



# **THE FUTURE OF SHIPPING IN THE BALTIC SEA**

Tomas Alfthan

Examensarbete / Degree Thesis  
International Business Administration  
2015

DEGREE THESIS	
Arcada	
DegreeProgramme:	International Business Administration
Identificationnumber:	
Author:	Tomas Alfthan
Title:	The Future of Shipping in the Baltic Sea
Supervisor (Arcada):	Sveinn Eldon
Commissioned by:	
<p>Abstract:</p> <p>On January 1<sup>st</sup> 2015 an EU legislation came into force stating that all ships operating within a Sulphur Emission Controlled Area have can only operate with ships that emit a maximum of 0,1% as opposed to the previous limit of 1,0%. This meant that the ships had to modify their engines to be able to comply with this or use a more expensive fuel that emits less sulphur emissions. The changes brought extra costs to the shipping industry and as it is Finland's main form of export, potentially to the rest of the country's export as the Baltic sea was introduced in the area. This report looks into where the costs lie, whether they may affect the economy as a whole and how the future of shipping in the Baltic sea may look.</p>	
Keywords:	Sulphur, Emissions, Legislation, Sulphur Emission Control Area (SECA),Liquid Natural Gas (LNG), Scrubber, Marine Gas Oil (MGO), Finland, Baltic Sea,
Numberof pages:	46
Language:	English
Date ofacceptance:	

# CONTENTS

<b>1 Introduction</b> .....	5
1.1 Background.....	5
1.2 Research aim.....	5
1.3 Research questions.....	6
1.4 Limitations.....	6
1.5 Methods and Structure.....	7
<b>2. Theory</b> .....	9
2.1 Finland's Export.....	9
2.2 Sulphur Dioxide.....	10
2.3 SECA.....	11
2.4 Solutions for ships to operate in the Baltic Sea.....	12
2.4.1 LowSulphurFuel.....	13
2.4.2 Heavy fueloilwith a Scrubber.....	14
2.4.3 LiquidNatural Gas (LNG).....	15
2.5 Installation costs and paybacktime.....	16
<b>3. Research Findings</b> .....	18
3.1 Estimated costs.....	19
3.2 The Finnish government.....	22
3.3 The Baltic Connector.....	24
3.4 Wärtsilä and Alfa Laval.....	27
3.5 Hanko Port.....	30
3.6 Port of Helsinki.....	32
3.7 Finnshipping.....	33
3.8 DHL.....	35
3.9 Ship Onwers.....	36
3.10 Monitoring.....	38
<b>4. Discussion of Research findings</b> .....	40
<b>5. Conclusion</b> .....	45
<b>References</b> .....	46

## Appendices

Appendix 1..... Email with Julius von Herten at Finnshipping	59
Appendix 2 Email with Andreas Slotte at Helsinki port	61
Appendix 3 Email with Eve Tuomola at Helsinki port	63
Appendix 4 Email with Jukka Holsa at UPM	64
Appendix 5 Email with Timo Sjösten at Hanko port	65

## FIGURES

<b>Figure 1.</b> The new SECA zone	11
<b>Figure 2.</b> Global sulphur emission limits 2000-2025	12
<b>Figure 3</b> Marine fuels	13
<b>Figure 4</b> Payback times	17
<b>Figure 5</b> Fuel price graph showing HFO vs MGO price 2010-2014	21
<b>Figure 6</b> Natural gas pipeline network in the area of the gulf of Finland	23
<b>Figure 7</b> The planned route of the Balticconnector offshore pipeline	25
<b>Figure 8</b> Wärtsilä Q1 2015 order intake figures	28
<b>Figure 9</b> Alfa Laval Q1 2015 interim report figures	29
<b>Figure 10</b> Alfa Laval Q1 2015 order intake figures	29
<b>Figure 11</b> Port of Hanko transport routes	31

## TABLES

<b>Table 1.</b> Estimated share of the tonnage of Finland's foreign trade in terms of maritime traffic expressed as a percentage by sector and estimated additional costs due to the estimated rise in the price of fuel calculated on the basis of this distribution	9
<b>Table 2</b> Scrubber installation cost for 38,500 dwt tanker	16
<b>Table 3</b> LNG engine installation cost for 38,500 dwt tanker	16
<b>Table 4</b> Cost of Balticconnector pipeline	26
<b>Table 5</b> DHL MARPOL surcharge EUR/shipment	35
<b>Table 6</b> Transfennica bunker prices 2015	37

# **1 INTRODUCTION**

## **1.1 Background**

On the 1<sup>st</sup> of January 2015 a new directive set by the European Union came into force stating that all ships operating in the Baltic Sea can have a maximum of 0,1% sulphur emissions as opposed to the previous limit of 1,0%. Traditionally vessels operate on high sulphur fuel as it is the cheapest option so all affected ships had to change their operating system in order to comply with the legislation or start using fuel with less Sulphur emissions but which is traditionally more expensive. These changes are expected to bring extra costs to the ship owners who then will most likely forward the cost to their customers and given that Finland exports most of their products by sea; the costs may affect much of the whole country's economy as well as change the country's shipping industry.

## **1.2 Research aim**

This thesis studies the effects of the legislation and how they will change the future of shipping in the Baltic Sea by looking at what the alternatives are for shipping with lower Sulphur emissions and what different parties are doing. Initially the goal was to look at the costs to big exporting companies affected by the legislation and how the costs would be distributed from the logistics to the customers and from there try to determine how the legislation may affect the country's economy as a whole, but this proved almost impossible due to said companies such as UPM unwilling to share their information as well as uncertainty in the industry given how recent this topic is at the time of writing. Therefore the research aim was changed to determine how the future will look in terms of what different solutions ship owners can choose to legally operate in the Baltic Sea and if one seems more economically viable than the other by looking at what some affected companies and ports are doing to prepare as well as the government.

The chosen topic was selected due to its relevance to the author's studies in International Business in terms of both logistics and business in general given the importance of the country's sea export as well as being a current matter given it has come into force in 2015.

### **1.3 Research questions**

To help find answers to these questions and more there are three research questions which will help cover the necessary topic areas and give more concrete results.

1. What are/have the affected parties doing/done in order to prepare themselves for the new legislation?
2. Will the resulting costs from the legislation lead to any noticeable changes in the Finnish shipping industry?

### **1.4 Limitations**

The topic of the EU Sulphur legislation covers so many countries and areas that there are several limitations to this thesis.

The research will focus solely on the effects of the legislation from Finland's point of view as they may differ from for example Sweden's or Denmark's view. However, any information from another country that is relevant may be included.

The information used in the thesis is mostly attained via press releases, newspaper articles and interviews. This is mainly due to the reluctance of some companies to give out any financial information relating to the legislation changes so the parties used in the research are ones with available information which unfortunately meant having to exclude major Finnish export companies. The information used consists mainly of facts, figures and comments found and attained via the internet, literature and relevant persons who were willing to answer questions sent to them via email.

One big factor that may affect the results of the study is the time factor, the legislation comes into place during the writing of this thesis in which time plenty can change. Since the legislation has very recently come into place it has proven to be difficult to find literature, concrete figures and results from some of the affected firms or ports that are still in the planning stages of how to cope with the changes. The proximity of time between the writing of the thesis and the legislation will provide plenty of useful information but due to the constant amount of news flow, any changes as of the 19.08.2015 will not be taken into account.

## **1.5 Methods and structure**

The material selected to be used in the thesis is both primary and secondary data, mainly gathered from interviews and through the internet, more specifically data and press releases found on the websites of the EU, the Finnish government, Finnish newspapers and Finnish companies related to the subject of the EU sulphur legislation.

The reason for the interviews being conducted via email is for practical reasons as email was the simplest way to contact the respective persons and at the time of the interviews the author was fulfilling his practical work commitments which led to very little time being found to conduct the interviews in person. The chosen people to interview were the most relevant people to find in their respective positions whose contact information were found on their websites or had been forwarded by somebody that recommended them. The chosen questions were ones that the author believes that give a picture on both costs and preparations made by the respective intervieweesøparty as well as a forecast on future decisions. Several more interviews were made in which the interviewee could not share any financial data or did not yet have a strategy in place given they were conducted at around the same time that the legislation came into place.

The theory is strictly secondary data that will cover background information that will help the reader understand the topic as well as the solutions that the ships can choose. The research findings is a more in depth description of decisions made by selected parties that are affected by the directive including ship owners, ports, ship brokers as well as the

Finnish government that looks into how they have prepared themselves and any potential future expectations.

The study looks at the different parties affected by the legislation including ports, the government, scrubber manufacturers, ships owners, etc. to try to get a picture of the wholeness of the situation in order to determine how the future may look. By having several different parties from different parts of the industry, the author felt it would give a clearer picture than if the study would focus solely on for example how the ports of Finland have prepared themselves.

It is structured in such a way that the theory part gives the reader information about what the legislation will change and what the ship owners operating in the Baltic sea can do to comply. The research findings chapter then focuses on the different parties, how they are affected, how they have prepared, and other relevant information regarding them. The discussion or the research findings then gives the authors thoughts on the topic and answers the research questions.

The use of SWOT analysis can be seen throughout the research findings chapter with one following every sub chapter as the author feels that this is a simple and good way to give the reader a basic and quick look at the overall picture of the actor in question regarding the effects of the directive on them. The SWOT analysis consists of at least one of each strength, weakness, opportunity and threats from the actors' perspective based on the authors findings.



## 2 THEORY

### 2.1 Finland's export

Due to its geographical location, Finland exports a great majority of its products by sea. According to the Finnish customs statistics, almost 80% of Finland's total export in 2014 was shipped overseas as well as over 90% of its total import (Finnish Customs, 2015).

**Table 1:** *Estimated share of the tonnage of Finland's foreign trade in terms of maritime traffic expressed as a percentage by sector and estimated additional costs due to the estimated rise in the price of fuel calculated on the basis of this distribution (LVM, 2009)*

Sector	Exports	Imports	Total	Estimated additional cost
Agriculture	0.0 %	0.7 %	0.41 %	1,763,994
Forestry	0.0 %	0.0 %	0.00 %	382
Mining	4.7 %	0.0 %	2.02 %	8,668,913
Construction	0.9 %	8.1 %	5.02 %	21,581,213
Forest industry	51.5 %	9.5 %	27.64 %	118,890,562
Metal industry	9.1 %	18.4 %	14.36 %	61,776,307
Technology industry	0.4 %	0.4 %	0.43 %	1,838,810
Chemical industry	24.1 %	6.8 %	14.22 %	61,169,232
Food industry	3.1 %	2.1 %	2.51 %	10,812,674
Other industry	3.7 %	2.3 %	2.89 %	12,416,636
Commerce and trade	2.3 %	6.9 %	4.92 %	21,153,124
Other services	0.2 %	44.9 %	25.58 %	110,023,494
<b>Total</b>	<b>100 %</b>	<b>100 %</b>	<b>100 %</b>	<b>430,095,340</b>

The table above made by the Finnish ministry of transport and communications shows what a big role the forest industry plays in Finland's export which also means that it is expected to have the highest additional cost due to the directive but the difficulty with proving how the sulphur directive has affected the industry is the fact that the paper

industry has been declining for years due to the decrease in use of paper so it is very difficult to find evidence that the sulphur directive surcharges have affected the industry. According to Metla boards executive summary on the economic outlook for the Finnish forest sector, the Finnish sawnwood is expected to have a slightly reduced competitiveness in the Central Europe in 2015 as a result of the sulphur legislation coming into place but otherwise the impact of the directive is expected to be relatively minor and they do not expect the industries profitability to decrease significantly in 2015 (Metla, 2014).

One major concern is the risk of the rising shipping prices leading to road transport becoming the cheaper option, therefore the companies opt to use more lorries etc. which may lead to the closure of certain sea routes and congested roads, especially in major roads to ports or major European highways which in turn could lead to the lead time being increased. This would affect all logistics and export sectors equally but given that the forest industry is the biggest Finnish exporter, the extra costs, and lead time could be very damaging.

Finland's only sea access is through the Baltic Sea which due to a large number of ships trafficking the area for many years has led to it become one of the most polluted seas in the world, it borders to Sweden, Russia, Finland, Estonia, Latvia, Lithuania, Poland, Germany and Denmark. One of the major pollutants emitted by ships is sulphur dioxide (SO<sub>2</sub>), a gas blamed for causing breathing problems to people as well as other environmental problems.

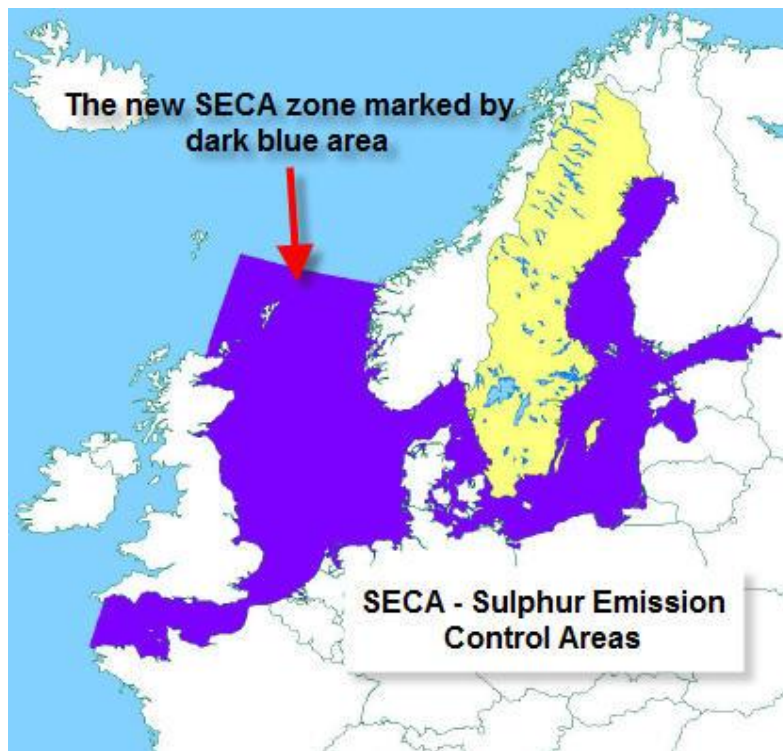
## **2.2 Sulphur Dioxide (SO<sub>2</sub>)**

The shipping emissions in Europe account for an estimated 50,000 premature deaths per year with most of the blame on the sulphur dioxide which is the largest emission. The emitted SO<sub>2</sub> air particles are so small that they can enter the lungs, pass through tissue and enter the blood causing inflammations and heart and lung failures, they are especially harmful to people with asthma, elders and young children. Ship emissions may also contain carcinogenic particles which can cause tumors. The estimated social cost blamed on shipping emissions is €58 billion. The estimated amounts of emissions from shipping

in Europe per year prior to the directive coming into place were 3, 4 million tons of SO<sub>2</sub>, 3, 3 million tons of nitrogen oxide and 250,000 tons of particulate matter. The forecast made then was that these emissions would increase by 40 to 50% by 2020 leading to ship emissions potentially becoming the single largest polluter ahead of all land based sources. (Transportenvironment, 2011)

## 2.3 SECA

In order to attempt to improve the ship air pollution conditions the European Union (EU) made a directive parallel to the International Maritime Organizations (IMO) Marine Pollution (MARPOL) Annex VI consisting of a strategy for Sulphur Emission Control Areas (SECA) such as the Baltic Sea Region (shown below) amongst others to contribute to the improvements regarding the sulphur particle emissions.

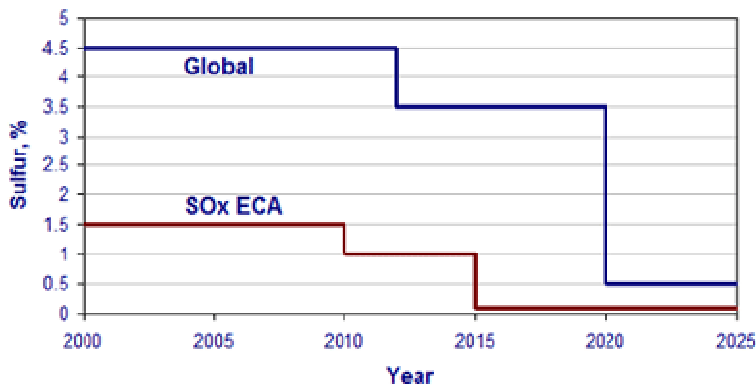


**figure 1:** *The new SECA zone (Woodland group, 2014)*

The legislation states that all ships trafficking the SECA must by 2015 have a maximum sulphur content of fuels limited to 0,1%, as opposed to the earlier limit of 1,0%, and the goal is to reduce it to 0,5% for all ships globally by 2020 (euroactiv, 2012). These changes

will reduce the pollution greatly, but it will also cost the shipping companies great amounts to modify their ships or use more expensive fuel that emits less sulphur in order to follow the new legislation, this will raise costs for all parties involved and could potentially affect the whole countries economy given the great amount of export by sea there is in Finland.

The chart below shows the comparison between the global sulphur emission limits allowed and the limits within the SECA (also known as ECA if other emissions than sulphur have been taken into account).



**figure 2:** Global sulphur emission limits 2000-2025 (Axces)

## 2.4 Solutions for ships to operate in a SECA

Technically, there are three main options for companies to choose from to comply with the legislation other than building a new ship readily installed with an engine that meets the regulations. These are touse either low sulphur fuel, heavy fuel oil with a scrubber, or having the ship be powered by Liquefied Natural gas (LNG) (DNV, 2011). Below are short descriptions as well as the main advantages and disadvantages of each option.

## 2.4.1 Low sulphur fuel

Changing to low sulphur fuel or Marine Gas Oil (MGO) is the simplest and cheapest investment for ships as they will not need to change anything on the ship, instead just changing the type of fuel they use. This is however, in the long run, not necessarily the cheapest option due to the much higher fuel cost. This is also potentially a very risky option due to the fact that it is not even known whether there will be enough low sulphur fuel to run all the ships as more areas are aiming to reduce their sulphur emission levels too and a shortage of fuel would result in rapidly increasing prices which in the end companies may not be able to afford. (Gcaptain, 2012).

Another potential issue that Gard wrote in a report regarding the changing of fuels is the risk of the machinery not being able to handle it, if for example a vessel changes from Heavy Fuel Oil (HFO) to MGO with an engine designed for HFO then there might be some corrosion etc. to the machinery leading to for example problems with the lubrication leading to the risk of fuel leaks. (Gard, 2014)

### Marine fuels

- **Residual oil:** it is the heaviest fraction of the [distillation of crude oil](#), with high viscosity (=> pre-heating necessary => used only in large ships) and high concentration of pollutants (e.g. sulphur). Its combustion produces a much darker smoke than other fuels and it needs specific temperature for storage and pumping. Due to these drawbacks, it is also the cheapest liquid fuel on the market.
- **IFO 180** (Intermediate Fuel Oil) : it is a mix of 98% of [residual oil](#) and 2% of [distillate oil](#).
- **IFO 380** (Intermediate Fuel Oil) : it is a mix of 88% of [residual oil](#) and 12% of [distillate oil](#). Due to the higher content in distillate oil, IFO 380 is more expensive than IFO 180.
- **MDO** (Marine Diesel Oil) : it mainly consists of [distillate oil](#) and has a lower sulphur content than the three fuels described above.
- **MGO** (Marine Gas Oil) : it is pure [distillate oil](#) and has the lowest sulphur content.

TABLE 12. Most Common Marine Fuels (Vis 2003, BP 2004, Exxon Mobil Marine 2006, CARB 2005)

INDUSTRIAL NAME	ISO NAME	COMPOSITION	ISO SPECIFICATION SULFUR WEIGHT %	WORLD AVERAGE
Intermediate Fuel Oil 380 (IFO 380)	MRG35	98% residual oil 2% distillate oil	5%*	2.67%
Intermediate Fuel Oil 180 (IFO 180)	RME 25	88% residual oil 12% distillate oil	5%*	2.67%
Marine Diesel Oil	DMB	Distillate oil with trace of residual oil	2%	0.65%
Marine Gas Oil	DMA	100% distillate oil	1.5%	0.38 %

\* IMO regulation capping sulfur at 4.5% supersedes ISO specification

(ICCT, Air Pollution and GHG Emissions from Ocean-going Ships: Impacts, Mitigation Options and Opportunities for Managing Growth, March 2007)

figure 3: Marine fuels

## 2.4.2 Heavy fuel oil with a scrubber

A Scrubber is an exhaust gas cleaning system and these are seen as a reliable, more cost effective solution. They require a large investment to install but once installed, they reduce sulphur emission by up to 98% and are able to run on conventional bunker fuel. A report published in 2012 by leading classification society Germanischer Lloyd demonstrated that for a 4,600 twenty-foot equivalent unit (TEU) after 2015, a scrubber on a ship with under 10% of its operations being in a Emissions Controlled Area (ECA), the payback period on a scrubber would be just under 72 months, this period reduces to just over 24 months if the operations within the ECA grew to 45% (Mirja-Maija Santala, 2012) making this an appealing choice.

There are four different types of scrubbers and the cost is between €1-5 million depending on the size of the ship according to Juha Kytola, head of environmental solutions at Wärtsilä, a Finnish company that makes scrubbers (gCaptain, 2013).

The main issue with scrubbers is the fact that it is still fairly new technology and untested and with it being such a big investment, many ship owners are planning to wait and follow the market to see whether it is a good investment in the future. It is widely expected to be a more popular option in 2020 when the IMO global limits are set to lower as the investment is seen as more viable when the vessel is used more within a SECA. Also, since the investment is so big, it may not be worth it to invest in an old vessel, ship owners may rather wait until they renew their fleet and then fit their new ships with scrubbers instead. So far there are only about 80 ships out of a worldwide total of 55,000 that have scrubbers already installed and an estimated 300 are on order, the majority of ships that use scrubbers are passenger ferries, offshore service ships and roll-on, roll-off (RoRo) ships that carry cargo that can be rolled in such as trucks, trains, cars, etc.

Scrubbers have recently been criticized by the German environmental organization Nature and Biodiversity Conservation Union (NABU) for not in fact being a good solution at all neither environmentally or economically since they discharge their waste into the water and no one has yet investigated the impact on the environment from that and there is still no official facts proving them to be economical. What came as a bad surprise is that obviously nobody ever systematically investigated the impact of scrubbers

on the marine environment before entitling this technique as a proper "solution" in the European Sulphur Directive. At the same time it is clear for everyone that simply discharging harmful substances into the ocean instead of to the air will not result in an improvement for the environment. Our report shows that currently scrubbers cannot be considered a solution, neither in ecological nor in economical terms," Said the chief executive officer of NABU to world maritime news. NABU's transport policy officer Daniel Rieger also criticized the scrubbers for allowing ship owners to keep using heavy fuel oil rather than investing in eco-friendly and cleaner fuels.(WMN 2015)

### **2.4.3 Liquified Natural Gas (LNG)**

LNG does not contain sulphur, resulting in almost no, if not zero, sulphur emissions, making it an attractive option as long as the vessel in question has an engine that can work with it. LNG does however potentially emit methane gas which is a high global warming potential. Another disadvantage with LNG is the extra storage needed to contain the fuel, the volume needed is 1.8 times the amount needed for diesel which is difficult to make for certain ships to switch to LNG. There is also a very limited fuel infrastructure available at the time of writing meaning that it can be difficult to acquire LNG and being a relatively new market the future prices for LNG are hard to foresee leaving this option to be a risky one in the long term. (CNSS). An LNG network is however being made in order for more ships to be able to use it but in a similar problem as with the scrubbers, it may not be economically viable to invest in an LNG engine in an old vessel.

## 2.5 Installation costs and payback time

Green ship of the future is a private Danish industry initiative that made a study on comparing technologies for the IMO emission levels. In this study they also investigated the average price for the installation of both systems for a 38,500 dwt tanker which is shown below to give a rough picture of the installation costs.

**Table 2** *Scrubber installation cost for 38,500 dwt tanker*

3 shipyards (1 Danish, 1 German and 1 Chinese) have been ask to submit a tender for the rebuilt and the prices were remarkable identical.

Scrubber machinery and equipment	2,600,000 USD
Steel (150t) / pipe / electrical installation and modification	2,400,000 USD
Design and classification cost	500,000 USD
Off-Hire (20 days @ rate 17.000 USD/day)	340,000 USD
<b>TOTAL</b>	<b>5,840,000 USD</b>

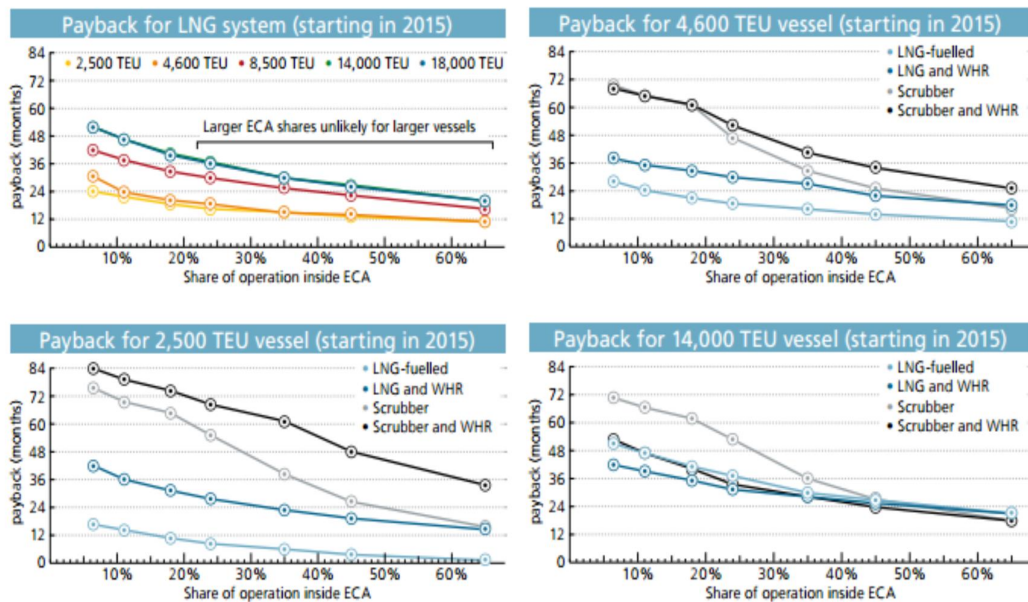
**Table 3** *LNG engine installation cost for 38,500 dwt tanker*

LNG machinery, tanks and equipment, main engine conversion	4,380,000 USD
Steel (300t)	2,000,000 USD
Design and classification cost	500,000 USD
Off-Hire (40 days @ rate 17.000 USD/day)	680,000 USD
<b>TOTAL</b>	<b>7,560,000 USD</b>

The difference in price is 1,720,000 \$US with the LNG engine proving to be more expensive. (Green ship of the future, 2012)



Germanischer Lloyd and MAN conducted a study to find the costs and payback times for both scrubbers and LNG engines.



**Figure 4** Payback times (Germanischer Lloyd, 2013)

What can be concluded from their study and graphs is that the payback time for both systems depends very much on how much they are used inside an ECA. LNG generally has a shorter payback time than a scrubber, and the smaller the vessel, the shorter the payback time, but this is due to the less investment compared to the bigger vessels. (Germanischer Lloyd, 2013)

### 3 RESEARCH FINDINGS

This chapter focuses on a few selected parties that are affected by the legislation and in which way they are affected and how they have prepared as well as their possible future decisions. Due to the reluctance to give financial information from major companies, the author has looked into relevant parties with available information which includes the government, ports, ship owners, scrubber manufacturers, etc.

The low oil prices in the beginning of 2015 was good news for the ship owners and their customers as it was largely expected that the high gas costs which traditionally rise would lead to high costs for them and likely encourage them to make a long term decision more quickly.

In order to give the reader a clear picture about how alternatives for the ships differ, a SWOT analysis has been made by the author to give help the reader understand why the following parties have opted for their choices.

#### **Scrubber SWOT analysis:**

**Strengths:** Can use cheaper heavier fuel, saving money in the long term.

**Weaknesses:** Large installation cost

**Opportunities:** One the global level of sulphur is set to 0,5%, many may opt to use scrubbers as it may prove to be more economically viable if used more strictly in an ECA.

May be seen as a better investment to new ships rather than old ones, if proven to be economical and successful, ship owners may decide to install scrubbers in their next generation of ships.

**Threats:** Uncertainty over technology as it is still new may scare off potential investors.

NABU

### **Marine fuels SWOT analysis**

**Strengths:** Any vessel can use the fuel without needing to modify the engine

**Weaknesses:** More expensive than traditional heavy fuel.

**Opportunities:** Can easily be used a short term solution while ship owners follow the situation and decide what to use in the long term.

**Threats:** Risk of damaging engines designed to work with heavier fuel.

### **LNG SWOT analysis:**

**Strengths:** Very eco-friendly

**Weaknesses:** Large costs to install LNG engine may put off investors, especially in older vessels.

**Opportunities:** LNG network being made

**Threats:** Uncertainty over gas price.

## **3.1 Estimated costs**

The new EU legislation will definitely affect all parties involved in Finland's export. The fuel costs alone are expected to add roughly €400 million per year to the industry according to Finland's transport minister, Merja Kyllönen (Baltic transport journal, 2012) and TraFi have estimated costs of up to €460 million per year for sea traffic that opts to use low Sulphur fuel and €120 million per year if scrubbers are installed (LVM, 2014). In order for the ship owners to get back these extra costs, the customers will have to pay more for the services and this could cause a chain reaction of rising costs affecting several different industries.

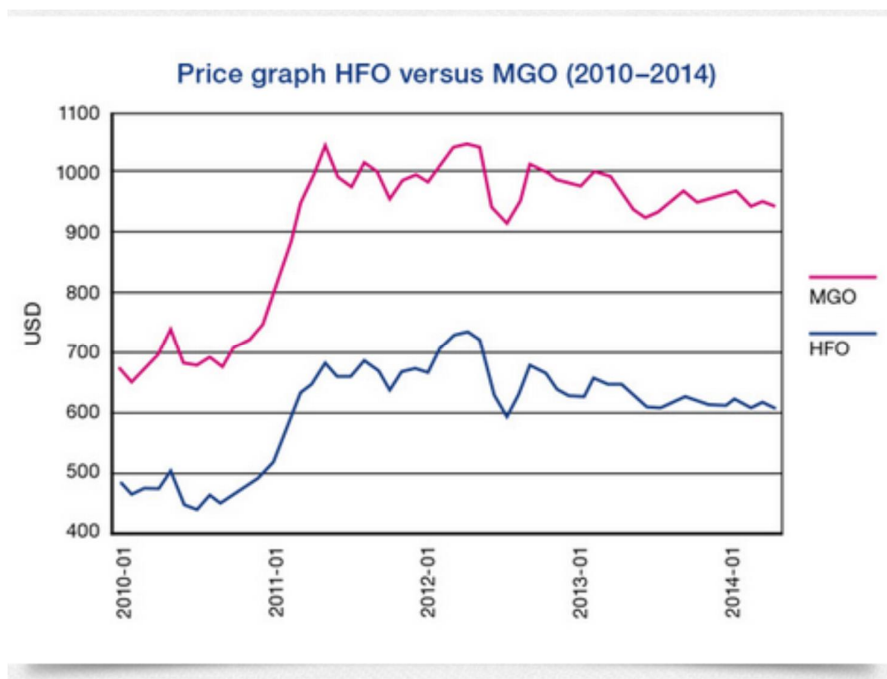
It has been estimated that the overall bill for switching fuels or installing exhaust filters will be between €2,6bn and €11bn, (this is an estimate for the whole Baltic sea region) this amount has been defended by estimated public health savings amounting up to €30bn,

including preventing 50,000 premature deaths per year in Europe blamed on pollution caused by high sulphur content from shipping fuels (Business green, 2012).

Finnish exporters estimate the yearly cost for meeting the new legislation to be about 1bn per year raising the cargo shipping costs and this has led to the forest industry being particularly hard hit as it is one of Finland's main export industries. Timo Jaatinen, Managing Director of the Finnish Forest Industries Federation has claimed to the news channel Yleutiset that investments on Finnish plants have stalled in the wait for the implementation of the new legislation "Now when it isn't known what is happening, investment is stalled, so Finnish factories are not developing. This is naturally a problem. If industry is to remain competitive, then it should also invest in the future." Jussi Pesonen, CEO of UPM threatened to newspaper Maasedun Tulevaisus, connected to the Central Union of Agricultural Producers and Forest Owners, that they might move their production to Central Europe as a result of the legislation (Yleutiset, 2012).

The project manager for the Midnordic green transport corridor pointed out the importance between both the affected countries and the different transport modes in the countries to communicate in order to challenge the potential problems that the legislation may bring, he said in the February newsletter that "There are always threats regarding implementation of new regulations. One threat is that the issue is handled domestically isolated in each country affected and this might end up with different regulations and migration of problems between countries. Another major threat is that decisions made and actions taken are not done in symbiosis between different transport modes (not looking at the whole picture) with modal back-shift as a result and that might jeopardize the whole idea with the new regulation." (MGTC, 2013). He stresses that the main concern should not be focused only on dealing with the direct costs caused by the directive in terms of higher fuel costs or large investments to retrofit ships, but it is equally important to make sure that there is a functional co-operation between the countries different transport systems to prevent for example problems in the shipping industry to spread to problems in the trucking industry due to the fact that there has been no communication or co-operation between these to let each other know the situation. The same goes for the affected countries, they need to work together on their regulations to not isolate themselves and cause problems to other affected countries due to lack of co-operation.

Although it is very difficult to predict future prices, most experts believe that the supply of MGO will increase the prices in the future whereas HFO is not expected to change so much. The graph below shows that MGO has been roughly 50% more expensive in the period before the legislation came into place and this is a leading argument for scrubber manufacturers such as Wärtsilä and Alfa Laval as they believe that the much lower cost of HFO which can be used in the SECA with a scrubber, means that the investment on installing a scrubber is worth it in the long term and could even pay itself back in as little as 2 years.



**Figure 5** Fuel price graph showing HFO vs MGO price 2010-2014 (Alfa Laval, 2014)

### **3.2 The Finnish government**

Given the importance of the matter to the country's export and therefore economy, the Finnish government has been active in trying to reduce and hinder any problems that may come.

Finnish newspaper Hufvudstadsbladet wrote that there is a threat of 12,000 jobs potentially being lost due to the extra costs from the sulphur directive (HBL, 2012), leading to the Finnish government having discussed compensation plans to aid the export industry and are one of the few affected EU member states that have openly pledged to help with funding. Initially the plan was to establish a diesel-based tax rebate for heavy transport that would compensate and reduce some transport costs for the export industry. In addition to this the government was to lift fees on shipping routes that are levied on maritime transport. This plan was halted by the European Commission, claiming that the plan was in conflict with the EU anti-competition law. (Lloydsloadinglist, 2012).

The Finnish government stated in a press release estimates of a predicted annual cost rise of between €400-600 in the following years after the legislation comes into place and called on several ministries to make an action plan to help reduce the negative effects on the country's competitiveness and industry (VN,2012). In another government press release, it was announced in August 2012 that the government agreed to include a €30 million grant in its budget for preparations for the sulphur directive; this includes the installation of scrubbers. €10 million was budgeted for 2013 which was monitored in order to make sure the measures taken are necessary to promote environmental technology and keep potential increase in logistics costs caused by the sulphur directive as low as possible. (VN, 2012). A decision was also made to halve the fairway fees which, together with a decision to eliminate freight railroad taxes from 2015-2017 in order to compensate the expected extra costs caused by the legislation, are expected to decrease the government's income by 55,7€ million per year (Finnish Government, 2014).

A separate plan for the development of the infrastructure needed for LNG was also prepared in 2013 stating in the government support program that a total of 123€ million would be provided to support a national LNG network including the discharge, storage, and supply of LNG to the terminals that use it. (TEM, 2013)

In September 2014 the Ministry of Employment and the Economy announced in a press release that they granted a total of 65, 2p million in three new LNG terminals around the coast of Finland bringing the total investment to over 200p million. They are expected to be completed by 2018 and the construction phase of these three ports are estimated to have a combined employment effect of 500 person years leading to 40 permanent jobs being created upon completion in the terminals and associated logistics chains.(TEM, 2014). By December 2014 the total investments from the ministry in LNG had reached over 300p million (TEM, 2014). Below is a picture that shows how the government financed LNG network is spread over the South of Finland.



Figure 6 Natural gas pipeline network in the area of the gulf of Finland (Gasum, 2014)

From the 2<sup>nd</sup> of April 2013, Finnish shipping companies were able to apply for investment aid from the government. An amendment issued on March the 14<sup>th</sup> 2013 that entered into force on April 1<sup>st</sup> 2013 has made this aid able to be granted to ships that are already in use, as opposed to investments on only new ships as was the decree prior to the new amendment. The aid is aimed to retrofit vessels with emission reducing technologies, mainly sulphur scrubbers but it may also be granted to technical solutions that help introducing alternative fuels with less sulphur emissions, or that reduce the emissions from currently used fuels. The EU has approved the scheme that allows the state aid to add up to a maximum of 50% of the total cost of the project (VN, 2013).

### **3.3 The Baltic Connector**

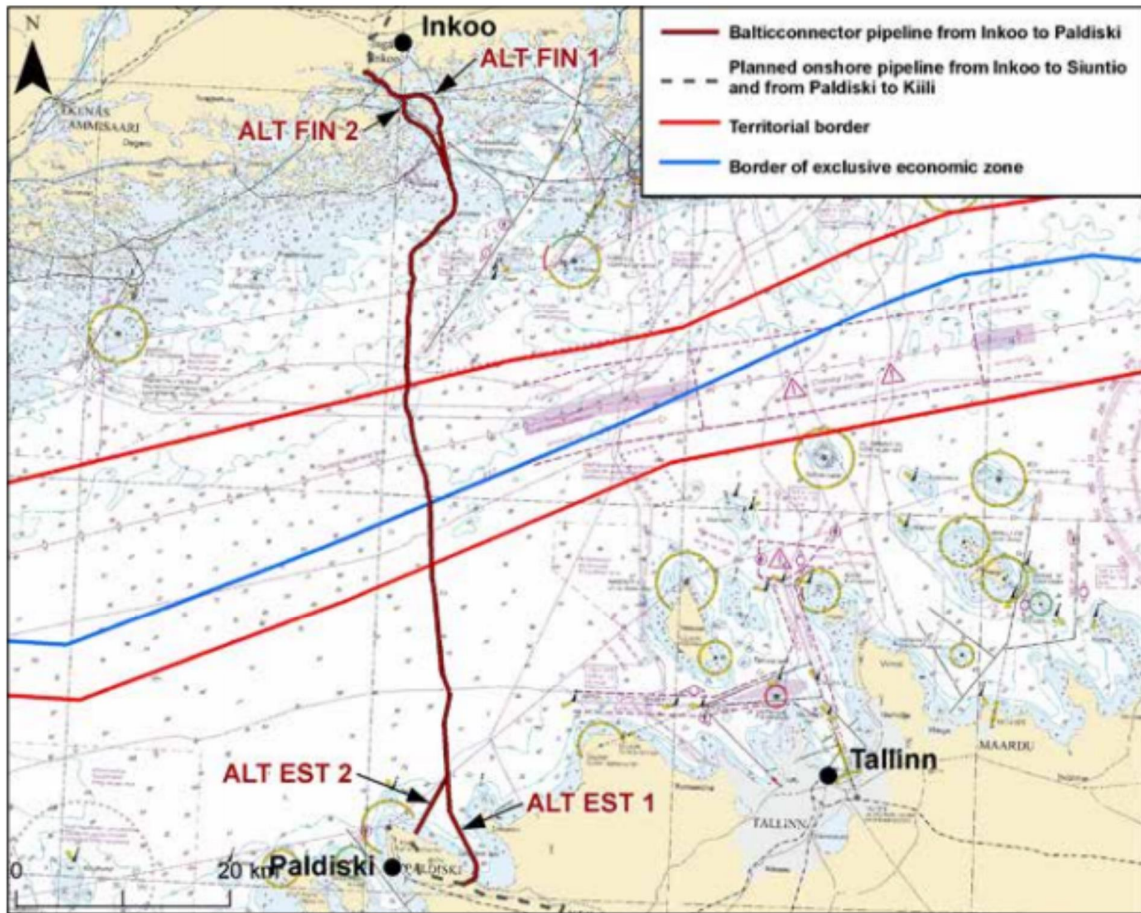
In November 2014 the Finnish government announced in a press release that it had become the majority shareholder in Gasum, a leading expert in natural energy gasses, after buying 51% of shares worth 510p million resulting in a 75% state ownership of the company as they previously owned 24%. This goal of this transaction was to make sure that the government had the best possible capabilities to develop Finland's gas markets and infrastructure.(VN, 2014)

In February 2014, the European Commission made a request to Gasum and the Estonian energy company AS Alexa Energy to look at possibilities of collaboration models for a LNG terminal for the Gulf of Finland. After several months of meetings and debates over possible stations for a terminal, the negotiations ended in the end of September 2014 due to the inability to find a commercially viable collaboration model. One major factor in the failure was the fact that the amount of EU investment aid was believed to be a lot larger than what it turned out to be during the negotiations.(Gasum, 2014)

The Finnish government and the Estonian government followed up on their negotiations over a joint LNG terminal and decided in the end of 2014 to build a Baltic connector, a pipeline that would connect LNG Finnish Gulf (Finngulf) terminals in either Porvoo or Inkoo in Finland with Paldiski in Estonia. The project is on the European Union's projects of common interest list meaning that it is eligible for EU funds that can cover up to 75% of the project. The final decision on how much funding they will get is expected



to be made in mid-July of 2015 (European Commission, 2015). The figure below shows the planned route of the pipeline.



**Figure 7** The planned route of the Balticconnector offshore pipeline (Gasum, 2014)

The EU stated in a press release that they had set a total of 650 million for grants for 2015. (EU, 2015). The LNG terminals are expected to cost over 500 million and the pipeline approximately 96 million as shown below.

**Table 4** *Cost of Balticconnector pipeline (Gasum, 2011)*

Materials	30.0 million Euros
Construction	47.0 million Euros
Engineering and Certification	2.7 million Euros
Management and Supervision	7.7 million Euros
Contingencies	8.7 million Euros

The pipeline is then expected to be ready in 2019 and continue from Estonia to Lithuania where there is another LNG terminal supplying the rest of the Baltic region with LNG gas.

Gasum has already planned an LNG port in Pori and is planning on making one in Turku. The one in Pori is planned to be in use by autumn 2016 and has received investments from the Finnish ministry of employment and the economy as well as Skangass which already has two similar ports, one in Sweden and one in Norway. (Gasum, 2014)

On the 2<sup>nd</sup> of October 2015, Gasum announced that due to the Baltic Connector and Finngulf projects are not commercially viable due to the decrease of gas consumption and deterioration of competitiveness in the Finnish gas market since the planning started in 2008, they will give up the project. Their motivation is that the future outlook has changed and an investment of this type would weaken the gas competitiveness even further, the other projects they have in Southern Finland will carry on as planned (Gasum) and the Finnish government will take over the Baltic Connector and Finngulf terminal. In order to see out the project, Finland's Minister of Economic Affairs, Olli Rehn said "The Balticconnector gas pipeline cannot be implemented without substantial European investment funding. To carry out the project, Finland will need 75% from the Connecting Europe Facility of the EU." He also emphasized that the pipeline will bring competition to the Finnish gas market as well as link Finland with European gas networks. (Finnish Government, 2015)

**SWOT analysis:**

**Strengths:** Decreases Finland's reliance on Russia for gas.

**Weaknesses:** Market uncertainty leaving it unknown when or if the large investment will pay back.

**Opportunities:** Opens up Finland to the European gas market.

**Threats:** If some other better solution than LNG is developed

### 3.4 Wärtsilä and Alfa Laval

Two companies looking to benefit from the new directive are Finnish Wärtsilä and Swedish Alfa Laval, leading scrubber manufacturers which both also provide LNG solutions to ships. Alfa Laval is a world leader in heat transfer, separation and fluid handling and had a total net sale of SEK 35bn in 2014. Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy market with a total net sale of €4,7bn in 2014. Wärtsilä acquired Hamworthy in 2011 meaning that they since then can provide scrubbers for all ship types as Hamworthy brought seawater scrubbers to their group. The prediction is that there may be up to 2,000 ships that sail through the affected sulphur legislation areas that will feel that with scrubbers being the most cost and space efficient ways to minimize emissions, many of them may order scrubbers and with the cheapest one costing €1 million, there is the potential for Wärtsilä to make up to €2 billion (Janina Pfalzer, 2013). This large amount may rise significantly given that there are about 70,000 existing ships in the world that may see these as a the most straight forward solution for them in the future (Anna-Leena Pojhanpalo, 2012).

The first two interim reports for 2015 that have been presented by these two companies show how the low oil prices have affected their marine business but the difficulty with looking at the interim reports of both Wärtsilä and Alfa Laval is that the scope of both their businesses is so great that there is no clear picture that shows the impact of the

decline in oil prices to their figures, especially in the SECA, but there are some observations that can be made from the figures and the statements regarding the marine market.

Wärtsilä stated in their Q1 report that during the first quarter, there was a 58% decline in contract activity for new vessels compared with the first quarter of 2014. The Q2 report stated that the decline for the first half of 2015 was 53% with only 458 contracts being made this year compared to 973 in the same period of 2014 (Wärtsilä, 2015). It can be argued that if the oil prices had not been as low as they were in the end of 2014 and beginning of 2015, they would have many more orders for scrubbers.

Their figures for the 2015 Q1 interim report were still positive and the low order levels were compensated by increase in maintenance services in the end of 2014. They stated that the year started with a slow market which was anticipated given the low prices and the wait and see attitude among many customers.

Despite the order intake having a positive 15% change, the table below shows that the ship power business declined by 24% which, for such big scrubber and LNG solutions manufacturer proves the market uncertainty. Wärtsilä announced in their report that this is not a worry and these are seen as long term solutions, and despite the lack of order in the first quarter, they expect the company's total net sales to improve by 0-10% from 2014(Wärtsilä, 2015).

MEUR	1-3/2015	1-3/2014	Change	2014
Power Plants	287	165	74%	1 293
Ship Power	336	440	-24%	1 746
Services	662	510	30%	2 045
Order intake, total	1 285	1 115	15%	5 084

**Figure 8** Wärtsilä Q1 2015 order intake figures (Wärtsilä interim report, 2015)

The Q2 report did not show any relevant significant changes regarding their marine market but they stated that the shipping industries remain challenging, again due to the low oil prices as well as depressed freight rates and overcapacity (Wärtsilä, 2015).

Alfa Laval had a similar trend to Wärtsilä in their interim report, they also had a small decrease in their first quarter of 2015 compared with the fourth quarter in 2014, a strong

demand for systems to ships transporting LNG showed better figures in the order intake which can be seen in the following figure.

### Marine & Diesel division

Consolidated SEK millions	First three months		Full year	Last 12
	2015	2014 *	2014	months
Orders received	4,008	1,923	12,522	14,607
Order backlog**	13,309	5,093	12,282	13,309
Net sales	3,495	1,537	10,870	12,828
Operating income***	702	280	2,019	2,441
Operating margin	20.1%	18.2%	18.6%	19.0%
Depreciation and amortisation	206	52	591	745
Investments	14	6	84	92
Assets**	25,515	7,998	25,299	25,515
Liabilities**	4,557	1,986	4,132	4,557
Number of employees**	3,096	1,819	3,127	3,096

\* Restated for move of manufacturing to Operations and Other. \*\* At the end of the period. \*\*\* In management accounts.

**Figure 9** Alfa Laval Q1 2015 interim report figures (Alfa Laval interim report, 2015)

They also had an overall increase in orders received but the orders in the marine business (shown below) were also on minus for the first three months of 2015. This was also blamed on a lower demand for exhaust gas cleaning systems (scrubbers) and marine cargo pumping systems.

Consolidated	Change excluding currency effects					
	Order intake			Net sales		
%	Structural change	Organic development	Total	Structural change	Organic development	Total
Q1 2015/2014	87.8	7.3	95.1	92.9	19.6	112.5
Q1 2015/Q4 2014	-	-3.5	-3.5	-	-10.1	-10.1

**Figure 10** Alfa Laval Q1 2015 order intake figures (Alfa Laval interim report, 2015)

In the second interim report, they showed record net sales but this cannot be credited to their marine division which they stated showed a sequential downturn. The demand is not expected to change much in the third quarter either (Alfa Laval, 2015).

Despite neither of these two major scrubber manufacturers showing any positive figures, there is plenty of potential customers and once the technology has been properly proven then they can expect to see an increase in orders but as mentioned before, this is more of a long term project given the investment in scrubbers so it is normal that it may take time before it can be clearly seen in their interim reports.

### **SWOT analysis**

**Strengths:** Major producers of scrubbers

**Weaknesses:** Low oil prices leading to uncertainty in market leading to decline in figures

**Opportunities:** If scrubbers and their LNG products prove to be successful then several more orders can be expected.

**Threats:** Other manufacturers with potentially better technology/prices taking customers away.

### **3.5 Hanko port**

The ports in Finland obviously play a major role in the shipping industry and the port of Hanko is a strategically important port based in the southernmost town in Finland, they see the legislation coming into place as a positive thing for them. Harbor master Timo Sjösten wrote in an email interview (Interview, 29.9.2014) that he believes that the geographical location of the port gives them an advantage as it is situated in the closest point from Finland to continental Europe thus leading to an increase in traffic as it will be cheaper for ships to load and unload there rather than continue further north, their shipments would most likely continue via land transport. An increased interest in shipping via Hanko has already been noticed and credit for this is due to the rising shipping costs as it has proven to be cheaper to transport goods via land further up the country from Hanko rather than transport the vessels further north to some other port. Timo Sjösten hopes and believes that the increased volumes and shipping there will benefit the whole city of Hanko in terms of more job opportunities. He also mentioned that Hanko would be a good location to have an LNG terminal but they do not have any plans yet on building one.



**Figure 11** Port of Hanko transport routes(*Port of Hanko*)

As a port they cannot estimate any extra costs that the legislation might bring to Hanko as the costs depend on each individual customer, depending on what solution they choose. They expect to compensate any extra costs with scrubber waste fees and for that they have planned mapped scrubber waste handling alternatives but in general, any waste removal costs etc. will be brought upon the shipping companies rather than the ports.

The Southern Finnish town of Hanko has had fairly big economic difficulties in the last couple of years, but sees its strategic position as a potentially huge advantage when the legislation comes into effect. They are hoping that more ships will use their port to and from Finland, using road transport from there up North, which would save expensive fuel costs for the ships, and bring more money to Hanko (västranyland, 2012).

### **SWOT analysis**

**Strengths:** The geographical position

**Weaknesses:** Hanko is a small town that may not be able to invest enough in the port to be able to accommodate as many ships as other ports close by.

**Opportunities:** More jobs for the people living in the area

**Threats:** The LNG network being built in other ports threatening to take potential customers away.

### **3.6 Port of Helsinki**

The port of Helsinki is another important port in Finland as it is the capital cities port. According to the director of traffic at the port of Helsinki, Andreas Slotte (Interview, 22.10.2014), there are, in theory, two ways of handling scrubber waste water but only one practical solution at the current time. Most often, the dirty scrubber water goes into a tank located in the ship, which is then emptied upon arrival to the port. The two ways of emptying the tank are either into a tanking truck that will then move the water to a proper scrubber waste water disposal location which is possible in any port as all that is required is a tanking truck. The other option which has not been done yet and which Andreas Slotte does not believe will be done due to the high costs and complexity of any necessary infrastructure to build special sewage pipes that bring the waste water directly from the port to the water disposal location. Scrubber waste water cannot be emptied into normal sewage due to it being too dirty. All the costs of the water waste are paid by the shipping companies so the ports themselves do not have to make any extra preparations.

Traffic office manager at the port of Helsinki, Eve Tuomola (Interview, 6.10.2014) does not believe that the legislation will bring any extra costs upon them. So far they have not taken any action but are following the situation and believe that more seagoing transport will opt to use land transport in the future to cut costs.

From the information gathered from the ports we can conclude that the ports themselves will not expect to get any extra costs brought upon them either directly or indirectly from the legislation as any costs will be covered by the shipping companies. Attempts to get any information from the waste handlers (Ekokem in Riihimäki) regarding any figures or potential figures that they expect as a result of the legislation were difficult to find due to the short time between the time of writing and the legislation taking place.



## **SWOT analysis**

**Strengths:** Capital city port

**Weaknesses:** No LNG terminal so LNG powered ships will prefer to use any other harbor that has one.

**Opportunities:** They are still monitoring the situation and could install an LNG terminal in the future but for now have good scrubber waste management logistics in place.

**Threats:** Companies may opt to use more Southern ports such as Hanko and road transport from there rather than ship their goods to Helsinki in order to save money on the expensive fuel, leading to fewer customers for the port of Helsinki.

## **3.7 Finnshipping**

Finnshipping is a ship broking company that does not own any ships but expect availability on ships to differ as the ship-owners who decide against upgrading their ships to comply with the legislation will use their ships outside of the affected SECA area. The majority of ships operating in the SECA area will most likely be younger ships in which investment in sulphur emission solutions is more worth it.

In order to prepare for the legislation, Finnshippings Julius von Herten said in an email interview (Interview, 30.9.2014) that the company has 5 solutions to different scenarios on upgraded vessels:

1-New low sulphur fuels → Price will rise compared to normal fuels → Freight will change together with bunker clause

As the low sulphur fuels are more expensive than current high sulphur ones, this option will lead to higher prices leading to the freight and bunker clauses to need to be changed.

2-Scrubbers → Big investment on vessels technics, technical uncertainty → Customers-specific agreement through bunker clause

As the scrubbers require a big investment, the customer agreements may have to be looked at specifically from case to case to cover the costs.

3-New vessels and engines → Long-term solution

Building new vessels with engines that comply with the legislation is an option but seen more as a long term solution.

4-Other technical engine solutions → Faster investments

As the topic becomes more current, other technical solutions leading to faster investments may be found.

5-LNG, dual fuel engines → Long-term solution

Building or modifying the vessel to use LNG or being a dual fuel engine is also a possibility but due to the high costs it is also seen as a long term solution.

### **SWOT analysis**

**Strengths:** As they have many years of experience and know how they may be able to advise shipping companies on what is the best/most economical solution.

**Weaknesses:** Are also very unsure about the market situation

**Opportunities:** As they do not own any ships and have to worry about fuel or upgrading costs, they can follow the market to see what the different shipping companies are doing.

**Threats:** If companies start opting to use land transport rather than shipping then they would lose customers.

### 3.8 DHL

DHL is a world leading postal and logistics company and have announced that the higher cost that the directive will bring to the shipping companies will be forwarded to road carriers as either a bunker surcharge or a MARPOL surcharge so they have calculated the effect of this and introduced a MARPOL surcharges per traffic area

The relevance of this information being included is just as an example to show how the costs will be forwarded from the shipping companies to the road carriers and then on to the customers.

MARPOL surcharge per traffic area as of January 1, 2015	Vechile combination	Full trailer loads (FTL)	Part loads / groupage (LTL)
		EUR/shipment	EUR/100 kg based on chargeable weight
		EUR/shipment	EUR/100 kg based on chargeable weight
Continental Europe		85,00	0,43
Central Eastern Europe		43,00	0,21
Sweden, Norway	85,00	48,00	0,24
Denmark		91,00	0,46
Baltic states		34,00	0,17
UK, Ireland		140,00	0,70

*Minimum: EUR 2.00 / shipment, maximum: see corresponding charge for FTL*

**Table 5** DHL MARPOL surcharge EUR/shipment (DHL)

#### SWOT analysis

**Strengths:** Are an established and experienced logistics company

**Weaknesses:** Can be charged with the MARPOL surcharge regardless of transport

**Opportunities:** Can forward the surcharge to customers, meaning no extra costs for them

**Threats:** Customers potentially being put off ordering because of increase in price.

### 3.9 Ship owners

With all three alternatives being fairly unproven and expensive, most affected companies decided to wait and see what the best option to choose would be. Finnlines is one such example, at the end of 2013 CEO Emanuele Grimaldi wrote in a letter to the company's collaborators and customers that "It remains an open problem the most suitable and efficient solution to adopt for coping with the January 2015 SECA zone regulation challenge. In any decision timing is crucial in setting the policies. Our strategy - for the time being - is to study, test and wait. As technology advances, it will become easier to judge which solutions are the most adequate to our ships and services. For the time being several options are available, including scrubber installation, LNG retrofit, MDO retrofit. We could even opt for changing nothing, as there are already contacts with various fuel producers for purchasing 0,1% sulphur products at competitive prices. Thanks to the young age of Finnlines's ships and the large size of our group, we are ready to promptly invest wherever it is, in absolute terms, most worth doing it." (Finnlines, 2013).

In May 2014 the company announced a capital expenditures (Capex) program in which the focus was on investing in environmental technology, this included installing scrubbers from Wärtsilä in 14 of their total of 22 vessels, 4 built in 2001-2002, 4 built in 2006-2007 and 6 of their newest fleet built in 2011-2012 (their revenue for the whole of 2014 was 532,9 million) (Finnlines, 2014). 17,9 million of the investment was funded by the EU as part of their Connecting Europe Facility (CEF) which also funded part of the Balticconnector (Finnlines, 2015) and which Finnlines qualify for through their part in Finnish foreign trade and connecting Finland with several countries in Europe. In July 2015 Finnlines announced their best ever second quarter results in ten years. Despite a 6,7% turnover decrease, blamed on macroeconomic juncture, bunker surcharge reduction, vessel maintenance, tonnage adjustment and retrofit, they believe that these results indicate that the measures taken, including the Capex investment program, were the right ones as they seek to consolidate their position in the market as well as becoming one of the best equipped shipping companies regarding technological innovation. (Finnlines, 2015).

Transfennica is another major shipping company operating in Finland that has decided to install scrubbers on several of their vessels (Transfennica, 2014).

Many shipping companies have opted to have monthly bunker fuel surcharges to their customers depending on the fuel prices of that particular month due to the fluctuating price. Some companies such as Stenaline and Transfennica base their surcharge on the average market price per 1000 KG of the fuel used as quoted by Bunker World Rotterdam.

Other companies such as unifeeder decided to impose a bunker fee surcharge of 65p per loaded twenty foot equivalent unit (TEU) as of the 1<sup>st</sup> of January 2015 and used the following calculation Total IFO LS fuel consumption in tons x price increase per ton / loaded TEUs, they announced that while the surcharge is expected to be the same, it may periodically change subject to any significant rise or decline in the price MGO.

Transfennica has publicly stated their bunker prices on their website and from December 2014 to March 2015 they are as follows:

December 2014	35,90 %
January 2015	0,00 %
February 2015	-10,40 %
March 2015	-8,80 %
April 2015	-4,10 %
May 2015	-5,10 %
June 2015	-1,60 %
July 2015	-2,70 %
August 2015	-5,30 %
September 2015	-9,90 %

**Table 6** *Transfennica bunker prices 2015 (Transfennica, 2015)\**

\*The price surcharge is based on a reference bunker price of 432, 77p per metric ton. 1, 0% is represented by a change of 10, 73p per metric ton in the price at a detail of 0, 1%. As the directive came into place in January the surcharge was set to 0% to form the base for a new basic freight conversion and bunker adjustment factor (BAF) level (Transfennica, 2015).

The Finnish Shipowners Association's managing director Olof Widen said in the beginning of January that around 85% of their member ships had opted to use MGO. Although this is more expensive, he defended the decision by arguing that the other alternatives are far too expensive, unproven and only suit certain types of vessels. For example LNG is only available to vessels with machinery that is compatible with the gas such as Viking Grace and if a normal vessel were to change the change in order to be able to run on LNG then the costs would be so high that the investments would not be able to pay themselves back. (Västrä Nyland, 2015)

The trend of MGO being the most used option in ECA's can also be seen in an industry survey made by Lloyds list shows that 62% of ship-owners are using MGO compared to 48% in 2014. The same survey also proved that the use of scrubbers has increased slightly from 17% to 19% whilst the use of LNG has decreased from 22% to 19%. During the period of the survey the bunker prices have almost halved as the oil prices have dropped and this has been acknowledged as a lucky development for the industry.(Bunker world, 2015)

### **3.10 Monitoring**

One important question regarding the legislation is how it will be monitored. There is no guarantee that shipping companies will comply with the rules as long as there is little or no monitoring or even penalties in place to those that do not follow leading to complying companies feeling unfairly treated amongst other arguments and problems. The Finnish Transport Safety Agency (Trafi) has threatened with fines and even grounding repeat offending vessels at the ports, but with their monitoring system based on risk it can be argued that it is easy to continue using low cost fuel with high sulphur emissions as the costs saved on that outweighs the potential risk of fines. Some alternatives to the absence of monitoring include having unmanned drones flying over the affected area with sensor technology that measures the exhaust from passing ships, taking fuel samples, when the ships are in the ports, or installing "sniffers" in strategic spots such as bridges in the Baltic sea that measure the exhaust from passing ships very much like the drone idea.(ShippingWatch, 2014)

Trafi announced at the end of 2014 that as of January 2015 ships will be monitored for sulphur emissions. Trafi will inspect vessels on the base of risk, meaning that higher risk vessels with a history of issues from previous inspections will be targeted.

“We have complemented our traditional sampling programme with new approaches in order to increase the efficiency of our supervisory work. For example, we are about to launch a new remote monitoring system, which will allow us to monitor ship emissions across the entire northern section of the Baltic Sea. International cooperation and exchange of information also play important roles in our day-to-day work and our efforts to target inspections at the most high-risk ships”, explains Director of the Inspections Division Juha-Matti Korsi. (Trafi, 2014)

The drone option seems to be the cheapest, easiest and most effective way of monitoring as they do not cost so much to make and do not require any extensive training to learn how to use.

## **4. DISCUSSION OF RESEARCH FINDINGS**

It is difficult to estimate exactly how big an affect this new legislation will play on the country's economy as a whole. There will obviously be many extra costs, in particular for shipping companies and major importers and exporters which have led to fears of job losses and threats of potential moving of entire factories to other countries that will not be affected by the legislation.

In the short time since the legislation has come into place a majority of ship owners have decided to use MGO which was expected to be much more expensive but luckily for the industry, the prices have not been so high due to the fall in oil prices, roughly a third of vessels in ECA's have chosen this option while they still wait and see if LNG or scrubbers may prove to be a good investment in the future. One other big factor in the popularity of the MGO is the fact that to change to one of the other two options, the vessels need a big investment and modification and that may not even be possible to older ships. The future price and availability of MGO is still a potential issue but as more ships will need to comply with the sulphur reduction globally in the future there is research for more potential solutions.

The Finnish government is investing in an LNG network and this will probably be the long term solutions for most companies once they renew their fleet, several other European countries have or will also build LNG terminals and international pipelines such as the Baltic connector reduce the risk of any potential conflicts involving Russia causing gas prices to rise which makes this much more appealing for the whole region especially from past experiences where some countries relying on gas coming from Russia has not been able to receive it or had to pay high prices for it. The European LNG network will ensure that the EU will not have to rely on one country to distribute it and since Russia is not a major LNG exporter this is not a potential risk either way.

Scrubbers may also be more of a popular option but as they are still relatively new to the market it is understandable that companies will prefer to see how they work before investing millions in them. As mentioned in the report, new doubts have arisen such as the environmental effects of them disposing of their waste into the sea, this has not yet been investigated but in worst case scenario they will prove to damage the water rather than air and will not be an option any more unless the manufacturers find another solution.



At the moment the scrubber waste water is easily collected and disposed of in the ports but that also adds extra costs. The main appeal of the scrubbers is that despite the large initial investment, the ships can continue to run on the same fuel as they are using now which is considerably cheaper and, at least not for the foreseeable future, not in danger of running out any time soon. The only major reason that may put off most customers is the large investment to install it, but that is where the government has already come to aid with the €30 million put in the budget to help finance these installations. One other thing that may affect the choice of installing a scrubber or switching fuels is if the vessel in question is used only in the SECA or also outside. If it is a short sea vessel being used strictly in the SECA then a scrubber would be a good option but if the vessel also operates outside of the SECA then it may run on normal fuels when outside of the area and then simply change to marine gas oil when entering the area.

But as the legislation is yet so new, it has also been discussed that many companies may also be keeping quiet about their strategy and waiting to see how the situation plays out as there is still uncertainty over various things, mainly the cost and availability of sulphur less fuels. The government will play a big part in trying to reduce costs as it tries to keep the country competitive and hinder scenarios such as the UPM in where major companies move their business out of the country which would only further damage the economy. However the government has for now just budgeted money to help implement the necessary requirements for shipping companies to deal with the costs but is monitoring the situation and will most likely take further action if needed.

Despite being able to apply for government aid for the payment for the installation of any project that would in turn help the ships comply with the legislation, the aid is only a maximum of 50% of the cost and there is no way that any shipping company can avoid extra costs which in turn will affect their customers. The author believes that due to the lack of monitoring and continued uncertainty regarding the future and what may be the best option for the shipping companies, many will most likely keep monitoring the situation without doing anything until they find a strategy that they are certain that will work for them. The EU and IMO probably will enforce the lower sulphur limits beyond the SECA at some point, most likely in 2020, but without any guarantees or proven options, companies will wait to see if any new technology has been developed before they start investing.

The main difficulty in finding any exact costs is the fact that most businesses have not yet decided what action to take and therefore cannot predict any costs and most shipping companies have yet to decide what option they decide to take, now with the government aid it is likely that many will opt for the scrubbers but then a significant investment of minimum €500,000 per ship will have to be made given that they receive full aid and that may be difficult to find. In the scrubbers favor however, it is a risk free investment which may help finding investors.

The payback time for both scrubbers and LNG powered engines are much lower if operated more in the SECA and with the sulphur emission area looking to be more widely used in 2020 by which time there will also be more know-how in the market means that we can expect to see much more ships operating with either of these two, this can also be backed up by the fact that it is widely expected that the MGO price will rise, if not in the near future then at some point when the demand will be so great and the fear of the supply being short which is bound to happen again, especially since that was already a worry before 2015. Two major scrubber manufacturers, Alfa Laval and Wärtsilä have also announced that they see their scrubbers as a long term solution.

Economically there is not too big a difference on which option the companies decide to fit their ships with but the costs very much depend on how much time it operated in the SECA. We have seen that very many ships operating strictly in the SECA have installed scrubbers already and LNG powered ships have been proven and once the network is in operation they will certainly be more popular. It is also worth mentioning that the SECA will most likely expand to a future and eventually the limits may be global by which time all ship owners will take one or the other option as their ships will not be able to be used only with normal high Sulphur fuel which is the case now with some owners leasing their ships to outside the SECA.

The predicted total cost to the economy is at around €1 billion but this as the oil prices dropped leading to cheaper bunker surcharges than expected this is also a difficult figure to estimate, the figure will also drop with time as the sulphur limits extend to other areas. The initial main threat was the expected bunker fee to rise but the industry has benefitted from the low prices which have not scared away any customers and discussed in the report, the bunker surcharge seems to be forwarded by every affected party to the customer, so technically the companies will not have any major costs other than then

vessel modifying but that pays itself back in the future. Judging by the large amounts of money invested by the Finnish government into creating an LNG network, it looks like there is no reason to believe that the shipping traffic will decrease in the future and this proves that the import and export should not either change radically because of the legislation.

The decision by Gasum to opt out of the Baltic Connector project due to the economic unfeasibility very late on in the process is an interesting one, on one hand it can be seen as evidence that the LNG market is not attractive for investors although they are still planning several terminals spread out around the coast, but this project would open the country up to the European gas markets which the government sees as a positive move that will bring more competition to Finland. The fact that they left it so late before they pulled out and that the government is still going to go forward with the project shows that it is a very important project for the country. The future outlooks contradict with each other, with Gasum claiming that the future outlook has changed substantially for the worse since they first looked at the plan in 2008 but the government making it look more positive with the potential competition it will bring and the reliance on Russian gas minimizing. This can be discussed through many aspects but the fact that the project is still going through at the moment means that it is still very important for Finland to have an open market but no one is ready to heavily invest to make it happen.

The answers for the research questions are:

1. What are/have the affected parties doing/done in order to prepare themselves for the new legislation?

The government is investing in a LNG network which is expected to be ready close to 2020 indicating that they are expecting LNG to be a major shipping solution in the future. The government has also given grants for scrubbers which have also been used by some major shipping companies in Finland but the clear majority have opted to use low sulphur fuels at least in the short term but this is can also be explained by the high costs it would

bring to invest in modifying older vessels to be able to run with scrubbers or LNG and the most likely scenario for the future is for the ship owners to monitor the situation and then install scrubbers or LNG engines on their new fleet once they renew it. Finding any concrete information relating to companies and how they have been affected is very difficult given the short amount of time in between the directive coming into place and the writing of this report but the general feeling is that most of the costs will be compensated by the bunker surcharge, such as in the cases of Transfennica and DHL, so logistics and export companies will not lose any money but may in worst case scenario lose customers in the future who in the end are the ones paying the extra fees. The overall costs though are widely expected to decrease after a couple of years after any major investments in any vessels that will ultimately bring the biggest costs.

The main Finnish ports have either planned to get LNG terminals or have scrubber waste water logistics in place both of which will not bring any costs to them directly as the ships will ultimately pay for those fees. Whether any ports may see a rise or fall in their customers is too early to be seen but generally they are not too worried and as in the case of Hanko are even looking forward to having even more traffic because of the directive.

1. Will the resulting costs from the legislation lead to any noticeable changes in the Finnish shipping industry?

The government is monitoring the situation and wants to keep the Finnish export industry competitive and prevent any changes in terms of less export. The initial main fear was that the forest industry would suffer most, being the top exporters of Finland, but as all the extra costs are expected to be covered by bunker surcharges the fear has died down and the forestry sector has not seen any significant losses. The fall in oil price at the same time as the directive came into place has also helped ease any fears about high export costs but no one can know the future prices but once the initial investment period is over probably in the next 10 years, there will be an LNG network in place as well as more knowledge on the scrubber technology and possibly new alternatives and then the ship owners can calculate investment costs more accurately and act accordingly and the impacts of the legislation will most likely not affect the economy negatively. In short,

the most noticeable change is the infrastructure with several new LNG terminals being built around Finland.

## **5. CONCLUSION**

Although at the time of writing it is very soon after the directive has come into action, the main findings from the research show that although the most favored option now in the Baltic Sea is for ships to use marine gas oil, the use of LNG and scrubbers will surely rise greatly in the next 10 years, especially LNG. The reasons for this conclusion are

The Finnish government has already invested over €200 million in an LNG network which will be ready by 2020 which will also connect Finland with the rest of Europe, decreasing its reliance on Russian gas.

The installation of scrubbers/LNG engines is in most cases not economically viable or even possible on old ships in use but new ships made to operate in a SECA will almost certainly have one of the two built in

Although low oil prices in the beginning of 2015 have led to marine gas oil costing less than expected, it can be expected to rise in the future, especially with the growing demand. With time, the technology will get better and the uncertainty will not scare investors off modifying their ships once they see concrete results from the available options.

The cost of the results of the directive was initially expected to have a negative effect on the Finnish economy as the extra costs would lead to job cuts as well as ultimately being paid for by the customers which in worst case scenario would lead them to buy for example paper products from a cheaper producer or opt to use road transport rather than shipping but although the investments for the shipping companies initially will be large, the payback time is relatively short, at least for the vessels operating for longer in the SECA that outside, and they can seek aid from the government if needed. The total costs, especially in the long term are expected to be far less than the health costs that will be saved by making the Baltic sea region more environmentally friendly by reducing the sulphur emissions. The costs for the ship owners are not expected to be significantly higher than normal once the initial modifying investments have been made and could

even become cheaper meaning that they may even save money in the long term on cheaper fuel once they modify their ships meaning that in the long term this could prove to bring positive developments to all parties involved including the health sector which was one of the initial main reason that the directive was made. The LNG network that is currently being built also ensures that all ships operating with LNG will not have to worry about the supply which has been the case before given the small number of active LNG terminals. Considering the amounts being spent on investments, LNG will probably be the leading choice for ships operating in the SECA in the future.

Any alternative ways of exporting do not seem to be an option since such a great amount of Finland's export is by sea and there have been no significant discussions that may indicate alternative ways of export even being an option. The government and industry will monitor the situation and take all possible necessary action needed in order to keep it strong and competitive. There have already been significant investments to keep the shipping industry competitive so there is no reason to believe that customers will opt to export any other way in the future. There is no reason to believe that the shipping in Finland will in any way decline because of the directive, on the contrary it will save costs after the initial investment and in any other case the government will do what it can to make sure it stays competitive.

## REFERENCES

Alfa Laval, First quarter of 2015, summary accessed on 26.4.2015 from

<http://feed.ne.cision.com/wpyfs/00/00/00/00/00/2C/CF/D0/wkr0006.pdf>

Alfa Laval, Competing fuel prices, accessed on 26.4.2015 from

<http://www.alfalaval.com/campaigns/puresox/documents/competing.htm#fuel-prices>

Axces, emission technology; Service and support, Standards and norms; Sox (sulfur), accessed on 31.5.2015

from [http://www.axces.eu/index.php?option=com\\_content&view=article&id=308:sox-sulfur-content-of-fuel&catid=141&Itemid=580](http://www.axces.eu/index.php?option=com_content&view=article&id=308:sox-sulfur-content-of-fuel&catid=141&Itemid=580)

Baltic transport journal, quote from model region for LNG in shipping, BTJ 5/2012, 28.1.2012, accessed on 21.7.2014 from

<http://baltictransportjournal.com/search/sulphur/the-sulphur-directive-will-burden-the-finnish-industry-with-ca-eur-400-mln-per-year-in-the-form-of-higher-fuel-costs.283.html>

Bloomberg, Finland plans to offset costs to industry from EU sulfur rules, Kasper Viita, September 13 2012 12.52, accessed on 04.08.2014 from <http://www.bloomberg.com/news/2012-09-13/finland-plans-to-offset-costs-to-industry-from-eu-sulfur-rules.html>

Bloomberg, Ship-scrubbing order boom for Alfa, Wärtsilä on rules, JaninaPfalzer, March 19<sup>th</sup> 2013, accessed on 04.08.2014 from <http://www.bloomberg.com/news/2013-03-18/ship-scrubbing-order-boom-for-alfa-waertsilae-on-rules.html>

Bunker world, Owners prefer MGO in ECAs, Julian Macqueen, 17.4.2015 11:45,

accessed on 19.4.2015 from <http://www.bunkerworld.com/news/Owners-prefer-MGO-in-ECAs-135930>

Business Green, EU moves to sink shipping sulphur emissions, BusinessGreen staff, 24 May 2012, accessed on 26.07.2014 from <http://www.businessgreen.com/bg/news/2179508/eu-moves-sink-shipping-sulphur-emissions>

Customs, Country statistics, January 2015, 31.3.2015, accessed on 21.4.2015 from [http://www.tulli.fi/en/finnish\\_customs/statistics/statistics/country/index.jsp](http://www.tulli.fi/en/finnish_customs/statistics/statistics/country/index.jsp)

DHL, Fuel surcharges and MARPOL surcharge, accessed on 26.4.2015 from [http://www.dhl.fi/en/logistics/customer\\_resource\\_area/guides\\_and\\_white\\_papers/fuel\\_surcharges.html#.VWw5emNw7z0](http://www.dhl.fi/en/logistics/customer_resource_area/guides_and_white_papers/fuel_surcharges.html#.VWw5emNw7z0)

DNV powerpoint, Greener shipping in the Baltic sea, June 2010, accessed on 02.08.2014 from <http://cleantech.cnss.no/wp-content/uploads/2011/05/2010-DNV-Greener-Shipping-in-the-Baltic-Sea.pdf>

DNV, Stricter sulphur regulations are coming- is shipping ready?, Erik Nyhus, 28.10.2011, accessed on 26.07.2014 from [http://www.dnv.com/industry/maritime/publicationsanddownloads/publications/updates/ferry/2011/01\\_2011/strickersulphurregulationsarecomingisshippingready.asp](http://www.dnv.com/industry/maritime/publicationsanddownloads/publications/updates/ferry/2011/01_2011/strickersulphurregulationsarecomingisshippingready.asp)

Euractiv.com, Europe tackles sulphur emissions from ships, 24 May 2012, accessed on 04.08.2014 from <http://www.euractiv.com/energy-efficiency/europe-cracks-sulphur-emissions-news-512957>

European commission press release, Completing the internal energy market: 100p million released to connect European energy networks, 5.3.2015 accessed on 23.4.2015 from [http://europa.eu/rapid/press-release\\_IP-15-4560\\_en.htm](http://europa.eu/rapid/press-release_IP-15-4560_en.htm)

Finnlines PLC press release, Finnlines invests in environmental energy, 15.5.2014 10:00 accessed on 5.4.2015 from [http://www.finnlines.com/company/news\\_press/press\\_releases/finnlines\\_invests\\_in\\_environmental\\_technology](http://www.finnlines.com/company/news_press/press_releases/finnlines_invests_in_environmental_technology)



Finnlines PLC press release, Finnlines PLC entered into a repeat order with Wärtsilä to supply exhaust gas cleaning systems, 28.08.2015 9 am, accessed on 8.9.2015 from [http://www.finnlines.com/company/news\\_press/press\\_releases/finnlines\\_plc\\_entered\\_in\\_to\\_a\\_repeat\\_order\\_with\\_waertsilae\\_to\\_supply\\_exhaust\\_gas\\_cleaning\\_systems](http://www.finnlines.com/company/news_press/press_releases/finnlines_plc_entered_in_to_a_repeat_order_with_waertsilae_to_supply_exhaust_gas_cleaning_systems)

Finnlines PLC Stock exchange release, Finnlines PLC Interim Report January-June 2015 (unaudited), 29.07.2015 14:00, accessed on 25.09.2015 from [http://www.finnlines.com/company/financial\\_information/stock\\_exchange\\_releases/finnlines\\_plc\\_interim\\_report\\_january\\_june\\_2015\\_unaudited](http://www.finnlines.com/company/financial_information/stock_exchange_releases/finnlines_plc_interim_report_january_june_2015_unaudited)

Finnlines PLC Stock Exchange Release, Finnlines PLC Interim Report January-March 2015 (unaudited), 13.05.2015 13:00, accessed on 25.09.2015 from [http://www.finnlines.com/company/financial\\_information/stock\\_exchange\\_releases/finnlines\\_plc\\_interim\\_report\\_january\\_march\\_2015\\_unaudited](http://www.finnlines.com/company/financial_information/stock_exchange_releases/finnlines_plc_interim_report_january_march_2015_unaudited)

Finnish government, Investment aid for ships to ease adaptation to sulphur emission limits, 14.3.2013 14.11, accessed on 26.7.2014 from <http://valtioneuvosto.fi/ajankohtaista/tiedotteet/tiedote/fi.jsp?oid=379472>

Finnish government, press release 213/2012, Action plan to compensate the negative impacts of the sulphur directive, Government communications department, 27.6.2012 10.19, accessed on 21.7.2014 from <http://valtioneuvosto.fi/ajankohtaista/tiedotteet/tiedote/fi.jsp?oid=361349&c=0&toid=1802&moid=1803>

Finnish government, kommunikationsministeriet, press release: Farledsavgifterna och banskatten slopas 2015-2017, 15.09.2014 11.40, accessed on 7.9.2015 from <http://xn--statsrdet-b3a.fi/ajankohtaista/tiedotteet/tiedote/en.jsp?toid=1946&c=0&moid=2173&startDate=2011-06-26&oid=424602>

Finnish government, press release, Finland to apply for EU funding for gas pipeline between Finland and Estonia, 2.10.2015 11:33, accessed on 7.10.2015 from [http://valtioneuvosto.fi/en/article/-/asset\\_publisher/suomi-hakee-eu-tukea-suomen-javiron-valiselle-kaasuputkelle](http://valtioneuvosto.fi/en/article/-/asset_publisher/suomi-hakee-eu-tukea-suomen-javiron-valiselle-kaasuputkelle)

Finnish government, press release, Minister Kyllönen: Adaptation to sulphur regulations cannot be funded from basic infrastructure maintenance, Ministry of transport and communications, 27.8.2012 11.55, accessed on 21.7.2014 from <http://valtioneuvosto.fi/ajankohtaista/tiedotteet/tiedote/fi.jsp?oid=363562>

Finnish government, press release, EU approves Finland's investment aid to sulphur scrubbers, Ministry of transport and communications, 25.1.2013 10.49, accessed on 21.7.2014 from <http://valtioneuvosto.fi/ajankohtaista/tiedotteet/tiedote/fi.jsp?oid=376071>

Finnish government, press release, Support for environmental technology to play key role in adapting to sulphur regulations, Ministry of transport and communications, 29.8.2012 9.55, accessed on 22.07.2014 from <http://statsradet.fi/ajankohtaista/tiedotteet/tiedote/sv.jsp?oid=363639&c=0&toid=192123&moid=192125>

Finnish government, press release 258/2012, The government has agreed on the budget proposal for 2013: Investments in growth and employment to boost confidence in Finland's economy, government communications department, 4.9.2012 14.10, accessed on 21.7.2014 from <http://valtioneuvosto.fi/ajankohtaista/tiedotteet/tiedote/fi.jsp?oid=363890>

Finnish government, The state of Finland becomes a majority shareholder in Gasum, government communications department, press release 479/2014, 3.11.2014 9.49, accessed on 21.3.2015 from [http://valtioneuvosto.fi/en/article/-/asset\\_publisher/valtiosta-tulee-gasumin-enemmistoomistaja](http://valtioneuvosto.fi/en/article/-/asset_publisher/valtiosta-tulee-gasumin-enemmistoomistaja)

Gard.com, Loss prevention material, No 06-14: Preparing for low sulphur operation, 3.1 Effects of low sulphur fuel on the operation accessed on 18.4.2015 from

<http://www.gard.no/ikbViewer/web/updates/content/20785475/no.-06-14:-preparing-for-low-sulphur-operation>

Gasum, Balticconnector Executive Summary, February 2011, accessed on 26.4.2015 from [http://www.gasum.com/globalassets/lng/balticconnector\\_executivesummaryreport.pdf](http://www.gasum.com/globalassets/lng/balticconnector_executivesummaryreport.pdf)

Gasum, Balticconnector, Natural gas pipeline between Finland and Estonia, January 2014, accessed on 26.4.2015 from [http://gasum.com/globalassets/balticconnector/balticconnector\\_eia\\_programme\\_eng.pdf](http://gasum.com/globalassets/balticconnector/balticconnector_eia_programme_eng.pdf)

Gasum, corporate info, 2014, Negotiations on gulf of Finland LNG terminal end, 30.9.2014 accessed on 26.4.2015 from [http://www.gasum.com/Corporate\\_info/News/2014/negotiations-on-gulf-of-finland-lng-terminal-end/](http://www.gasum.com/Corporate_info/News/2014/negotiations-on-gulf-of-finland-lng-terminal-end/)

Gasum, corporate info, news, 2014, Pori LNG terminal accessed on 26.4.2015 from [http://www.gasum.com/Corporate\\_info/Skangass2/Pori-terminal/](http://www.gasum.com/Corporate_info/Skangass2/Pori-terminal/)

Gasum, corporate info, news, 2014, Skangass invests in Pori LNG terminal- LNG to be supplied to customers from the terminal in 2016 accessed on 26.4.2015 from [http://www.gasum.com/Corporate\\_info/News/2014/skangass-invests-in-pori-lng-terminal--lng-to-be-supplied-to-customers-from-the-terminal-in-2016/](http://www.gasum.com/Corporate_info/News/2014/skangass-invests-in-pori-lng-terminal--lng-to-be-supplied-to-customers-from-the-terminal-in-2016/)

Gasum, corporate info, news, 2015, Finngulf terminal and balticconnector pipeline not commercially viable, 02.10.2015, accessed on 7.10.2015 from [http://www.gasum.com/Corporate\\_info/News/finngulf-terminal-and-balticconnector-pipeline-not-commercially-viable/](http://www.gasum.com/Corporate_info/News/finngulf-terminal-and-balticconnector-pipeline-not-commercially-viable/)

gCaptain, Shipping industry, IMO study on low sulphur fuel availability needed now, gCapatain staff, July 23 2012, accessed on 02.08.2014 from <http://gcaptain.com/ics-requests-imo-study-availability-low-sulphur-fuel/>

gCaptain, Wärtsilä and Alfa Laval see jump in orders for emissions scrubbers, Fathomshipping, March 26<sup>th</sup> 2013, accessed on 04.08.2014 from <http://gcaptain.com/wartsila-alfa-laval-jump-orders/>

Germanischer Lloyd, Costs and benefits of LNG as ship fuel for container vessels, key results from a GL and MAN study accessed on 23.4.2015 from [http://www.lngbunkering.org/sites/default/files/2013%20GL MAN LNG study web.pdf](http://www.lngbunkering.org/sites/default/files/2013%20GL%20MAN%20LNG%20study%20web.pdf)

Green ship of the future, presentation from 9<sup>th</sup> annual green ship technology conference, Copenhagen 2012, Vessel emission study: Comparison of various abatement technologies to meet emission levels for ECAs accessed on 23.4.2015 from <http://www.greenship.org/fpublic/greenship/dokumenter/Downloads%20-%20maga/ECA%20study/GSF%20ECA%20RetroFit%20Presentation%20for%20GST2012.pdf>

HBL, svaveldirektivet antogs av EU parlamentet, 11.9.2012, accessed on 02.08.2014 from <http://hbl.fi/nyheter/2012-09-11/svaveldirektivet-antogs-av-eu-parlamentet>

HBL, Svavelosande debatt om svaveldirektiv, 18.10.2012, accessed on 02.08.2014 from <http://hbl.fi/nyheter/2011-10-18/svavelosande-debatt-om-svaveldirektiv>

HBL, Sämre flyt för finska rederier, Tomas Karls, 28.5.2008 07.55, updated 21.6.2011 17.22, accessed on 02.08.2014 from <http://hbl.fi/nyheter/2008-05-28/samre-flyt-finska-rederier>

HelsinginSanomat, Business community alarmed at costs of new sulphur limits on fuel for ships, 14.4.2009, accessed on 04.08.2014 from <http://www.hs.fi/english/article/Business+community+alarmed+at+costs+of+new+sulphur+limits+on+fuel+for+ships/1135245163938>

HelsinginSanomat, EU parliament passes new sulphur directive- despite protests by Finland, 12.9.2012, accessed on 04.08.2014 from <http://www.hs.fi/english/article/EU+Parliament+passes+new+sulphur+directive+-+despite+protests+by+Finland/1329104779154>

HelsinginSanomat, Export industries offered generous tax breaks, 20.8.2012, accessed on 04.08.2014 from <http://www.hs.fi/english/article/Export+industries+offered+generous+tax+breaks/1329104646300>

HelsinginSanomat, Finnish industry wants tax breaks to compensate for maritime sulphur directive, 13.8.2012, accessed on 04.08.2014 from <http://www.hs.fi/english/article/Finnish+industry+wants+tax+breaks+to+compensate+for+maritime+sulphur+directive/1329104610111>

HelsinginSanomat, Lowering Sulphur oxide limits could cost Finland more than a billion euros, 9.10.2008, accessed on 04.08.2014 from <http://www.hs.fi/english/article/Lowering+sulphur+oxide+limits+could+cost+Finland+more+than+a+billion+euros/1135240094913>

Letter to the stakeholders by the new President and CEO Emanuele Grimaldi  
Helsinki 8/11/2013, A new era is starting for Finnliness, 8.11.2013, accessed on 4.4.2015 from [http://www.finnlines.com/yritys/uutiset\\_ja\\_media/lehdistoetiedotteet/a\\_new\\_era\\_is\\_starting\\_for\\_finnlines](http://www.finnlines.com/yritys/uutiset_ja_media/lehdistoetiedotteet/a_new_era_is_starting_for_finnlines)

Lloydsloadinglist.com, Owners denied state aid for SOx compliance, Craig Eason, Friday 5<sup>th</sup> of April 2013, accessed on 04.08.2014 from <http://www.lloydsloadinglist.com/freight-directory/searcharticle.htm?articleID=20018036320&highlight=true&keywords=finland+sulphur&phrase=#.UWHtcKLwm8B>

Lloydsloadinglist.com, Welcome boost for Finnish exporters, Gerard O'Dwyer, Friday 7<sup>th</sup> of September 2012, accessed on 04.08.2014 from <http://www.lloydsloadinglist.com/freight-directory/searcharticle.htm?articleID=20017986173&highlight=true&keywords=finland+sulphur&phrase=#.UWHtcKLwm8B>

Lloydsloadinglist.com, Clean seas cost, Isabel Lesto, Thursday 11<sup>th</sup> of October 2012, accessed on 04.08.2014 from <http://www.lloydsloadinglist.com/freight-directory/searcharticle.htm?articleID=20017995924&highlight=true&keywords=finland+sulphur&phrase=#.UWHtc6Lwm8B>

Lloydsloadinglist.com, A bid to clean the air, Craig Eason, Friday 8<sup>th</sup> of February 2013, accessed on 04.08.2014 from <http://www.lloydsloadinglist.com/freight-directory/searcharticle.htm?articleID=20018023327&highlight=true&keywords=finland+sulphur&phrase=#.UWHtdKLwm8B>

Marine Fuels, accessed on 4.4.2015 from [http://dev.ulb.ac.be/ceese/ABC\\_Impacts/glossary/marinefuels.php](http://dev.ulb.ac.be/ceese/ABC_Impacts/glossary/marinefuels.php)

Metla, Finnish Forest Sector Economic Outlook 2014.2015, Executive summary accessed on 21.4.2015 from <http://www.metla.fi/julkaisut/isbn/978-951-40-2493-1/Outlook-Summary-14.pdf>

Midnordic green transport corridor, newsletter 4/10, The sulphur regulation on Baltic sea, Feb 2013, accessed on 22.07.2014 from [http://www.midnordictc.net/download/18.54a0ea8e13cdccff2542b7/MNGTC\\_Newsletter\\_5.pdf](http://www.midnordictc.net/download/18.54a0ea8e13cdccff2542b7/MNGTC_Newsletter_5.pdf)

Ministry of Employment and the Economy, Support program, 18.10.2013, accessed on 29.3.2015 from [https://www.tem.fi/en/energy/investment\\_support\\_for\\_lng\\_terminals/support\\_programme](https://www.tem.fi/en/energy/investment_support_for_lng_terminals/support_programme)

Ministry of Employment and the Economy, press releases: energy, The ministry of Employment and the Economy granted EUR 65,2 million in three new LNG terminals, 18.09.2014, 13:08, accessed on 29.3.2015 from [https://www.tem.fi/en/energy/press\\_releases\\_energy?89521\\_m=116057](https://www.tem.fi/en/energy/press_releases_energy?89521_m=116057)

Ministry of Employment and the Economy, press release: energy, Hamina energy receives nearly 28 million euros for construction of LNG terminal, 10.12.2014 12:00, accessed on 29.3.2015 from [https://www.tem.fi/en/energy/press\\_releases\\_energy?89521\\_m=116897](https://www.tem.fi/en/energy/press_releases_energy?89521_m=116897)

Ministry of Transport and Communications, Press release: Svaveldirektivet trader I kraft I början av 2015, 12.06.2014 13:25, accessed on 7.9.2015 from <http://www.lvm.fi/pressmeddelande/4411699/svaveldirektivet-trader-i-kraft-i-borjan-av-2015>

Ministry of transport and communications, publication 31/2009, Sulphur content in ships bunker fuel in 2015, a study on the impacts of the new IMO regulations on transport costs, accessed on 31.5.2015 from [http://www.lvm.fi/docs/en/339549\\_DLFE-8042.pdf](http://www.lvm.fi/docs/en/339549_DLFE-8042.pdf)

Port of Hanko, image, accessed on 4.8.2014 from [http://www.portofhanko.fi/img/euroopankartta\\_iso.jpg](http://www.portofhanko.fi/img/euroopankartta_iso.jpg)

Navigator Internation, Finnlines awarded EU funding for environmental upgrading and sustaining the competitiveness for three of its major liner services, 28.07.2015, accessed on 25.09.2015 from <http://navigatormagazine.fi/finnlines-awarded-eu-funding-for-environmental-upgrading-and-sustaining-the-competitiveness-for-three-of-its-major-liner-services/>

RZDpartner.com, Finland to confront the sulphur directive, 05.09.2012, accessed on 15.07.2014 from <http://www.rzd-partner.com/news/different/380778/>

ShippingWatch, Jorgen Rudbeck, Drones as new weapon against emission violators, 21.2.2014 11:49, accessed on 4.4.2015 from <http://shippingwatch.com/carriers/article6505859.ece>

StenaLineFreight, Bunker surcharge / low sulphur, Adjustment rules 2015 seca area, accessed on 4.4.2015 from <http://www.stenalinefreight.com/bunker-charge>

Trafi, Ships to be monitored for sulphur emissions as of January, 16.12.2014 4:00 pm accessed on 5.4.2015 from [http://www.trafi.fi/en/about\\_trafi/news/3089/ships\\_to\\_be\\_monitored\\_for\\_sulphur\\_emissions\\_as\\_of\\_january](http://www.trafi.fi/en/about_trafi/news/3089/ships_to_be_monitored_for_sulphur_emissions_as_of_january)

Transfennica LTD, Bunkers, Bunker fuel surcharge effective from 1.1.2015 accessed on 4.4.2015 from <http://www.transfennica.com/Index.aspx?pgId=112348>

Transfennica, bunkers, bunker fuel surcharge from 1.1.2015 accessed on 21.4.2015 from <http://www.transfennica.com/Index.aspx?pgId=11234>

Transfennica, Transfennica right on track to meet future environmental regulations accessed on 21.4.2015 from <http://www.transfennica.com/Index.aspx?objectName=NewsShow&objectId=112054>

transportenvironment.org, Air pollution from ships, 2011, accessed on 04.09.2014 from <http://www.transportenvironment.org/what-we-do/shipping/air-pollution-ships>

TTJ, Sulphur directive approval to cost Finnish forestry sector €200m, 28<sup>th</sup> May 2012, accessed on 04.08.2014 from <http://www.ttjonline.com/news/sulphur-directive-approval-to-cost-finnish-forestry-sector-200m-290512>

UK chamber of shipping final report, Impact on jobs and the economy of meeting requirement of MARPOL Annex VI, March 2013, accessed on 04.08.2014 from [http://www.ukchamberofshipping.com/media/filer/2013/03/08/amec\\_uk\\_chamber\\_of\\_shipping\\_report\\_on\\_impact\\_of\\_2015\\_sulphur\\_targets.pdf](http://www.ukchamberofshipping.com/media/filer/2013/03/08/amec_uk_chamber_of_shipping_report_on_impact_of_2015_sulphur_targets.pdf)

Västra Nyland, Svavelfattigt I finländsk fartygstank, 2.1.2015 13:52 updated on 2.1.2015 14:38 accessed on 5.4.2015 from <http://vastranyland.fi/nyheter/2015-01-02/701896/finlandska-fartyg-anvander-dyrare-bransle>

Västra Nyland.fi, Dyrare fartygsbränsle kan gagna Hangö, 6.9.2012, accessed on 02.08.2014 from <http://vastranyland.fi/nyheter/2012-09-06/dyrare-fartygsbransle-kan-gagna-hango>

Västra Nyland.fi, Yrvaken svavellobbning, John-Erik Jansen, 13.9.2012, accessed on 02.08.2014 from <http://vastranyland.fi/opinion/ledare/2012-09-13/yrvaken-svavellobbning>



Woodland Goup, image, accessed on 4.8.2014 from [http://anchortime.com/portal/images/stories/SECA\\_areas.jpg](http://anchortime.com/portal/images/stories/SECA_areas.jpg)

World maritime news, Nabu: Scrubbers must be rejected, 13.3.2015, accessed on 18.4.2015 from <http://worldmaritimeneeds.com/archives/154724/nabu-scrubbers-must-be-rejected/>

Wärtsilä, Scrubbers suited to newbuild and retrofit market, Anna-Leena Pohjanpalo, 7 May 2012, accessed on 26.07.2014 from <http://www.wartsila.com/en/scrubbers-suited-to-newbuild-and-retrofit-market>

Wärtsilä, Realising the competitive potential of sulphur ECA compliance, Mirja-Maija Santala, August 2012, accessed on 02.08.2014 from <http://www.wartsila.com/en/media/Articles/realising-the-competitive-potential-of-sulphur-ECA-compliance>

Wärtsilä, Wärtsilä closed loop scrubber, accessed on 02.08.2014 from <http://www.wartsila.com/en/emissions-reduction/exhaust-gas-technology-hamworthy/scrubber>

Wärtsilä corporation, Q1 interim report, January-March 2015 accessed on 26.4.2015 from <http://wartsila-reports.studio.crasman.fi/file/dl/i/VhoeUg/mZqgh3FFLVBZx8HI4Ph6DA/InterimreportQ12015.pdf>

YleUutiset, EU parliament approves sulphur directive, 11.9.2012 14.57, updated 12.9.2012 6.26, accessed on 26.07.2014 from [http://yle.fi/uutiset/eu\\_parliament\\_approves\\_sulphur\\_directive/6290175](http://yle.fi/uutiset/eu_parliament_approves_sulphur_directive/6290175)

YleUutiset, Forest industry: More shutdowns in Finland if sulphur directive remains unchanged, 9.9.2012 18.54, updated 11.9.2012 14.54, accessed on 26.07.2014 from [http://yle.fi/uutiset/forest\\_industry\\_more\\_shutdowns\\_in\\_finland\\_if\\_sulphur\\_directive\\_remains\\_unchanged/6287841](http://yle.fi/uutiset/forest_industry_more_shutdowns_in_finland_if_sulphur_directive_remains_unchanged/6287841)

## **APPENDIX 1.**

Email with Julius von Hertzen at Finnshipping 30.9.2014

Hej,

Vi hjälper gärna till.

Denna lagstiftning har väckt mycket diskussioner och frågor varav många fortfarande obesvarade.

1. Will the legislation bring upon any extra direct or indirect costs to Finnshippings business? If yes, is there any compensation for it? and are there any other consequences from it? (layoffsetc)

Answer: The legislation will not bring upon any extra costs or other consequences to Finnshipping as we are brokers and do not own any ships, but for shipowners it will if they decide to renew their ships according to the legislation.

2. Does Finnshipping expect the traffic to differ once the legislation is in place? If yes then do you believe it has to do with the rising costs of shipping due to the legislation?

Answer: Shipowners that decided not to upgrade their ships according to the legislation will reposition their ships outside the SECA area which will ofcourse effect on availability of ships. Vessels age will most likely make a difference if it will make any sense to upgrade it according to the legislation, in other words will younger ships stay in the SECA area and older trade outside it.

3. Has the legislation already affected Finnshipping? If yes then how?

Answer: No it hasn't

4. Do you expect any potential costs/changes to affect Finnshippingsbusiness as a whole in any way?

Answer: No.

5. What procedures has Finnshipping taken to prepare for the legislation coming into place?

Answer: We are trying our best to get the feeling of how it will develop and how owners will react to it and what solutions they see.

F.ex. if owners decide to upgrade their vessel according to the legislation we see 5 solutions of how to do it

1. New lowsulphur fuels → Price will rise compared to normal fuels → Freight will change together with bunkerclause
2. Skrubbers → Big investment on vessels technics. Technical uncertainty → customer-specific agreement through bunkerclause
3. New vessels and engines → Longterm solution
4. Other technical engine solutions → faster investments
5. LNG, dual fuel engines → Longterm solution

Hoppas dessa svar hjälper dig någolunda

mvh

Julius von Herten

## APPENDIX 2.

Email with Andreas Slotte at Helsinki port 22.10.2014

Hej igen,

Här är några svar. Allt är ännu ganska öppet men det här är det bästa jag kan producera för tillfället. Jag svarar gärna på ytterligare frågor senare, om det behövs.

1. Har alla hamn i Finland ha scrubberwastewater alternatives?

- Svaret beror på hur fartygets system ser ut. Oftast går det smutsiga vattnet från scrubbers när i någon tank, som sedan måste tömmas i hamnen. Då är alternativen att antingen pumpa det i en tankbil på kajen, eller i någon form av avloppssystem på kajen. Tankbil kan man ju ta till vilken hamn som helst. Ett avloppssystem är förstås en mer komplicerad infralösning. Observera dock att vattnet som produceras för tillfället är alldeles för smutsigt för att kunna släppa ut i det "vanliga" kommunala avloppssystemet. Därför är tankbilar enda alternativet för tillfället. I framtiden kunde man ju dock, åtminstone i teorin, bygga specialavloppsledningar i hamnarna som leder direkt till reningsverk. Det skulle dock vara väldigt dyrt och jag tror inte att det någonsin blir aktuellt på riktigt.

2. Har ni olika sätt att sköta om vattnet?

Samma svar som ovan; i teorin ja, i praktiken nej

3. Är det hamnen som står för förberedelse kostnaderna för det här eller någon företag?

Så länge trafiken sköts med tankbilar så uppstår det inte kostnader för hamnen. Nog för rederiet.

4. Får hamnen någon kompensation för eventuella kostnader? (t ex skatte avdrag, bidrag etc)

N/A, se föregående fråga

5. Behövs det extra arbetskraft för att sköta om vattnet? och är det någon på båtarna som ska föra bort det eller hamnen?

Tankbilstrafiken sköts av tankbilsföretag. Rederiet betalar de extra kostnader som uppstår. Sedan skall dessutom avfallet renas och förstöras (av t.ex. Ekokem Oy i Riihimäki), vilket också är dyrt. Även de kostnaderna står rederiet för.

Hoppas det här var till någon hjälp!

Hälsningar,

Andreas

### **APPENDIX 3.**

Email with Eve Tuomola at Helsinki port 6.10.2014

Will the legislation bring upon any extra costs to Helsinki ports business? If yes, is there any compensation for it? and are there any other consequences from it? (layoffsetc)

No, it doesn't.

2. Does Helsinki port expect the traffic to differ once the legislation is in place? If yes then do you believe it has to do with the rising costs of shipping due to the legislation?

Yes, the bunker prices get higher, shipping companies have to invest in scrubbers or other systems in order to reduce costs

3. Has the legislation already affected Helsinki port? If yes then how?

No, it hasn't

4. Do you expect any potential costs/changes to affect Helsinki ports business as a whole in any way?

No mentionable

5. What procedures has Helsinki port taken to prepare for the legislation coming into place?

We follow the progress, the port has no direct affect. We expect that a part of seagoing transports will choose the land transport through the Baltic countries.

Kind regards,

Eve Tuomola

## **APPENDIX 4.**

Email with JukkaHolsa at UPM 30.9.2014

Hello

I am a third year student at Arcada university of applied sciences in Helsinki and i am currently working on my thesis which is about the EU legislation coming into place in 2015 concerning the new limits of sulphur emissions in shipping in the baltic sea and how that affects the Finnish economy. As a major sea traffic service provider in Finland it would be of great help to me if i could get some information regarding the role of UPM in this topic. I would be very grateful if you could spend a couple of minutes to answer the following questions

1. Will the legislation bring upon any extra costs to UPM seaways business? If yes, is there any compensation for it? and are there any other consequences from it? (layoffs etc)
2. Does UPM seaways expect the traffic to differ once the legislation is in place? If yes then do you believe it has to do with the rising costs of shipping due to the legislation?
3. Has the legislation already affected UPM seaways? If yes then how?
4. Do you expect any potential costs/changes to affect UPM's business as a a whole in any way?
5. What procedures has UPM seaways taken to prepare for the legislation coming into place?

Hello Tomas,

UPM started preparations for the forthcoming sulphur regulation already 2011-2012. End result of the implemented actions was a significant change in UPM's European short sea shipping network and related contractual structure and commitments. Due to the sensitive nature and confidentiality of the made agreements UPM can't disclose any information, nor financial implications of the made arrangements.

Unfortunately UPM is not able to contribute more to your thesis but I wish you all the best in your work in this very challenging issue.

Best regards,

Jukka

## **APPENDIX 5.**

Email with Timo Sjösten at Hanko port 29.09.2014

Hello

I am a third year student at Arcada university of applied sciences in Helsinki and i am currently working on my thesis which is about the EU legislation coming into place in 2015 concerning the new limits of sulphur emissions in shipping in the baltic sea and how that affects the Finnish economy. As a major sea traffic service provider in Finland it would be of great help to me if i could get some information regarding the role of UPM in this topic. I would be very grateful if you could spend a couple of minutes to answer the following questions

1. Will the legislation bring upon any extra costs to Hanko port business? If yes, is there any compensation for it? and are there any other consequences from it? (layoffs etc)
2. Does Hanko port expect the traffic to differ once the legislation is in place? If yes then do you believe it has to do with the rising costs of shipping due to the legislation?
3. Has the legislation already affected Hanko port? If yes then how?
4. Do you expect any potential costs/changes to affect Hanko port 's business as a whole in any way?
5. What procedures has Hanko port taken to prepare for the legislation coming into place?

Gd day,

Below some answers which we hope helps you in your thesis work:

1. Depending on owners and their future desisions some additional costs for scrubber waste water handling might arise. Adjustments in port waste fees might be needed to compensate the additional costs.
2. We believe the traffic will increase and this partly due to the rising sea tranport costs.
3. Yes. In increased interest of shipping via Hanko.
4. We hope increased volumes can help the unemployment situation in this area.
5. Mappedscrubberwastewaterhandlingalternatives.

Kind regards,

Appendix 6

Email with Timo Sjösten at Hanko port 01.07.2015



Hello

I contacted you back in October regarding the sulphur directive and Hanko port and now that it has come into force i would be grateful if you could take some time to answer a couple of follow up questions based on the answers i got back then mainly explaining that the legislation looked positive for Hanko in terms of more traffic. The questions are basically the same but i am trying to determine whether the expectations were met.

1. Have there been any costs for the port from the directive?
2. Has the traffic increased or decreased since 1.1.2015? and is that because of the directive?
3. Has Hanko as a city benefitted in any way? (eg. more jobs, more traffic -> more customers, etc)
4. Are there any plans on building any LNG terminal or filling station in Hanko in the future?

Thank you once again for you time and help

Regards

Tomas Alfthan

Hello Tomas,

Below some short answers to your questions:

1. So far no additional costs due to the directive
2. Traffic has increased since 1.1.2015 and partly it is due to the directive.
3. More traffic gives more job opportunities, so Hanko as a city benefits also from the increased traffic.
4. Hanko would be a good location for an LNG terminal. Future will show if there will be one or not.

brgds,