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The European Union Emission Trading System and its financial impact on deep-sea chemical tanker shipping companies' investments in environmentally friendly technologies

Bachelor's thesis in Shipping Management

Supervisor: Jan Emblemsvåg

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Science and Technology

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Abstract

Shipping is responsible for around three percent of the global emissions, and if new implementations and regulations are not implemented, this number is predicted to rise. As a result, the world is changing and new regulations are coming, both on a global and regional level. Among others these new laws include the IMO Carbon Intensity Indicator which came into effect in 2023, FuelEU Maritime from 2025, and the EU Emission Trading System commencing on the 1st of January 2024.

This thesis will focus on “*the European Union Emission Trading System and its financial impact on deep-sea chemical tanker shipping companies’ investments in environmentally friendly technologies*”. While writing this thesis I have had my internship at Odfjell SE, a deep-sea chemical tanker company which will be used as an example of the segment. To assess the financial impact of the EU ETS an explanation of the legislation is necessary, as well as a look at the new ship installations Odfjell are implementing.

As there is limited research done on the topic previously, I have conducted multiple interviews with employees at Odfjell to gain insight into how they prepare for the new legislative, in addition to its impact on new investments in environmentally friendly technologies across the fleet.

Based on the qualitative research conducted, it became clear that the EU ETS will have an impact on how deep-sea chemical tanker shipping companies will invest in environmentally friendly technologies on their vessels. However, both CII and FuelEU Maritime were deemed more crucial as they would directly impact the shipping company. While the EU ETS will create a cost for carbon the goal for the shipping companies is to transfer this cost to the customer. By polluting less than the competition a shipping company will become more attractive to the customer, as the carbon tax will be smaller. If a company is non-compliant with both CII and FuelEU Maritime, penalties will be imposed, which means increased costs for the shipping company itself.

Preface

During the fifth semester at Shipping Management the students are met with the possibility of writing their bachelor thesis while they have an internship at a relevant company. This has given me much insight in how shipping works and what it is like to work for a company within the branch of trade. During the previous semesters I have had a lot of broad, but interesting subject that have given me a wide and insightful view on the maritime industry. Through the internship this view has been narrowed down and I have learned more about how the industry functions in practice. I have learned a lot over the last months and would like to thank Odfjell for giving me the opportunity to be an intern at their company.

While the writing process has been demanding and I have experienced both ups and downs, I am left with much valuable knowledge that I aim to bring with me during the last semester, as well as for future jobs.

This thesis has been written while working at Odfjell, and I would like to thank all the employees for a warm welcome and making me feel like part of the workplace. During the internship I have had the possibility of working with employees in different branches of the Company. This has given me valuable information on the opportunities my education will open for future employment. I must also thank all the interview candidates that took time out of their day to answer my questions. As there are few studies done on the subject previously, these interviews were very valuable, and I would not have been able to write this thesis without them. I must also thank Jan Emblemståg my supervisor from NTNU for his good guidance and for following up on me.

Lastly, I would like to thank my friends, family and fellow students for their support and encouragement throughout these months.

Key words

EU ETS	European Union Emission Trading System
MRV	Monitoring, Reporting and Verification
MSR	Market Stability Reserve
DWT	Deadweight Tonnage
GHG	Greenhouse Gas
IMO	International Maritime Organization
CII	Carbon Intensity Indicator
FEUM	FuelEU Maritime
EEXI	Energy Efficiency Existing Ship Index
DNV	Det Norske Veritas

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1.0 Introduction

Climate change has been a hot topic over the last decade and for the maritime industry things are no different. Shipping relies on fossil fuel as their main source of energy, and as a result pollution is on a rise. This has led to numerous new regulations and initiatives to reduce the emissions from the shipping industry. In 2023 the International Maritime Organizations (IMO) Carbon Intensity Indicator came into effect. Here the vessels are given a grade from A to E based on their emissions, and penalties follow as a result of not complying. While the CII is applicable to vessels all over the world, there are also regional legislations being implemented. For the EU/EEA both the European Union Emission Trading System (EU ETS) and FuelEU Maritime are hot topics as they will become operational within the next years. The FuelEU Maritime will set a limit for the amount of GHG gasses a vessel can emit, and again penalties will be imposed if the GHG gasses exceed the limit (Cullinane, 2023).

1.1 Issue for this thesis

While the CII and FuelEU Maritime are just some of the regulations that will affect shipping over the next year, this thesis will focus on *“the European Union Emission Trading System and its financial impact on deep-sea chemical tanker shipping companies’ investments in environmentally friendly technologies”*.

1.2 The purpose of the thesis

During my internship at Odfjell I was quickly introduced to the EU ETS and its affects. As the year progressed, I attended multiple conferences and seminars, and the new regulation was always a topic. The purpose of this thesis is therefore to take a closer look at what the EU ETS is, how it will affect the deep-sea chemical tanker market, by using Odfjell as an example, and lastly assess the financial impact of the legislation in accordance with the installation of new energy saving devices to the vessels.

1.3 Limitations

As shipping will be implemented in the EU ETS from the 1st of January 2024, obtaining an insight on how different companies aim to handle the regulation will be difficult. This comes as a result of many companies not being entirely sure on what the new regulation is or how to tackle it. As my internship is at Odfjell SE I have decided to focus on the EU ETS and the deep-sea chemical tanker segment as that is the segment they operate in.

When it comes to different environmentally friendly technologies Odfjell has already implemented a lot on their fleet. As a result of this I have decided to look more into the new installations that are currently being implemented or are planned to be in the near future. It is however important to note that there are dozens of other alternatives and options available, but as there is limited time to write the assignment while working 50%, this has been deemed optimal.

It is important to note that the money gathered from the EU ETS will be distributed among the participating countries and for the most part reinvested in green technologies and a green future. This is something that could impact the future outlook for investment for the deep-sea chemical tanker market, however my goal is to assess the direct impact the allowances and the EU ETS will have. Therefore, this is something that will not be taken into account during this thesis.

1.4 Outline for the assignment

The first part of the assignment is a brief explanation of Odfjell as well as the deep-sea chemical tanker market. Furthermore, an overview of the EU ETS and its history will be presented before the regulation in regard to shipping is assessed. I will then focus on the new types of ship installations Odfjell are implementing and how they work.

In the second part of the thesis, I will assess for the methodology used. Here the different research methods will be explained and my reasoning for choice of research method presented. The third part of the assignment is the analysis. Here the different findings made during the research period will be presented. The final part of the assignment is the discussion part where previous research and my finds will be used to look at the issue for the thesis, before a conclusion is made.

2.0 Theory

Odfjell SE is the parent company of the Odfjell Group, with subdivisions such as Odfjell Terminals and Odfjell Tankers. To narrow it down, this thesis will focus on Odfjell Tankers as this is where the EU ETS and other regulations will apply. Odfjell serves more than 600 customers and specializes in shipping chemicals and liquids. Odfjell is a major deep-sea chemical tanker shipping company, with a fleet consisting of 70 chemical tankers, all above 5000 DWT (Odfjell, 2023). This implies that the entire fleet will be affected by the regulations in the EU ETS commencing on the 1st of January 2024. Odfjell has a goal of obtaining a climate-neutral fleet by 2050, and a reduction in carbon intensity within 2030. Recently they reported that they have already acquired a 51% improved carbon intensity, meaning the 2030 goal has already been reached (Odfjell, 2023). This makes them an interesting candidate for the issue in this thesis, as they are ahead of the competition and constantly looking for new energy-saving technologies.

2.1 The deep-sea chemical tanker market

Chemical tankers are used when transporting chemicals in bulk. These vessels have to follow highly complex safety instructions, as well as special training for the crew as they are involved in the entire process. There are different types of tankers based on the vessels ability to transport different types of chemicals and the ships size. This assignment will focus on the deep-sea chemical tanker market. These vessels are between 10 000 and 50 000 DWT and are used to transport goods all over the world (Allied Market Research, 2023).

2.2 EU ETS

Shipping is one of the most energy-efficient modes of transportation, however, nearly three percent of the worlds emissions in 2018 came as a result of the 1 076 million tons of CO₂ emitted from the industry. In Europe shipping is responsible for three to four percent of the total emissions, and while this may not sound like a lot it is equivalent to over 124 million tons of CO₂ in 2021. The global emissions from the shipping sector are predicted to increase by 130% compared to 2008 levels by 2050, if necessary implementations are not made (European Commission, 2023).

First established in 2005, the EU Emission Trading System (EU ETS) is the world's first international emission trading system. This is a cap-and-trade system that focuses on reducing greenhouse gas (GHG) emissions, by implementing a cap for the amount of emissions different energy-intensive sectors are allowed to emit. Each ton of CO₂ is equivalent to an allowance, that can be bought through auctions, traded and some are handed out for free. These auctions are held several times a year by the European Energy Exchange (EEX) and companies are required to register with the European Commission to participate. Furthermore, these allowances are also traded on the secondary market by brokers or on online trading platforms. Here the price of an EU Allowance (EUA) fluctuates based on supply and demand. It is also possible for companies to bank EUAs if they expect high emissions in the future and want to ensure they have a sufficient amount available (DNV, 2023).

The EU ETS consist of four different phases, and the current phase, phase four, is about to commence on January 1st, 2024. This is the phase that introduces shipping to carbon fees, and the one this thesis will focus on. However, there are three previous phases, and the first was launched in 2005 and lasted until 2007. This functioned as a 3-year learning phase in order to prepare for the second phase. Energy-intensive industries and power generators became obligated to pay for their carbon emissions. While almost all the allowances were given to business for free, there was established a 40-euro fine if the companies did not comply with the regulations. Through the first phase a price for carbon was established, however as the supply of allowances exceeded demand, and the price of the allowances fell to zero. This meant that the allowances could not be used in phase two (European Commission, 2023).

The second phase started in 2008 and lasted until 2012. The cap for allowances was reduced as a result of the surplus of allowances that were acquired in phase one. Furthermore, the penalty for not complying with the rules was increased from 40 euros to 100. More countries joined the EU ETS and some even held auctions to buy allowances. As a result of the financial crisis in 2008 the reduction in emissions was greater than previously expected, which impacted the prices for allowances negatively throughout the period (European Commission, 2023).

Phase three lasted from 2013 to 2020 and changed the system drastically, compared to the previous phases. Instead of national caps on allowances, an EU-wide cap was introduced. Instead of the free allocation of allowances, auctions became the standard way of allocating new allowances. In 2005 there was a total of 321 million allowances in total, whereas in 2011, 70 million allowances were traded every day (European Commission, 2023). In 2014 Miljødirektoratet conducted a study to figure out how companies located in Norway who were subjected to the EU ETS believed the regulation to be an incentive to invest in low emission technologies. The conclusion of the study was that the cost of emissions is predicted to rise in the future, due to multiple circumstances including the EU ETS, however the price of allowances could not be considered the main reason for new investments (Holm, 2014).

The current phase, phase four started in 2021 and will last until 2030. The focus has now shifted to the European Commission and how to reach zero emissions by 2050, as well as a 55% net reduction in greenhouse gas emissions by 2030. To be able to achieve the climate goals for 2030, the sectors covered by EU ETS will have to reduce their emissions by 43% compared to the levels measured in 2005. The amount of annual allowances used to decline at a rate of 1,74%, however, to reach the 2030 goal the decline was increased to 2,2% from 2021 (International Carbon Action Partnership, 2022).

After the big shift in price per allowance displayed during the financial crisis in 2009, which led to a surplus of allowances on the supply side, the need for something to regulate the market and prices was deemed necessary. As a result of this the Market Stability Reserve (MSR) was established in 2015. The MSR was established to enhance the long-term predictability, as well as the regulatory stability for the allowances, without any interference from the Commission or Member States, and became operational in 2019. When there is a large surplus of allowances in the market, they are put into the MSR to make sure the price per allowance does not plummet, and when the demand for allowances rise, the MSR release allowances back into the market. By doing this the price per allowance becomes more stable and predictable (European Commission, 2023).

Over the last four years the amount of allowances stored in this reserve has doubled, from 12% to 24%, however, the feeding rate at 12% will be reestablished in 2024. A feeding rate of 12% means that 12% of the total amount of allowances can be stored in the MSR and released into the market when necessary. Furthermore, the number of allowances in the reserve cannot surpass the number of allowances auctioned the previous year. If the amount is to exceed this, the allowances will lose their validity (European Commission, 2023).

During the first phase the companies that were affected by EU ETS received the allowances for free, in phase four on the other hand, the free allowances will primarily be distributed to sectors that are at a high risk of moving their operation outside of the EU. This is referred to as carbon leakage and occurs when a company decides to transfer their production, or operation outside of the EU as a result of costs related to climate policies. The operation is then moved to a country with fewer or no emissions constraints, which ultimately increases their emissions (European Commission, 2023). For the sectors that are considered less exposed, the free allowances will be phased out from about 30% in 2026, to zero in 2030 (European Commission, 2023).

The EU ETS will from 2024 be applicable to ships above 5000 Gross Tonnage (GT) that are transporting cargo or passengers for commercial purposes. Odfjell's fleet consists of 70 chemical tankers, either: owned, hired on a time charter, bareboat charter or through a pool. These ships are all above 5000 GT, which means that they will be applicable to the EU ETS regulations and will have to acquire allowances when transporting to, from or through Europe. From 2024 the ships will have to acquire allowances for their CO₂ emissions; however, they still need to report on the methane (CH₄) and nitrous oxide (N₂O) emissions to the EU MRV.

The Monitoring, Reporting and Verification (MRV) was established for the EU in 2017 and is considered the first step to analyze and collect data on shipping emissions. So far, the EU MRV is only applicable to ships above 5000 GT on voyages related to the EU. Furthermore, a monitoring plan is required to be submitted after a vessel has called at a port within the EU. The respective plan is to include a description of the vessel, the fuel used on the charter, monitoring methods and other relevant information (DNV, 2023).

This monitoring plan will give the shipping companies an idea of how many allowances they will need to acquire to cover their emissions. Additionally, to ensure a smooth implementation of shipping in the EU ETS, there will be a 3-year implementation phase. This implies that shipping companies will only have to surrender allowances equivalent to 40% of their emissions in 2024, and 70% of their emissions in 2025. From 2026 and onwards 100% of the emissions will be applicable, and an accurate MRV will be even more significant to surrender the correct number of allowances (European Commission, 2023).

During a voyage within the EU/EEA 100% of the emissions are applicable to the EU ETS, as well as 50% of the emissions that occur during a voyage into or out of the EU/EEA (DNV, 2023). For deep-sea chemical tankers this will add a substantial cost, as the majority of the tankers are transporting multiple products to different ports. If a customer wants to transport something from India to USA, but the ship will sail through Europe for other deliveries, they will have to pay for 50% of the emissions during the voyage to/out of Europe, as well as 100% of the emissions within the EU. This means that transporting goods by sea will become substantially more expensive.

2.2.1 EU ETS expenses

Even though the EU ETS expenses are not integrated yet, it is already possible to make assumptions regarding the amount of allowances needed, as well as the price a company will have to pay for their emissions. By studying numbers from Thetis, the official EU MRV reporting system for CO₂ emissions from ships, it becomes possible to see each ships emissions on EU related voyages. In 2022 Odfjell had 39 vessels that operated in EU/EEA and reported to Thetis. Based on the reported emissions from 20 of these vessels one is able to make assumptions and showcase the effect EU ETS will have on shipping.

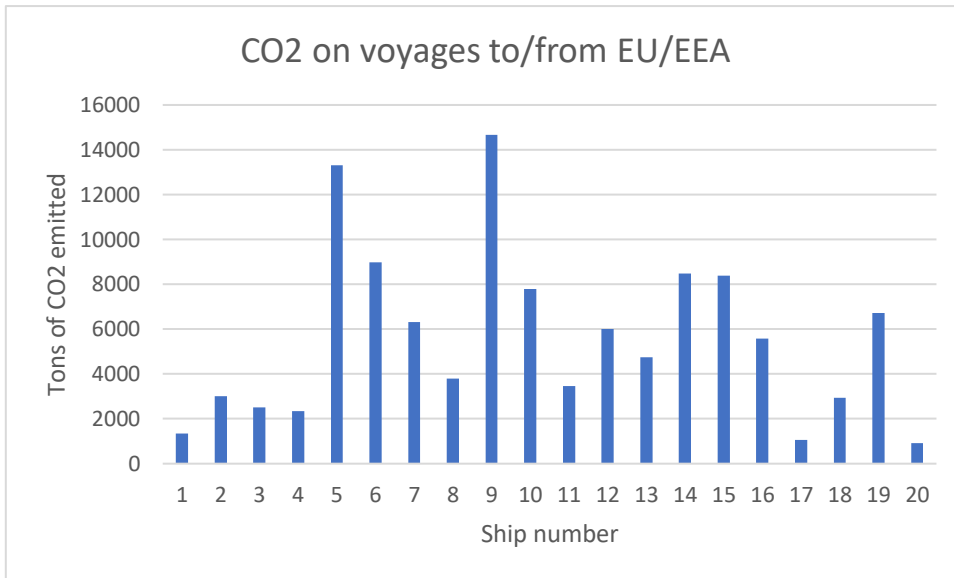


Figure 1: CO2 on voyages to/from EU/EEA (Authors calculation based on numbers from (EMSA, 2023))

The graph above shows the amount of CO2 emitted annually by Odfjell-vessels on voyages to/from EU/EEA ports. As previously explained, the company will have to present allowances equivalent to 50% of the emissions produced on these types of voyages. By adding all the tons of CO2 emitted and dividing it by the number of ships, we find that the average amount of CO2 produced annually as a result of voyages to/from the EU is 5616 tons. The price for allowances fluctuates, however a price of 100 euros per allowance is not unheard of. This means that Odfjell will have to pay $5616/2 * 100 = 280\ 800$ euros per vessel, and this is only for the voyages to and from Europe.

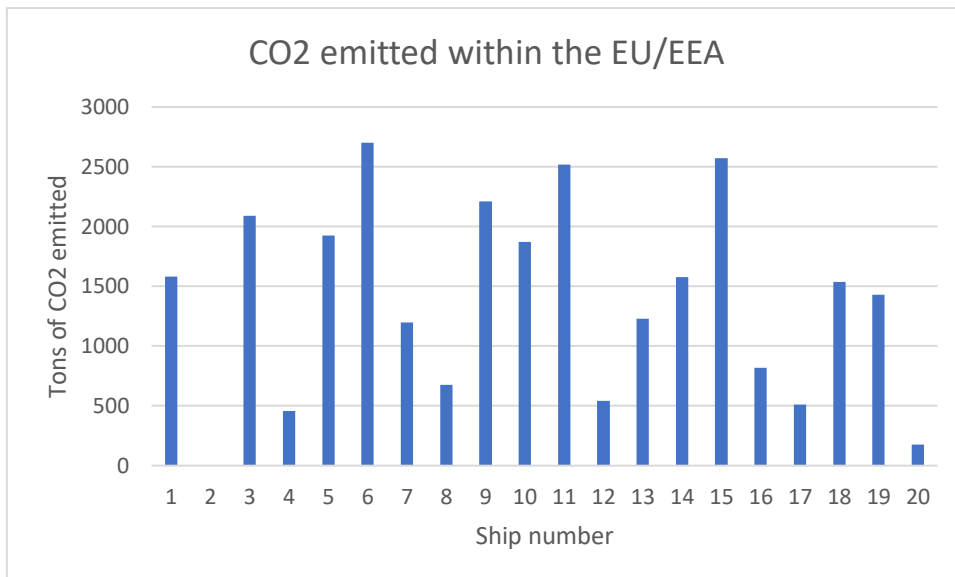


Figure 2: CO2 emitted within the EU/EEA (Authors calculation based on number from (EMSA, 2023))

Similar to the previous graph, the one above is also based on Thetis and the same vessels. However, here the tons of CO2 emitted are within the EU/EEA. This implies that they will be required to submit allowances equivalent to 100% of the emissions. The average amount of CO2 emitted on these types of voyages is 1381 tons. By again assuming that the price per allowance is 100 euros, Odfjell would have to pay $1381 \times 100 = 138\,100$ euros per vessel. This means that the cost per ship will increase by approximately 418 900 euros annually. These numbers are just estimates, and the shipowner will most definitely try to transfer this expense to the cargo owners, however it still gives an estimate of the costs the EU ETS will bring to shipping.

2.3 Energy-saving devices:

Odfjell has installed more than 130 energy-saving devices on their vessels since 2014. Many of these devices can be referred to as “low hanging fruits”, as they are quite easy to install and give quick results. Now this toolbox is starting to run empty, and they have to look at more advanced, newer technologies to obtain an effect. As this assignment will focus on how the EU ETS will affect how investments in environmentally friendly technology are made, I have deemed it more relevant to look at these newer installations. Therefore, the eSAIL technology from bound4blue and the OceanGlide technology from Alfa Laval will be the installations I use as a basis.

2.3.1 eSAIL



Figure 3: Odfjell vessel equipped with eSAIL (Odfjell, 2023)

The picture above shows one of Odfjell's vessels equipped with the eSAIL technology. Odfjell recently partnered with bound4blue to install their eSAIL system on a chemical tanker, making it the first tanker in the world to take advantage of this new technology. While the traditional vessel relies on their engine for propulsion, this eSAIL takes advantage of its WAPS, or Wind-Assisted Propulsion System to harness the wind to generate a forward thrust. The eSAIL can produce up to seven times more lift than a normal sail is able to, while only obtaining the space of a single sail. While Odfjell's tankers require a highly experienced and trained crew, the eSAILS are operated via an autonomous control system. The system gathers information from multiple sensors, and then controls the different parts of the sail to ensure optimal fuel savings. When the effect of the eSAIL is harnessed correctly, a reduction in fuel can reach double digits, ultimately reducing emissions produced on a voyage (bound4blue, 2023). The installation of the eSAILS on the Odfjell vessel will be completed in 2024.

2.3.2 OceanGlide

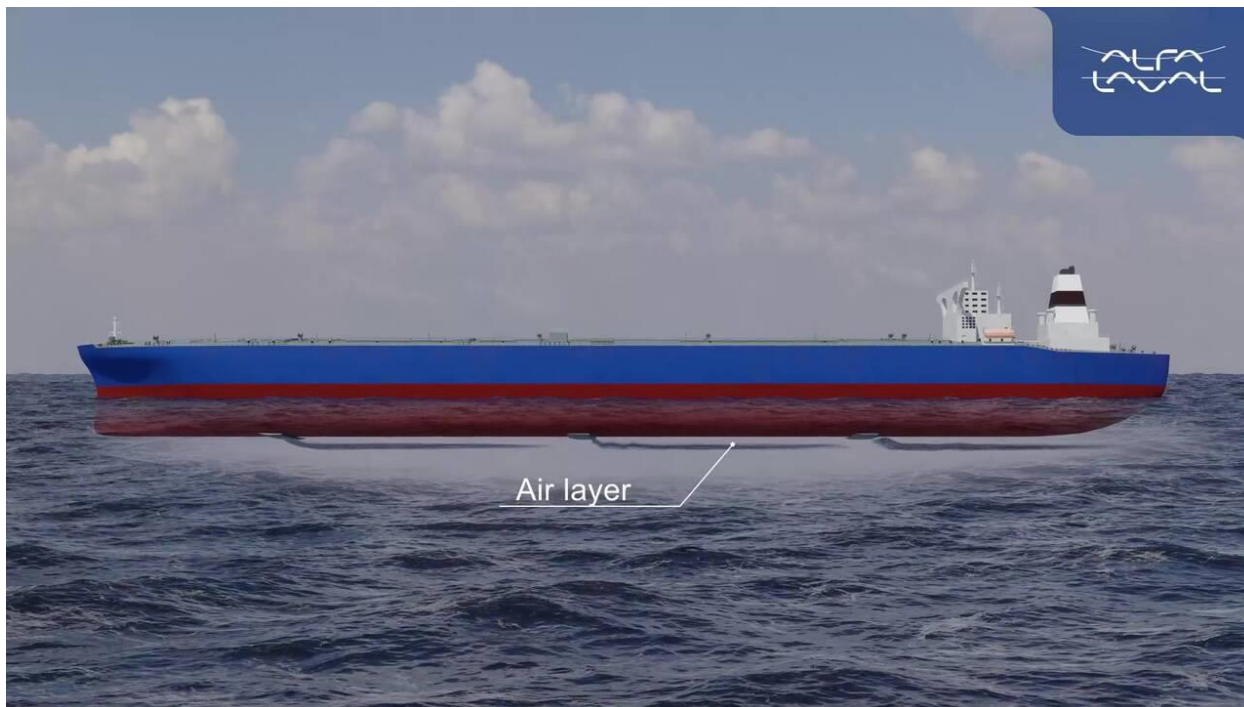


Figure 4: Vessel equipped with OceanGlide (Alfa Laval, 2023)

The picture above demonstrates how the OceanGlide technology will function. Odfjell has installed the “OceanGlide” fluidic air lubrication system provided by Alfa Laval on one of their vessels. The idea is to use fluidic oscillators to create a layer of micro air bubbles spread across the flat bottom of the vessel, which then reduces the friction and drag. This ultimately reduces the fuel consumption, as the vessel will break the water with more ease, leading to a decrease in emissions from the voyage. Furthermore, the system is easy to install and designed without any moving parts which makes it possible to attach to the bottom of the vessel at any shipyard, without complications. Previous trials show that the CO₂ emissions can be reduced by up to 12% from the new technology (Alfa Laval, 2023).

3.0 Methodology

There are two main types of methodologies, quantitative and qualitative. When preparing a survey, it is important to figure out the purpose of the survey and choose research method accordingly. If the data is quantitative, it is countable, in the sense that one would be able to see how many answered the different options. This is referred to as hard data, and an example could be the question “how many times a week do you work out?”, followed by different suggestions such as: “none”, “1-2 a week”, “4-5 a week” and so on. Quantitative research is usually gathered through multiple choice surveys (Larsen, 2017, p. 25).

Qualitative data on the other hand is referred to as soft data and seeks to gather a better understanding of why the research subject answer the way they do, with a possibility for follow-up questions. This type of information is normally shown through text, instead of numbers. Instead of asking how many times a person works out, the qualitative research instead focuses on why the person works out. Qualitative research is normally collected through interviews (Larsen, 2017, p. 25).

There are multiple factors that needs to be considered when deciding which methodology should be used for the research. The issue one is trying to solve in the research paper can affect which research method is optimal. While quantitative issues often are descriptive or comparative, qualitative issues on the other hand focus on making descriptive or ethnographic studies. A descriptive quantitative issue could be “What are some of the reasons presented when students are asked why they study shipping management?”. A descriptive qualitative issue would sound more like “In what way does shipping management prepare students for the working life and ensure a smooth transition from education to work?” (Larsen, 2017, p. 26).

However, there are more factors than just the issue for the research paper that are relevant when choosing research method. The purpose of the research is important when determining the approach. If the goal is to conduct a statistically representative research, quantitative research method is the optimal choice. This is because one is able to make assumptions about a group based on the population in the study. In a qualitative study this is usually not possible, as there are fewer subjects, but more detailed information (Larsen, 2017, p. 26).

It is also important to assess your own strengths and weaknesses, as well as the time available when choosing which research method is most appropriate for the task (Larsen, 2017, p. 26). Conducting a larger quantitative study takes more time, as there is a lot of work involved in finding the correct candidates, creating the study as well as sorting and analyzing the results. As the time delegated for the thesis is limited, I have decided to use qualitative research, in the shape of interviews as my research method. This will provide more depth to my questions and insight on how EU ETS will affect shipping companies in the deep-sea chemical tanker market, their investments in environmentally friendly technologies, as well as what implementations can be done to minimize the carbon emissions.

3.1 Strengths and weaknesses with qualitative and quantitative research

When conducting quantitative research with a questionnaire all answers are written in advance, which ensures that the focus does not shift, and you acquire answers for the questions you were asking. This is an advantage for the rest of the process, as you will not have to search through large amounts of text to find the information you were looking for, furthermore, if the questions are accompanied with predefined answers, the handling of information will become far easier. If the participants in the survey are selected by probability selection it becomes possible to generalize statistically and make assumptions for the entire population, based on the participants that answered the survey. Collecting information in this way also makes it possible to easily create graphs and tables showing the information gathered in a clear fashion. Furthermore, the survey will often be anonymous, which might make it easier for the participants to be sincere and voice their truthful opinion (Larsen, 2017, p. 28).

3.1.1 Weaknesses with quantitative research methods

By using a questionnaire to conduct the research the answers could easily be misleading or incomplete. This comes as a result of the predefined answers not being diverse enough to cover the different opinions or alternatives the interview subject require. While quantitative research might give the ability to generalize certain groups, the information gathered during the survey could be misleading or insufficient of showing the whole truth. The validity of quantitative research in the form of a questionnaire is also debatable. Validity in this context refers to whether the information gathered is considered relevant or valid for the research issue. To ensure the results are valid it is important that a comprehensive amount of work has

been put into the survey, for example asking the same question in different ways can ensure a correlation between the answers (Larsen, 2017, p. 28).

3.1.2 Strengths with qualitative research methods

One of the main differences between quantitative and qualitative research is how the information gathering is conducted. In qualitative research interviews, face-to-face is considered the standardized method, which gives the interviewer the opportunity to ask follow-up questions. This is great when one's knowledge on the research topic is lacking, as the questions will be able to enlighten one further and fill the knowledge gaps. Furthermore, the validity of the research is often considered to be higher, as the interview subject is able to explain themselves as well as address any misconceptions (Larsen, 2017, p. 29). By conducting my research in this fashion, I was able to learn about the new ship installations Odfjell had implemented on their vessels. Furthermore, I gained insight into these installations and how they worked as a result of follow-up questions, as well as the interview subjects' personal opinions in detail regarding both the EU ETS and the different ship installations.

My view on the topic was further broaden as the interviews were conducted with people from different positions and at different levels of the organizational hierarchy within Odfjell. This gave insight in how EU ETS will affect and has affected the day-to-day life of both the employees and vice presidents of the company, as well as how they view the future.

I had originally planned to conduct more interviews, but as the fourth interview came to an end there seemed to be a strong correlation between the answers I received from the different participants. Based on this and the limited time available for the thesis, I have deemed the four interviews to be sufficient for answering the issue at hand.

3.1.3 Weaknesses with qualitative research methods

While the quantitative research might be more time consuming in the early stage as the questions have to be carefully thought out with appropriate alternatives, qualitative research is usually more time consuming after the interviews are complete. This was very noticeable after I had finished the four interviews, as the recorded interviews lasted for more than two hours, and I spent a lot of time transcribing the conversations to find the necessary information. It is also easy to write the questions in search for a specific answer, which could have impacted the way some of the interview subjects answered. When people know they are being recorded they might also change their behavior or answers, which could have impacted the results.

3.2 The participants for the qualitative research

When conducting research in a qualitative study we are not trying to generalize a group of people or organizations as is often the case in quantitative studies, instead we seek to learn more about a certain topic from a different point of view. During my research process I have conducted interviews with participants who have different work titles and positions in the company. This has given me the ability to study the issue from different angles, and gain insight into how EU ETS affects the different fields of expertise within the company, well as their views on the new regulation and its impact. When selecting units using a non-probability sampling there are different approaches. To achieve the results I was looking for, I decided to use a combination of discretionary selection and snowball sampling (Larsen, 2017, pp. 89-90).

In discretionary selection the units are recruited based on subjective criteria. This can include things such as age, gender, education, and is done to ensure a variety of participants (Larsen, 2017, p. 90). During my research I chose to recruit units with different professions and interest to be able to reflect on the issue from different perspectives, and to truly see the impact of EU ETS. Furthermore, the snowball sampling became part of the selection process as I was introduced to new names that could be relevant for the study as I interviewed and reached out to new people. By conducting the interviews based on a combination of the two methods, I obtained a lot of information that might not be available online, as well as subjective thoughts regarding the ETS and the future outlook for energy saving installations on the Odfjell fleet.

3.3 Interview structure

There are multiple ways to conduct an interview, one of these is the structural interview. Here the interview form consists of premade questions which the candidates will have to answer in a chronological order. These questions should be sufficient to cover the research issue, and it becomes far easier to compare the information one has found, as well as organizing it. However, there is a high probability for information going to waste, as there will be little to no follow-up questions.

The semi-structured interview is probably the most common within qualitative research. This form of interview capitalizes on the use of a flexible interview guide consisting of questions and/or keywords, however, the order of the questions depends on the conversation. There are often asked follow-up questions to ensure better answers, in other words the interviewer will have an active role both beforehand, as well as during the interview.

It is also possible to conduct an unstructured interview, or an interview with an open interview guide. Here the candidate is able to talk freely about the relevant subjects, and the guide is mostly built up of keywords and topics that should be touched upon. The advantage of unstructured interviews is the sheer amount of information gathered, as the candidate will be able to lead the conversation and talk freely on the different topics. However, the time spent transcribing and coding the interviews will be greatly increased, as there is little to no structure (Larsen, 2017, p. 100).

When I started preparing for the interviews, I quickly figured out that the semi-structured interview would be the best fit. I had already obtained some information on EU ETS while writing the theory part of the assignment, which meant that asking follow-up questions and having a freer structure for the interview guide would be possible. Transcribing the interviews was relatively easy as I had asked most of the same questions, with only the order being slightly changed.

3.4 How the interview was conducted

When conducting qualitative research in the form of interviews, there are typically three main stages one will go through. First comes the “warm-up” questions, these are simple and concrete, and I used them to learn about the candidates’ previous job titles as well as their current position in the company. The “warm-up” phase is used to ease the candidates into the interview, and give them a sense of achievement, which can enhance the answers for future questions (Tjora, 2021, p. 159).

The second phase is where the participants are met with reflective questions. The goal here is to ask broad questions, so called “grand tour questions” that will let the participant talk about their experience and insight. These questions are often accompanied by follow-up questions to gain a better understanding of the subject. My interviews consisted of 12 questions, with keywords that would help lead the conversation further, should it be needed. The first question the participants were asked was about their relationship with the EU ETS, this was done to give some context to the answers that were to come. For example, does the relationship they have to the EU ETS affect their views on its effect? The participants all had good knowledge regarding the new regulations, however moments of silence did occur during the interviews, but by giving them time to think they were able to elaborate further. As they all had different positions within the company their experience of the effect the new regulation will have might differ, which provided me with different views and insight (Tjora, 2021, p. 160).

The final phase is the rounding questions. During this part of the interview, I asked whether the participants believed the EU ETS to be an incentive for investments in environmentally friendly technologies. As there is little research done on the topic previously, this was helpful when evaluating the effect of the EU ETS and writing my conclusion.

After the interviews were finished, I made sure to thank the participants and informed them of the future process for the research. Furthermore, contact information was exchanged to give both the participants and me the opportunity to reach out if any further questions would arise (Tjora, 2021, pp. 160-161).

3.5 Validity and reliability

Validity and reliability are a part of the research process and something that must be evaluated throughout the process. The terms are introduced early on and something one needs to consider from the moment the population and data categories for the research are established (Larsen, 2017, p. 93).

Validity in research is about the relevance of the study and whether the research conducted can be considered to be valid. In qualitative studies the focus is on the research and its creditability whether its authentic and the transferability of the results. For quantitative studies the creditability of the study refers to whether one is able to measure the findings made, however, for qualitative studies the focus shifts to look at to what degree we are able to investigate what we seek to investigate. This means that the emphasis on the questions asked during the interview is important, to ensure that the conclusions made based on the research, are credible.

For a qualitative study to have authenticity it is important that different voices are heard. During my research this was ensured by interviewing multiple participants with a different background and field of expertise. Although they shared much of the same views, which I will go further into in part five of the assignment, they gave different reasonings and will be affected by the new regulations in dissimilar ways. This gives the study more authenticity, as these people possess knowledge in different areas, but fulfill each other to provide the full picture on how the EU ETS will have an impact on environmentally friendly ship installations.

The transferability of the results is important as the goal of a qualitative study is to transfer the findings to other groups than the participants of the study. Since this study uses Odfjell as an example of a deep-sea chemical tanker company, some of the questions asked during the interview could be a bit too specific to generalize the deep-sea chemical tanker market. However, these questions mainly focus on the ship installations they are currently testing or planning to test. I believe the essence of whether the EU ETS will affect how deep-sea chemical tanker shipping companies choose to invest in green technology, will still be applicable to other companies in the business of trade, as their overall operations are fairly similar.

3.5.1 Reliability

The term reliability says something about the research conducted and whether it is thorough and dependable. In quantitative research it is much easier to establish reliability, as the researcher can conduct the survey multiple times to figure out if there truly is a correlation between the questions and answers. For qualitative studies this becomes more challenging, as different researchers can interpret things said in interviews differently, or perhaps some are more observant of body language than others. The interviews might also have different result had they been done on a different day, or with someone else asking the questions. To ensure a high reliability in the research it is therefore important to ensure that the questions asked during the interview are understandable and not misleading, furthermore, the transcribing of the interview must be done thoroughly (Larsen, 2017, pp. 94-95).

As I have conducted my interviews alone, my subjective interpretation of the answers and the participants body language could affect the reliability of the research in a negative matter. However, I have spent a lot of time transcribing the interviews and coding them, to find correlations between the participants and their answers.

4.0 Analysis

To get a better understanding of how the EU ETS will affect deep-sea chemical tanker shipping companies' investments in environmentally friendly technologies I have conducted four interviews with employees at Odfjell. The participants all work at different departments at the company, to ensure that I got different perspectives on the subject. The interview was divided into three parts, first came questions regarding their background and current job title, then questions about the EU ETS and how it will affect the company, and lastly the rounding questions that focused on my research question.

4.1 Interview number one

The first interview was conducted with a fleet performance analyst. This was a relevant candidate for the research as he had been working with the EU ETS since the summer of 2022. One of the first questions asked was about his previous relationship and knowledge regarding the EU ETS. This was done to see if a lack of knowledge would affect how the participants viewed the EU ETS and its effects. The participant then explained that Odfjell already have the ability to autogenerate emission reports for each customer, based on their specific cargo onboard the vessel. This was done to be compliant with Sea Cargo Charter, which is a global framework for aligning the chartering activities with environmental focus to enhance the decarbonizing of shipping. The legislations revolving around Sea Cargo Charter was then used to create emission reports that was distributed among the customers.

Next, the participant was asked how they are planning for the future, and whether they will hire someone to work specifically with the EU ETS and following up on the prices of allowances. He then explained how the different branches would have different tasks, and that it would be "combined efforts" between the departments to make it work. For example, the finance department will be in charge of purchasing and selling allowances, as well as handing them over to the EU to show that they are compliant with the new regulations. While for fleet performance the focus will be on reducing emissions. Furthermore, the participant mentioned that the EU ETS is only a part of the package, and that there are a lot of other regulations, either established or coming, that functions as incentives for reducing emissions. Lastly, he mentioned that "The allowance price for a voyage between the US and Rotterdam will only amount to about 1% of the freight rate".

The participant was then asked about how the EU ETS will affect ballast journeys, as there will be an extra cost related to the emissions, as the vessel emits CO₂ whether there is cargo on board or not (ballast is heavy material stowed on the vessel to ensure its stability). He proceeded to answer that “luckily, we rarely travel in ballast, however it does happen. The framework for Sea Cargo Charter explains that the first customer after a voyage in ballast, shall cover the CO₂ emissions produced on said ballast voyage. It might seem a bit unfair, however there are multiple companies and cargo owners that have agreed on the framework, so I doubt there will be a change in how we operate around ballast voyages as a result of the EU ETS”.

After a couple of questions about the EU ETS and how the company is planning to handle the new regulations, the focus shifted to the issue I am writing about. The next question focused on the OceanGlide technology that was recently installed on one of the tankers, as well as the eSAIL that will be installed next year, and what results they are looking for. The participant started off by explaining that they invest a lot in these types of ship installations as they believe it to be a “legitimate business case”, in the sense that these installations enhance the performance of the vessel and reduce the amount of fuel needed. When asked how long they expect it to take before such installations become a positive investment, he explained that a 5% fuel reduction will make the investment positive “relatively quickly”. He further explained that new technology such as the eSAIL will be applied to a newer vessel, as it is a more costly investment, which will require more time to be considered positive. Furthermore, the participant shared how the EU ETS combined with IMO’s CII will function as a sales pitch to customers. “If you chose this vessel that is A or B rated you will have to pay less in carbon taxes to the EU”.

As Odfjell is a deep-sea shipping company they have a fleet spread across the world. Therefore, I asked whether the EU ETS would impact their vessel scheduling, and if they would move the more energy-efficient part of the fleet to operate in Europe. The participant then said that “the allowance prices are not high enough”. He then proceeded to mention FuelEU Maritime and explained how this is a new regulation that will be implemented in Europe from 2025, where they will have to reevaluate the placement of ships and where they operate.

Finally, I asked if the EU ETS will have an impact on how much they are willing to invest in energy-efficient technologies and ship installations. The participant answered that “The EU ETS will be an extra cost for us as a shipping company, even though the goal is to transfer this cost to the customers. As the ship becomes more energy-efficient, the cost is lower. Therefore, investing in new energy saving devices becomes more lucrative, however, I don’t know if EU ETS is a driver, or part of a bigger picture”.

4.2 Interview number two

The second interviewee worked at Odfjell’s Financial Department and will be responsible for the financial side of the EU ETS regulation. When asked about his thoughts on the new regulation he was very positive. “If we are going to decarbonize the shipping industry it is crucial that the charterers are onboard, as they decide how much will be shipped and creates the competition. They are the ones that can ensure we don’t ship a half-full vessel... If this is a cost that can be transferred to the charterer it will work well, but if the shipowner is stuck with the cost it won’t work, then it is just an extra cost”.

When the participant was asked whether the EU ETS would lead to any new technical solutions or ship implementations, both on the existing and future fleet, I was met with much of the same answer as in the previous interview. “There will be a bigger focus on transferring the cost to the customer. I believe that CII and FuelEU Maritime will have a bigger effect on implementing new ship installations. As the EU ETS is only applicable to voyages within, or to/from the EU we won’t be able to reap the benefits of the installations without longer journeys to the EU. We estimate that the EU ETS will cost about 15-16 million euros when it is fully implemented with today’s allowance price, which is just too low for it to be a driver for new installations in itself.”

I then proceeded to ask him about OceanGlide and the eSAIL, and if he thought this was something that could be spread across the fleet. “I hope and believe that OceanGlide will be spread across the fleet. When it comes to the eSAIL it is important with the correct sailing patterns. In some instances, the sails will just increase the draft of the ship, which means that the fuel consumption will increase. We will have to spend some time assessing which ships are suitable for the different installations”.

As the final question I asked if the EU ETS will have an impact on how much they are willing to invest in energy-efficient technologies and ship installations. The participant answered in quite the same way as the participant from the first interview. “The EU ETS is part of a bigger package that affects our mindset when it comes to investments that will decarbonize our fleet. The last couple of years EU ETS has been everything everyone has talked about, but in a couple of years it will be FuelEU Maritime, and then something else. EU ETS is not the deciding factor for how we look at it, but it’s a smart part of a bigger package”.

4.3 Interview number three

The third interview candidate worked at Odfjell Ship Management. He was responsible for evaluating and implementing new technologies and energy saving devices, this resource brings first-hand knowledge about the technical side of the EU ETS regulation.

One of the first questions I asked him was whether he believed the EU ETS to be an efficient way of reducing the greenhouse gas emissions from shipping. “There are a lot of elements to consider, but I believe FuelEU Maritime will affect us more. We are not that exposed in the EU, as about 20% of the fuel consumption will be applicable to the EU ETS. I believe it will be a contributor to investing in environmentally friendly technologies, but there are a lot of other elements to consider as well”.

When asked what technical solutions he believed the EU ETS will lead to on the existing and future fleet, the answer was much like in the previous interviews. “I believe that FuelEU Maritime and CII will be more dominant when it comes to implementing new technologies. The more expensive it becomes to operate ship; the more changes will be made. One becomes more aware of energy saving devices and reducing the emissions when the costs increase, and FuelEU Maritime, CII, IMO EEXI and the GHG fuel standard, as well as EU ETS and other local regulations will lead to an increase in investments”.

The participant was then asked about the new installations they have implemented and about the results they are looking for. “Over the last 10 years we have spent about 30 million dollars on energy saving devices on the existing fleet. We’ve done around 130 installations, and it has become clear that the toolbox is starting to turn empty. We have spent a lot on propeller modifications which has been efficient and implemented on a lot of the vessels. We have now deemed it necessary to up the stakes and started with the OceanGlide. This has proven more

expensive than planned, however we expect it to become a positive investment after 6-10 years, but this may vary. If the fuel prices are to increase, the downpayment will be done quicker.”

I asked if they had any particular ships in mind when it comes to new installations. “We do have a fleet transition plan in accordance with the CII-rating. The ships built in Poland between 2003 and 2007 are in most need of a retrofit. Instead of buying biofuel we invest in new technology, which strengthens the case for the eSAIL. I believe it is highly beneficial for shipping to focus on new technologies and installations instead of biofuels, at least for the years to come.”

Finally, I asked whether the EU ETS will have any influence on how much they are willing to invest in new environmentally friendly technologies. “I believe it will have an effect, a small one. If you had conducted the same interview with a company such as Utkilen, which operates in the short-sea segment, primarily in the northern Europe, the results might differ. The EU ETS will be a part of the equation, but it won’t matter as much as other regulations. Had it on the other side been a world-wide IMO regulation, it would have been a different story. As our biggest hub is in Houston, local regulations have less of an impact.

4.4 Interview number four

The fourth and final interview was with a candidate from the technology department who has been working in Odfjell from 2007. Similarly, to the previous interviews one of the first questions I asked him what whether he believed the EU ETS to be an efficient way to reduce emissions. “Yes, I believe so. This creates an incentive for ship owners to invest in new technologies to reduce emissions. In Odfjell we have already invested in a lot of energy saving devices, and now our customers will be able to see the effects of this as they won’t have to pay as much in allowance costs as they will when transporting with someone else”.

I then asked how the customers will be affected by the new costs introduced. “We have already spent a lot of time collecting and analyzing data, which gives us the opportunity to operate with an open book. This will give us the possibility of showing our customers just how much they have to pay for the allowances, based on their amount of cargo. I am not sure if our competitors will be able to do the same thing. I have a feeling that the EU ETS cost will be baked into the freight rate for many companies. If this is the case then the EU ETS

loses its value, however if there is a common level established, we will make a lot of money, as our emissions are lower than our competitors.”

Furthermore, the participant was asked how much time they spend reporting on their emissions, and whether this will increase in the coming years. “It will be a lot more focus on this the coming years. FuelEU Maritime will be introduced in 2025, and the importance of data control will just increase, however shipping is only able to focus on one thing at once, so for the moment EU ETS is all everyone talks about. Companies will have to see the importance of energy saving devices, as 75% of the world's fleet does not have a single installation, which I can't understand as some of these ESD have a repayment time of half a year. For smaller shipping companies this will be even more challenging as they do not necessarily have the expertise in-house to grasp the new regulations, nor the resources to hire companies such as DNV to aid them”.

I then asked about the eSAIL and OceanGlide and if he believed this is something they will implement on the rest of the fleet. “From 2024 to 2030 we plan to implement 57 different installations. If the OceanGlide proves to be as efficient as we expect I assume this will be installed on ten more vessels. We estimate the OceanGlide to become a positive investment after approximately five years, which means they will be installed on vessels that will continue their operation for the years to come. For the eSAIL the situation is a bit different, as they can be removed from one ship and installed on another. As long as the foundation for the sails is installed it does not take more than a day to insert the sails. This means that we could install them on the Polish-class ships and transfer them to newer vessels when their life cycle is complete”.

Finally, I asked if he believed the EU ETS to be a driver for investments in environmentally friendly technologies. “I think so. In theory you have four different options to be compliant, either you execute a severe speed reduction, use alternative fuel which is really costly, have an electric vessel which is not possible at the moment or invest in energy saving devices which is what we do. From 2025 we will have to use alternative fuels to be compliant with FuelEU Maritime, which will be done using Biofuel. Currently the price difference is about 260 dollars per ton, which is quite significant. This number will only increase in the years to come as the demand will increase. Shipping is also competing with the aviation industry as

they have no other option than biofuel”. As in the previous interviews the conclusion seemed to be that the EU ETS is a small part of a big package, that will affect the way Odfjell invests in environmentally friendly technologies.

5.0 Discussion

In this part of the assignment, I will start by briefly explaining FuelEU Maritime (FEUM) and IMO CII, as they were frequently mentioned throughout the interviews. I will then explain how these regulations affect deep-sea chemical tanker shipping companies, and finally look at the EU ETS and whether it will have a financial impact on how Odfjell will invest in environmentally friendly technologies.

5.1 FuelEU Maritime

Similarly, to the EU ETS, FuelEU Maritime is a regulation aimed at decarbonizing shipping. It will be applicable to maritime transport within the EU from the 1st of January 2025. The main objective of the new regulation is to ensure consistent use of, and an increased demand for renewable and low-carbon fuels. This will be done by introducing well-to-wake limits to the greenhouse gas (GHG) intensity of energy used onboard ships. The term Well-to-wake refers to the entire process of the fuel production, the delivery as well as the use onboard the ship (Bureau Veritas, 2023). It will also be mandatory for cruise ships and container vessels to use shore power while docked from 2030 (DNV, 2023).

The greenhouse gasses included in the FEUM are carbon dioxide, methane and nitrous oxide. The company will have to be registered with an administering authority where they will report on their emissions. If the GHG intensity for a company is higher than the requirements a penalty will be issued. Here the difference between the measured greenhouse gas intensity and the required amount will be multiplied by the energy use, which ultimately can lead to hefty fines. Furthermore, the penalty will increase if a company is non-compliant for two or more consecutive periods (DNV, 2023).

The scope of FEUM is quite similar to the EU ETS, as it is applicable to vessels 5000 + GT. It also takes into account 100% of the GHG produced on voyages between EU ports, 100% of the GHG at-berth, as well as 50% of the GHG at voyages between the EU and a country outside the continent (DNV, 2023).

What truly separates FuelEU Maritime from the EU ETS is the ability to pool the compliance of vessels. For example, if a vessel is 125% compliant, in the sense that it is performing better than necessary, the 25 extra percent can be distributed among other worse-performing vessels to make the fleet compliant. This pooling possibility is not limited to vessels within one company which potentially creates a market for selling compliance (Marine Regulations, 2023).

5.2 Carbon intensity indicator

CII came into force in 2023 and measures the “GHG emissions to the amount of cargo carried over distance travelled”. There will have to be submitted an annual report for the ship, and the first CII-ratings will be established in 2024. The carbon intensity indicator establishes an annual reduction factor a vessel must have to ensure a continuous improvement for its operational carbon intensity, within a specified rating level. As a result of the ship’s CII, the vessel is graded based on its carbon intensity with a score ranging from A to E, where A is the optimal score. If the ship is graded D for three consecutive periods, or E for one year, a corrective action plan must be submitted to showcase how the required index, which is a C or above, is to be achieved (International Maritime Organization, 2023).

There are many ways for a ship to improve its rating, for example a speed reduction, hull cleaning to reduce the drag, using a low-carbon fuel, or install energy saving devices. A vessel rated as A or B will be more attractive to customers as the environmental focus is on a rise throughout the world. Furthermore, a highly rated vessel pollutes less, which means that both the EU ETS and FEUM will be less of a burden.

5.3 The regulations impact on green investments

Through the theory and interviews it is clear that the EU ETS will have an impact on the deep-sea chemical tanker sector in shipping, the question is whether it will affect the way investments in environmentally friendly technologies are valued. During the interview I learned that only 20% of Odfjell’s emissions will be applicable to the EU ETS, with a majority of them being on voyages to/from the EU/EEA. As previously mentioned, voyages from outside the EU to a port within the EU will only have to present allowances for 50% of the emissions produced. This means that the EU ETS costs will be lower than for a company that mainly operates within the EU.

Through the interviews I was told that when fully implemented the EU ETS will have a cost of about 15-16 million dollars, using the current allowance prices. I was also informed that Odfjell had invested about 30 million dollars in energy saving devices during the last 10 year-period. This goes to show that even though the EU ETS is considered to have less of an impact on Odfjell, the annual costs will be equivalent to about half of their spendings on energy saving devices over the last 10 years. This could prove to be a motive for further investments and installations as it would lower the amount of allowances required.

When looking at all the new regulations coming to shipping, they all have one thing in common: the less you pollute, the more attractive you become for customers. For both FUEM and the EU ETS the costs of allowances and penalties will be lower if the fleet is more energy-efficient. As the allowance price is a cost that will be transferred to the customers, the fewer allowances required means lower costs for the customers. FUEM is a cost the shipping company will have to pay themselves and by having an energy-efficient fleet, complying with the regulations becomes easier, ultimately leading to fewer or no penalties. By adding CII into the equation this becomes even more clear as the vessels will be graded based on their performance and pollution. Having a highly graded vessel will make the company more sought out by customers, as costs in regard to other regulations will be lower. Furthermore, environmental focus is on the rise throughout the world and having an energy-efficient fleet is attractive in itself as it gives customers the opportunity to export their products in an environmentally friendly way, which again impacts their own reputation in a positive matter.

5.4 EU ETS strengths

To be compliant with the EU ETS it is important for the shipping company to be aware of their emissions. As Odfjell has been required to report on their pollution since 2017 through the MRV this is something they are able to do in an efficient way and as mentioned in the interviews, they even have the possibility to showcase each customer and their part of the total CO₂ emitted. For the first time the customers will truly experience the effect of the different ship installations, as there will be fewer allowances required when transporting with an energy-efficient vessel. As the yearly number of allowances decreases it is expected that the price per allowance will increase as a result. This furthers the incentive to implement new ship installations to lower the emissions.

While the price per allowance is predicted to increase, the interviews have shown that it might not be enough to make the EU ETS a driver for installing new energy saving devices for a deep-sea chemical tanker shipping company such as Odfjell. During the interviews it seemed like the main issue with the allowances was transferring the cost to the customer, and not necessarily reducing the CO2 emitted. It was further mentioned that for the EU ETS to have its desired effect, the emissions produced on a voyage must be broken down for each customer, to truly show how the regulation will impact shipping. Many of the interview subjects mentioned that for several shipping companies this will prove difficult, as they might not have the ability to show each customer how much of the emissions from the voyage is related to their specific cargo. This could lead to the EU ETS cost being baked into the freight rate, which beats the purpose as one will not be able to tell what impact their pollution has. As mentioned earlier this could benefit Odfjell as they have installed a lot of energy saving devices and have lower emissions than a lot of their competitors, so a standardized addition to the freight rate would mean they earn more money.

During the interviews one of the participants mentioned that Odfjell are already planning 57 new installations from 2024 to 2030, with the newly acquired OceanGlide technology being spread across the fleet to 10 new vessels. While Odfjell has already completed around 130 installations of different energy saving devices previously, it goes to show that the new regulations will have an impact on their investments in environmentally friendly technologies as this is more than a 40% increase in installations over a six-year period. One of the participants also mentioned that about 75% of the world fleet does not have any energy saving devices installed on their vessels. It seems like many shipping companies fail to see the potential of simple installations on their fleet. With the EU ETS and FUEM approaching, I believe many shipping companies will look further into the potential of ship installations such as the OceanGlide to cut their emissions, as alternative fuels simply will be too expensive.

Planning which part of the fleet is in need of a retrofit is also important, and for Odfjell the vessels built in Polen are frequently mentioned in the interviews as underperforming. This makes the installation of the eSAIL especially interesting. As explained in the interviews one can move the sails easily from ship to ship as long as the foundation is in place. This means that installations such as the eSAIL, which is considerably more expensive than a propeller modification, is possible to implement on vessels with a shorter lifespan left, as the sails can be reused on newer ships later.

Throughout the interviews the participants all seem to agree that implementing new and more environmentally friendly technologies throughout the fleet is the best way to reduce emissions and stay compliant with the new regulations. In several of the interview's biofuel is mentioned, but mainly as something they want to avoid for as long as possible. By equipping the vessels with new emission-reducing technologies the overall pollution and fuel consumption will be lower, meaning the amount of biofuel one would have to use decreases. As previously mentioned, the price difference between the fuel used on the fleet now and biofuel is about 260 dollars per ton. With almost 70 vessels transporting goods all across the world, 260 dollars extra a ton will accumulate substantial costs for the company. Moreover, the cost of biofuel is only predicted to increase as the aviation industry is also heavily dependent on it. This strengthens the case for investments in energy saving devices as they will permanently reduce the fuel consumption.

5.5 Why the EU ETS will not incentivize new ship installations

While the EU ETS is introducing a price on carbon emissions for the shipping industry, it has become apparent through the interviews, that it in itself might not be enough to incentivize investments in new installations across the fleet. As the amount of allowances decreases, the price for emitting CO₂ will increase, however, for the time being the cost is not high enough. Based on the interviews and previous theory it seems like the EU ETS is deemed more as a part of the package, rather than the reason for new investments. This is further strengthened by the survey conducted by Miljødirektoratet that concluded with the allowance price being too low to in itself, incentivize investments in environmentally friendly technology. While CII and FEUM directly affect the shipping company as their expenses will increase, the EU ETS will have more of an impact on the customers, as they are the one left with the bill for allowances.

Both in the first and second phase of the EU ETS the allowance price fell drastically, leading to a surplus of allowances. Even though the MSR has been introduced to somewhat regulate the allowance prices, previous history has shown that the cost of allowances can fluctuate heavily. Shipping is also an industry that is constantly impacted by global events, such as a financial crisis, war, and embargoes. These events can be unpredictable and will have the ability to affect how much goods are being shipped throughout the world, like the financial crisis in 2008 which led to a massive surplus of allowances for energy-intensive industries.

5.6 Limitations

If I were to conduct the same research again there are a couple of things I would do differently. I would have tried to reach out to other shipping companies to gather more insight and opinions revolving the EU ETS. Even though I have interviewed people from different branches in Odfjell their views have been fairly similar as they work for the same company. Had I been given more time on the assignment this is something I would have done, as more insight would have given a better impression of how the deep-sea shipping segment view the EU ETS.

It would also have been interesting to compare Odfjell to a shipping company that operates more within Europe to see if their views would be different. As mentioned in the interviews Utkilen would probably have some different opinions, however this would change the premises for the thesis as I have focused on the deep-sea segment of chemical tankers. If I had more time and resources, broadening the issue to look at chemical tankers in general would be interesting, as I assume the results would be quite different.

6.0 Conclusion

Throughout this thesis I have attempted to answer the issue “*the European Union Emission Trading System and its financial impact on deep-sea chemical tanker shipping companies’ investments in environmentally friendly technologies*”. I started off by setting the limitations to what a deep-sea chemical tanker shipping company is, before going into detail on the EU ETS. In the methodology-part of the assignment different research methods were evaluated and assessed for, before qualitative research was deemed the most fitting for this thesis, as it would give a better insight on how Odfjell viewed the new regulation. In the final part of the assignment, I have discussed the effects the EU ETS will have based on previous theory and my research.

The interviews were conducted with people working in different segments at Odfjell. This was done to get a better understanding of how the EU ETS will affect the entire company, and the different challenges they might face. While their work will all be affected by the EU ETS differently, they seemed to share much of the same views when it came to the regulations effect on environmentally friendly investments. Previous theory shows that the EU ETS can prove to be quite expensive, especially as the amount of allowances in the market shrinks, however, it seems like the biggest challenge for a company at Odfjell’s size will be transferring the cost to the customer.

In conclusion, I believe it is safe to say that the EU ETS will have an impact on investments in environmentally friendly technologies, however it will be limited. During the interviews all the participants agreed that the regulation will aid in creating an incentive for reducing emissions, as the company becomes more attractive to customers. However, other regulations such as the CII and FuelEU Maritime were considered to be more substantial in the decision-making process when it came to the implementation of new technologies on the fleet. The EU ETS cost will be distributed among the customers, while non-compliance with both FEUM and CII will lead to expenses for the shipping company.

6.1 Future research

All the participants in the qualitative research work at Odfjell. While this was positive when assessing how the EU ETS will affect Odfjell as a chemical tanker shipping company, future research should look to other shipping companies at a similar size to look for differences and similarities. This would make the conclusion more “bullet proof” as more participants from different companies within the same segment would increase the reliability of the study. As mentioned in one of the interviews, the same questions asked to a smaller chemical tanker company such as “Utkilen” could prove to give completely different results, as they for the most part operate within Europe. With this in mind it could be interesting to see how shipping companies that mainly operate within vs. outside of Europe assess the threat and possibilities of the EU ETS. While this thesis will be applicable to Odfjell, and somewhat the deep-sea chemical tanker market, a study containing different segments of the shipping industry would prove valuable, as one could draw a conclusion on a global basis. Finally, a recommendation for future research would be to compare the effects of the EU ETS next to FuelEU Maritime and CII, as they were frequently mentioned as more demanding and impactful for investments in environmentally friendly technologies.

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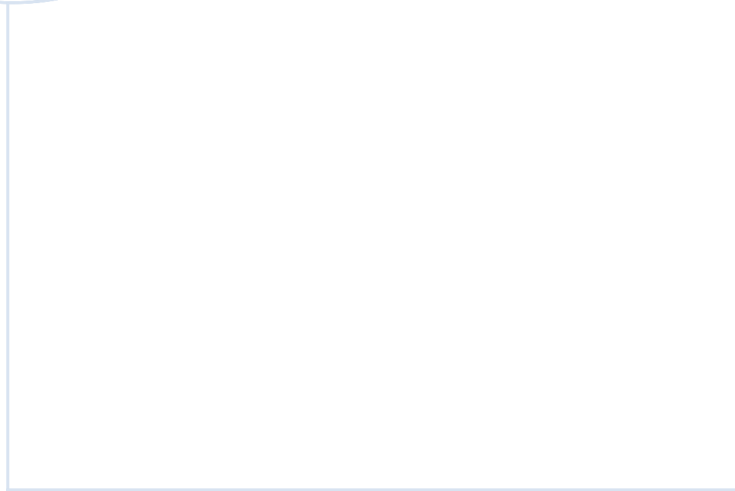
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8.0 Attachment

8.1 Basis for interview guide

Category	Question
Introductory questions	What is your background and what department do you currently work for?
	How good is your knowledge regarding the EU ETS and how will it affect your work?
Reflective questions	How will you buy the allowances? (Hedging or keep track of the market)
	How will the customers experience the new cap-and-trade system?
	What type of installations/methods do you currently use to track emissions?
	How much time do you spend reporting on emissions, and how do you think this will change over the coming years?
	How often does a vessel go in ballast, and will this change when the EU ETS is implemented?
	What is the goal for the eSAIL and OceanGlide? Is this something you want to spread across the fleet and how long does it take to become a positive investment?
	How significant will the EU ETS costs be for your company?
	Will the EU ETS change how you manage your fleet?
Rounding questions	Will the EU ETS lead to any technical interventions, both on the existing and future fleet?

	Will the EU ETS function as an incentive for new installations of energy saving devices?
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