 15 persons. The Annex permits the sewage discharge only when a ship is far enough from the nearest land i.e. at least 3 or 12 nautical miles (the former applies when the sewage is comminuted and disinfected by an approved installation, while the latter if the sewage is untreated). The Helsinki Convention further extends the MARPOL provisions to smaller ships.

It is worth mentioning that notwithstanding the IMO regulation, HELCOM adopted its first Recommendations 1/1 targeting sewage from ships already in 1980 ("Recommendation concerning measures to ensure the use of reception facilities for wastes from ships") and the sewage issue has been on the agenda for many years. HELCOM has also put forward a proposal to the IMO to designate the Baltic Sea as a special area for sewage from passenger ships (carrying more than 12 passengers), which became a reality in 2011. This means that sewage discharge into the Baltic Sea will be prohibited, unless it is processed by an approved on-board sewage treatment plant. Alternatively, untreated sewage can be delivered to a port reception facility (PRF). The decision entered into force on 1 January 2013.

Originally, the special area status was planned to take effect on 1 January 2016 for new ships and on 1 January 2018 for old, at the earliest, subject to the availability of adequate sewage PRFs in the ports within the region. The pace at which the network of PRFs was being created was insufficient and HELCOM countries notified the lack of ready PRFs for sewage, thus the entry dates have been postponed to 2019 and 2021, respectively. The 69<sup>th</sup> MEPC/IMO meeting confirmed the dates agreed upon at the HELCOM level; however, in certain cases (e.g. direct passages between the St. Petersburg area and the North Sea) the deadline has been postponed to 2023.

*HELCOM countries notified the lack of ready PRFs for sewage, thus the entry dates have been postponed to 2019 and 2021.*

## BALLAST WATER

In response to the growing problem of introducing invasive species from ships' ballast water and associated sediments into water basins, the IMO International Convention for Control and Management of Ships' Ballast Water and Sediments (BWMC) was adopted in 2004. Implementation of the BWM Convention is supported by numerous guidelines, which have been developed and adopted since 2004. They establish, among others, standards and procedures for BW treatment, requirements for ballast water management systems and reception facilities and rules for implementing the Ballast Water Management Plan. The multifaceted nature of the convention and the documents that support it as well as the interdisciplinary and inherent complexity of the problem render this legal instrument highly complicated.

The convention will enter into force 12 months after its ratification by 30 states, accounting for 35% of the world merchant shipping tonnage. As of 8 March 2016 BWMC has been ratified by 49 countries representing 34.82% of the world tonnage, so it is expected

*The convention will enter into force 12 months after its ratification by 30 states, accounting for 35% of the world merchant shipping tonnage.*

to enter into force very soon.

In 2012 HELCOM already undertook steps in preparing for the BWMC's entry into force. The HELCOM Ballast Water Road Map was adopted as a part of the HELCOM Baltic Sea Action Plan. It highlighted the need to cooperate with the North Sea countries to put in place a consistent exemption regime. One outcome of this cooperation is a jointly agreed upon regional procedure for applying and granting exemptions, adopted by HELCOM and OSPAR in 2013 (amended in 2015).

## Responses to environmental regulation and best practices

Baltic ports and maritime transport had to respond to the challenges and face the problems arising from new and forthcoming environmental regulations and Baltic Sea deterioration.

Despite serious concerns, European shipowners and ports were fully prepared for the new requirements and often exceeded expectations – some of their initiatives have gone far beyond these regulations. In many cases it was the ports that became environmental leaders promoting green initiatives; however, nothing could have been achieved without the cooperation between all stakeholders motivated by a single vision – a clean Baltic.

The main concerns that arose from the recent regulations were related to the implementation of the 0.1% sulphur limit in the SECAs. First of all, there were justified fears that it may be detrimental to the shipping industry's competitiveness and may provoke a modal shift from sea to land, because of the significant difference in the price of low sulphur fuels (MGO) and fuels with a higher sulphur content (IFO). Fortunately, the drop in fuel prices experienced in 2015 and Q1 of 2016 has limited the negative impact of the EU Sulphur Directive.

*The main concerns that arose from the recent regulations were related to the implementation of the 0.1% sulphur limit in SECAs.*

Switching to low sulphur fuels (MGO) is currently the most popular option. To meet the requirements of the EU sulphur directive and reduce SO<sub>x</sub> emission from ships, ship-owners may also consider alternative fuel types such as LNG and methanol or continue to operate on high sulphur fuel as long as sulphur scrubbers are installed on the ship's board to wash the sulphur from the exhaust gases. All solutions and technologies allowing to meet sulphur limits are available from stock for port authorities and ship operators.

The shipping industry's response was manifold – from service closures and companies exiting the market, through fleet renewals and retrofitting, to prosperity for shipyards signing contracts for scrubber installation and more orders for scrubber manufacturing companies.

### SCRUBBERS

In search of alternatives, some shipowners decided to invest in abatement technology, mainly in exhaust gas cleaning systems (EGCS) – popularly known as sulphur scrubbers.

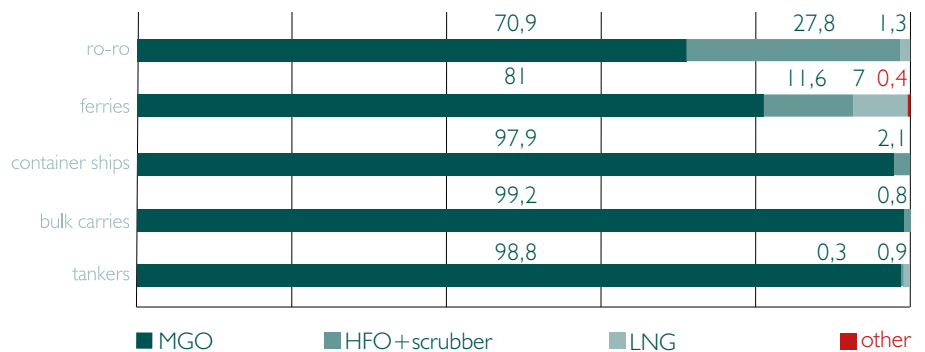
According to DNV-GL (Mohn, 2014) in the year 2000 there was only a single scrubber-equipped ship in operation and by 2014, in the anticipation of the



forthcoming regulation, their numbers had increased to 77. Considering order books and trends, it is expected that a total of 200 ships with scrubbers on board will be exceeded in 2017. Currently, irrespective of decreasing fuel prices, shipowners still invest in scrubber technology. Within European SECA 5.4% of the total short sea shipping fleet had been equipped with scrubbers by the end of 2015 (i.e. 73 vessels; 10 more were scheduled to be retrofitted at the beginning of 2016).

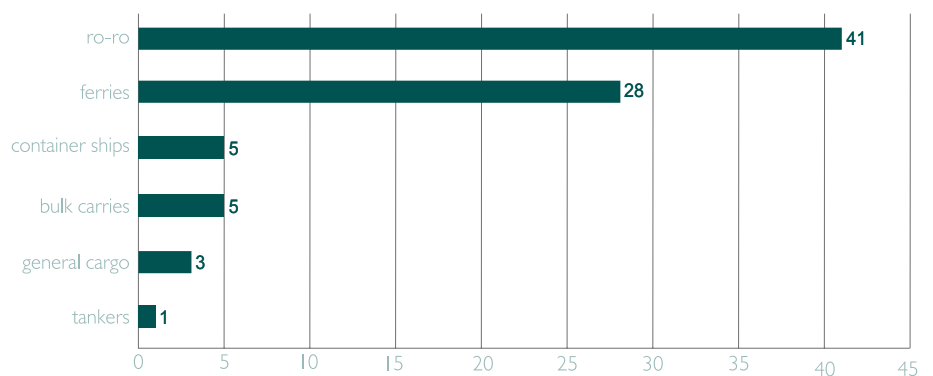
*Considering order books and trends, it is expected that a total of 200 ships with scrubbers on board will be exceeded in 2017.*

Technology applied in order to meet sulphur regulations by ships operating in SSS in the European SECAs (1Q 2016).  
Source: BPO SECA Report (2016)



There are two main types of sulphur scrubbers available on the market: dry and wet scrubbers. The most popular are wet scrubbers using ambient seawater (open loop) or fresh water (closed loop) for gas scrubbing. The use of open-loop scrubbers has already been banned by some EU countries, due to its potential negative impact on the marine environment (wash water is discharged into the sea). A variation of the closed loop system is a hybrid system which can operate as an open loop system while outside ECA. Dry scrubbers, widely used in land-based industry, are not popular in shipping and now there is only a single ship plying on the European waters which is equipped with a dry scrubber. It is worth mentioning that the use of scrubbers creates a need for receiving waste generated by the EGC systems. This kind of waste is currently not within the scope of EU Directive 2000/59/EC, which obliges ports to receive specified wastes under the waste fee. Baltic ports, however, enable the shipowners to disposal of scrubber waste.

Number of ships powered by LNG operating in the European SECAs (1Q 2016, domestic and international traffic).  
Source: BPO SECA Report (2016)

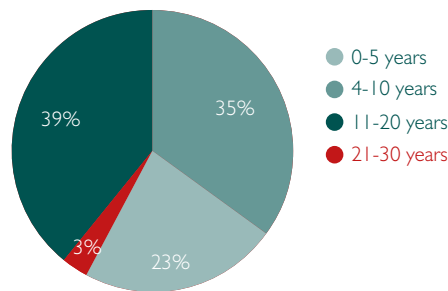


EGC systems are a solution for both new constructions and retrofits. The installation choice depends on a number of factors such as cost of low sulphur fuels, capital expenditure, operating expenditure of the scrubber, or time spent in the SECA.

The aforementioned factors predetermined the installation of (or the decision to install) scrubbers on ships operating in the Baltic Sea on fixed routes – ferries, ro-ro and general cargo (feeder container ships) – which constitute the majority

of all ships equipped with scrubbers.

Judging by the shipowners' websites and companies' reports (as of the beginning of 2016) some ferry/ro-ro operators have decided to retrofit half or even more of their fleets by installing scrubbers.



Statistics on the age of vessels when retrofitting took place.

Source: Rozmarynowska (2016)

The biggest investment in scrubber technology is foreseen by DFDS Seaways, which plans to complete the installation of scrubbers on 21 ships by 2017 (11 of which have already been equipped). Other shipping companies also have ongoing retrofit programmes, notably Finnlines (15 ships, 10 retrofits finalised), Transfennica (6 ships), Color Line (4 ships) and Scandlines on 4 ships (2 planned).

## LNG AS AN ALTERNATIVE FUEL



A ship's bunkering  
Source: DNV-GL (2015).

Shipowners can choose an alternative fuel path in order to meet the emission requirements. Other fuels such as biodiesel, methanol and ethanol as well as LNG have been widely researched and tested. In particular, the use of LNG as a ship's fuel attracts special attention of the shipping industry.

Remarkably, switching to LNG ensures not only SECA compliance, but also forthcoming rules on nitrogen oxides emissions. It enables a significant reduction in air pollution – ranging from SO<sub>x</sub>, NO<sub>x</sub>, and PM to CO<sub>2</sub> and black carbon. The SO<sub>x</sub> is completely removed, emissions of NO<sub>x</sub> and PM reduced up to 85% and CO<sub>2</sub> emissions by at least 20% (DNV, 2015).

*LNG enables a significant reduction of air pollution – ranging from SO<sub>x</sub>, NO<sub>x</sub>, and PM to CO<sub>2</sub> and black carbon.*

Currently, LNG is a significantly less popular option than MGO and scrubbers. The reason for this is that LNG-fuelled ships require dedicated technology (e.g. ship engines, special tanks and piping), which is costly in a short time perspective, hence this solution is more viable for newbuilds than retrofitting. However, the price gap between LNG compared to low sulphur fuels in favour of the former is seen as a key advantage, which is able to counterbalance the higher investment costs of LNG retrofitting or the extra expenditures for newbuilds.

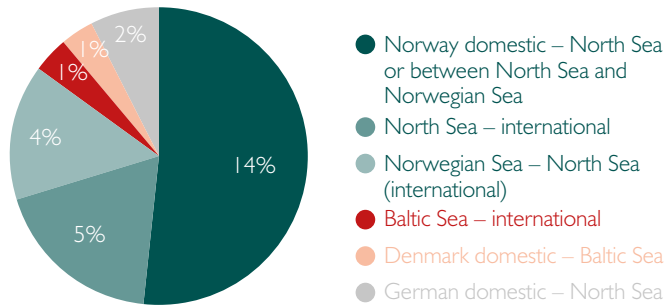
Judging by the market response and LNG's multiple advantages, the coming years will surely advance its development. The number of ships using LNG as fuel is increasing at quite a fast pace. Before 2015, there were only four LNG-fuelled ships in operation within the Baltic Sea, i.e. the dual-fuel ferry Viking Grace owned by Viking Line (the first ship to be powered by LNG on a regular basis) and two LNG-powered (gas-only engine) cruise ferries of the Fjord Line operator. At the end of 2015 there were 27 LNG-fuelled vessels (24 newbuilds, 3 conversion projects) plying the waters of the European SECA (primarily Norwegian waters).

The LNG alternative is gaining popularity – looking only at the total orderbook for



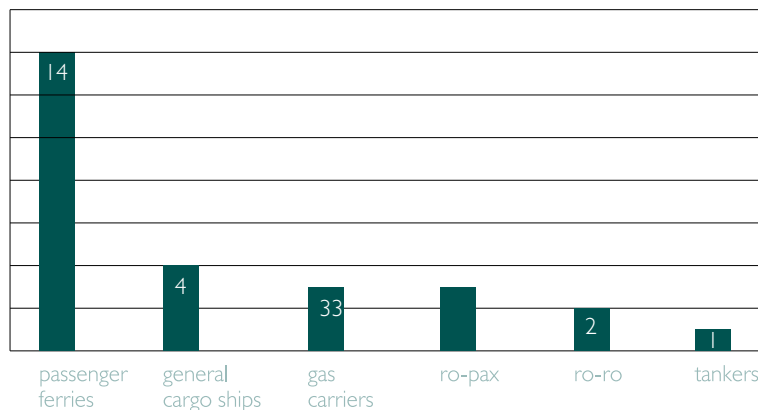
ships dedicated for the European SECA region (delivery date up to 2018) there are 40 vessels on order, 21 of which are powered by LNG and 7 are equipped with scrubbers (DNV, 2015).

Number of ships operating in each region of the European SECAs.  
SECA – one year after entry into force, BPO Report, 2016.



Specialised infrastructure for bunkering purposes is necessary to allow the growing number of LNG-fuelled ships to operate; therefore, ports of all scales should engage in establishing LNG bunkering facilities.

Number of ships powered by LNG operating in the European SECAs.  
SECA – one year after entry into force, BPO Report, 2016.



The development of LNG bunkering infrastructure within the Baltic Sea Region was initiated by the Baltic Port Organization (“LNG in Baltic Sea Ports” and “LNG in Baltic Sea Ports II” projects ) in order to harmonize the pre-investment works on the creation of a network of ports using a standardized LNG system. As a matter of fact, this is in line with EU Directive 2014/94/EU introducing an obligation for TEN-T core seaports to be equipped with publicly accessible LNG refueling points for maritime transport by 2025.

The infrastructure for LNG bunkering within the Baltic ports is gradually being put in place, thanks to the accompanying technical and safety impediments being addressed and eliminated. Terminals willing to feed vessels with LNG will need the necessary bunkering upgrades, utilising one of the available methods (e.g. ship to ship, tank truck to ship). The Port of Stockholm became the first port in the Baltic Sea Region (and one of the first in the world) to offer LNG bunkering solutions (bunkering boat), supplying the above-mentioned cruise ferry *Viking Grace*.

Other terminal infrastructure includes: Floating Storage and Regasification Unit Independence in the Lithuanian Port of Klaipeda and the land-based facilities in Lysekil (Sweden), both put into service in 2014; a gas bunker station dedicated to Fjord Line in the Port of Hirtshals (Denmark); small-scale LNG terminals in Nynäshamn and Gothenburg (Sweden); and a large-scale LNG terminal in Świnoujście (Poland) launched in 2015, which will also be prepared for ship bunkering.

Existing LNG infrastructure projects in the BSR serve as a good example of LNG synergy between ports, ship-owners and other stakeholders, which is essential for LNG to become a competitive alternative fuel. Thanks to the broad range of experiences gained during phasing in of the LNG fuel in the shipping industry, the Baltic Sea Region can be considered a benchmark for the implementation of LNG infrastructure in other European ports. It is strongly believed that the use of LNG as a ship fuel will become more and more widespread in the coming years.

*The Baltic Sea Region can be considered a benchmark for the implementation of LNG infrastructure in other European ports.*

## ON-SHORE POWER SUPPLY



OPS Cavotec  
Source: Cavotec.

On-shore Power Supply (OPS), also known as shore connection, shore side electricity and cold ironing, is a solution based on connecting a ship to shore-side electricity during its port stays, so that she may turn off auxiliary engines and stop the consumption of fuel. The shore-side electricity technique has been known for about 30 years; however, at the beginning only a low-voltage shore connection (380 V) was possible, notorious for poor ergonomics and high operating costs. Contemporary solutions utilise a high-voltage shore connection (10,500 V), which was offered for the first time in the world by the Port of Gothenburg and disseminated worldwide.

Initial problems have been resolved and OPS technology is much more mature and affordable now than it was a few years ago. The investment costs decreased substantially due to the availability of prefabricated assemblies and system standardisation ever since the OPS has been governed by international standard IEC/ISO/IEEE 80005-1. Directive 2014/94/EU on the Deployment of Alternative Fuel Infrastructure adopted in March 2014 could stimulate further development of OPS technology. It states that all ports, especially those of the TEN-T Core Network, shall be equipped with shore power by the end of 2025, unless there is no demand and/or the costs are disproportionate to the benefits, including environmental benefits.

The use of OPS allows a substantial reduction in emissions generated by ships moored at ports. Moreover, noise and vibration accompanying the work of auxiliary engines are completely eliminated. It is of particular importance not only for the crew and passengers but also for the port's neighbouring population, as a majority of the Baltic ports are in-city ports, located close to residential areas (e.g. Stockholm, Ystad, and Gdynia).

OPS requires adaptation and suitable equipment (e.g. frequency converters) not only in the port but also on-board the ship. That is why the cooperation of both is necessary.

The ports of Gothenburg, Lübeck, Helsinki, Ystad, and Stockholm have already been providing OPS for a couple of years. Gothenburg pioneered the high-voltage OPS, Helsinki introduced shore power in 2012 for Viking Line's ferries, the Port of Ystad has the world's largest OPS system for both 50 Hz and 60 Hz, while Stockholm's port will have all of its five new quays equipped with the OPS system by the end of 2016.

Ever since the OPS was put into use, the air quality in port areas has improved considerably and the noise level has been reduced. However, the overall pollution level depends on the source of energy used by the OPS – preferably it should be cheap energy from renewable sources.

## PORT RECEPTION FACILITIES FOR SEWAGE

The availability of adequate port reception facilities (PRF) in the BSR is crucial for implementing the MARPOL special area for sewage from passenger ships. The status of PRF for sewage and their use in the Baltic Sea area in 2014, with a focus on international cruise traffic, is elaborated in a HELCOM report (2015b). Nordic ports are committed to championing this issue.

*Ever since the OPS has been put in use, the air quality in port areas has improved considerably and the noise level has been reduced.*

According to this report, the PRF for sewage in Baltic ports develops at different paces. The five biggest Baltic cruise ports (St. Petersburg, Helsinki, Tallinn, Copenhagen, Stockholm), which receive 80% of all sewage from cruise ships in the Baltic, are fully prepared for new regulation. In all of Helsinki's three ports (West Harbour, South Harbour and Vuosaari cargo port) grey and black water may be discharged from the vessels directly to the city's wastewater system. Fixed reception points connected to the public sewage system are also available in Tallinn. Moreover, the port authority is planning to construct a microtunnel to receive sewage at rates up to 1000m<sup>3</sup>/h and to connect it to the deep collector of the public sewage company. The Port of Stockholm has recently upgraded the PRF in Stadsgården/Masthamnen to increase the capacity of the facilities for ro-ro/ro-pax but also cruise vessels. Fixed reception points for black and grey water are available at all piers used by cruise ships. In Copenhagen sewage from the cruise liners is now handled at the terminal in permanent facilities that are linked to a sewage treatment plant in Copenhagen.

Other BSR ports are on the way to making improvements. For example, the Port of Gdynia is going to be ready before 1 January 2019. PRFs will be available on the French Quay for cruises with a maximum intake rate of 200 m<sup>3</sup>/h and on the Polish Quay for the new ferry terminal with a maximum volume flow rate of 105 m<sup>3</sup>/h.

## REWARDING ECO-PERFORMANCE

Reducing emissions from shipping can also be achieved through awareness creation and economic incentives. Even if the ports do not invest themselves, they can foster environmentally-friendly initiatives by rewarding port users (shipowners and tenants) for their good eco-performance, especially when it exceeds the legal requirements. Many Baltic ports have chosen this option even though it is completely voluntary.

The most widespread approach is the incentive of environmentally differentiated port dues. Its main idea is granting a financial discount/reward to shipowners that meet the criteria defined by a port with regard to air emissions. Some of the Baltic ports encouraged shipowners to use low sulphur fuels even before the strict regulation came into force. For example, such a system of differentiated port dues has been used in Swedish ports since 1998 in order to reduce emissions of SO<sub>x</sub> and NO<sub>x</sub>.

The principles of incentive schemes vary between ports. Usually they are based on a ship's gross tonnage or are set as a lump sum, irrespective of a ship's parameters, payable per every ship call or per specified time period. Different criteria are also used as a benchmark in eco-incentive programs e.g. emission level, fuel used, technology (OPS) or eco-certificates such as Environmental Ship Index (ESI), Green Award Certificate or Clean Ship Certificate. They also differ in scope – some are directed at particular pollutants and others at a wide range of

environmental indicators; some are rewarding all ship types and others only specific ones, e.g. tankers.

Today, it's most common to reward shipowners that switch to LNG, reduce NOx emissions or use OPS. For example, ships fuelled by LNG will receive a 20% discount until 2019 in the Port of Gothenburg and save SEK 0.05 per GT in the Port of Stockholm (which would amount to a rebate of around SEK 1 million annually for a vessel of the size of Viking Grace, calling at Stockholm daily). In the latter shipowners can also expect a nitrogen oxides rebate from SEK 0.16 to SEK 0.22 depending on the amount of nitrous oxide emissions (for a normal-sized vessel operating daily it would amount to a discount of between SEK 3 million and SEK 4 million annually).

*Today, it's most common to reward shipowners that switch to LNG, reduce NOx emissions or use OPS.*

The different environmental indexes ESI and CSI are used as a basis of the reward system in the Port of Gothenburg. Vessels with an ESI score of at least 30 points, or those that have been classified as "green" according to CSI regulations, will be granted a 10% discount off the port dues, based on GT. The Port of Rostock also rewards ships with ESI exceeding 40 points (from 5% to 10% discount). The Port of Riga offers a 10% rebate on all port dues and charges to tankers carrying crude oil that have been awarded a Green Award Certificate.

Since the noise is becoming a nuisance in port areas, some ports promote on-shore power supply (OPS). In Stockholm, if a ship operator connects its vessel to the OPS, fulfils the criteria for a liner service and ensures to stay in service for a minimum of 3 years, then it is allowed to be granted a rebate of SEK 1 million.

## ENVIRONMENTAL MANAGEMENT IN BALTIC PORTS

Baltic ports treat all environmental issues with care and responsibility. Environmental legislation and concerns over the condition of the Baltic have had a direct impact on the environmental management of everyday port activity.

Rising attention is drawn to energy management in Baltic ports which tries to reduce overall energy consumption within the port areas by investing, for example, in energy-saving lighting and equipment, and energy sources such as solar panels or biogas. A lot of Baltic ports have also taken measures to reduce air and/or noise emissions from port operations by using cleaner fuels, electrification of port operations, eco-driving, and modernization of port equipment.

Equally important is the issue of modifying the modal split of ports' hinterland connections by improving the share of rail and inland waterway transport, and minimizing unnecessary and environmentally harmful road transport to and from the port. The rail shuttle concept introduced by the Port of Gothenburg may serve as a flagship example of this idea.

In order to ensure that ports develop in a responsible fashion, Baltic ports have proactively addressed their environmental and related socio-economic responsibilities through the development of Environmental Management Systems (EMS).

*Baltic ports have proactively addressed their environmental and related socio-economic responsibilities through the development of Environmental Management Systems (EMS).*

In many cases Baltic ports have voluntarily implemented EMS standards which



encompass the European EMAS and worldwide ISO 14000 family as well as those developed by ESPO/EcoPorts the Port Environmental Review System (PERS), which account for the highly specialized nature of port environmental challenges.

The main goals of fulfilling strict certification requirements are: demonstrating a port's commitment to environmental protection, improving the relationship with city government and giving strong evidence to the urban community that the port meets all environmental requirements.

<b>Environmental Performance Indicators</b> Does the Port ...	<b>Baltic ports</b> % of positive responses	<b>European ports</b> % of positive responses
1. Have an environmental policy?	91.67	89.87
2. Have an inventory of relevant environmental legislation and regulations?	100.00	89.87
3. Have an inventory of Significant Environmental Aspects for the port area?	100.00	83.54
4. Have objectives and targets for environmental performance defined?	91.67	83.54
5. Have environmental training program for its employees?	50.00	65.82
6. Have an environmental monitoring program?	83.33	78.48
7. Have environmental responsibilities of key personnel documented?	83.33	70.89
8. Publish a publicly available environmental report?	75.00	62.03
9. Have certified EMS standard (ISO 14001, EMAS, PERS)?	75.00	54.43

Selected environmental indicators and responses from European ports and Baltic ports exclusively (in 2013)  
Source: Wooldridge (2015).

The key components of EMS are widely implemented in European ports. However, it would not be too much of an exaggeration to say that Baltic ports in particular have set good examples of EMS and created a culture of environmental monitoring and reporting. In 2013 Baltic ports have an average Environmental Port Index<sup>1</sup> of 7.98, compared to 7.25 on average across all European ports. This high rating proves that Baltic ports are distinguished by their environmental performance (Wooldridge, 2015).

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<sup>1</sup> The Environmental Port Index has been established by the CLEANSHIP project.

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