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An analysis of the European Green Deal's effect on the European maritime industry

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Acknowledgements

Throughout the writing of this thesis, I was accompanied by many people. I would like to acknowledge their support.

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Abstract

This thesis analyses the European Green Deal's effect on the European maritime industry. It looks specifically at 5 policies from the European Green Deal: The Emissions Trading System (ETS), the Carbon Border Adjustment Mechanism (C-BAM), the Energy Taxation Directive (ETS), The FuelEU Maritime and the Alternatives Fuels Infrastructure Directive (AFID). The theory details each policy's targets and limitations. These goals are then applied to the maritime industry. This chapter examines which steps the different sectors must take to reach these objectives. The qualitative data is the individual discussions I had with 11 different persons. The interviewees all work in different sectors of the maritime industry. This thesis investigates their knowledge and opinions about these policies. To this end, I compare the theory that was researched and their point of view. The most common answer that is underlined is that the European Green Deal is a test. If in a couple of years, the first targets are met, the regulations will be a guideline for the rest of the world. However, even if Europe is carbon neutral in 2050, the impact of this continent will not be enough to fight climate change. The other countries that are considered as main emitters are North America and Asia, more specifically China. Without their initiative to reach the same goal of carbon neutrality in 2050, the increase in global temperature will not cease. This will have a strong impact on the economy of the European maritime industry. The different sectors will not be able to survive because of the strict regulations, involving numerous penalties.

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1. Introduction

1.1. Background

The word climate change is something that you regularly hear, through newspapers, social media, government reports. It is the subject of an extensive international debate because of its catastrophic the consequences for the world. The effect on each different sector has a consequence on another one. They are all correlated (National Oceanic and Atmospheric Administration, 2021).

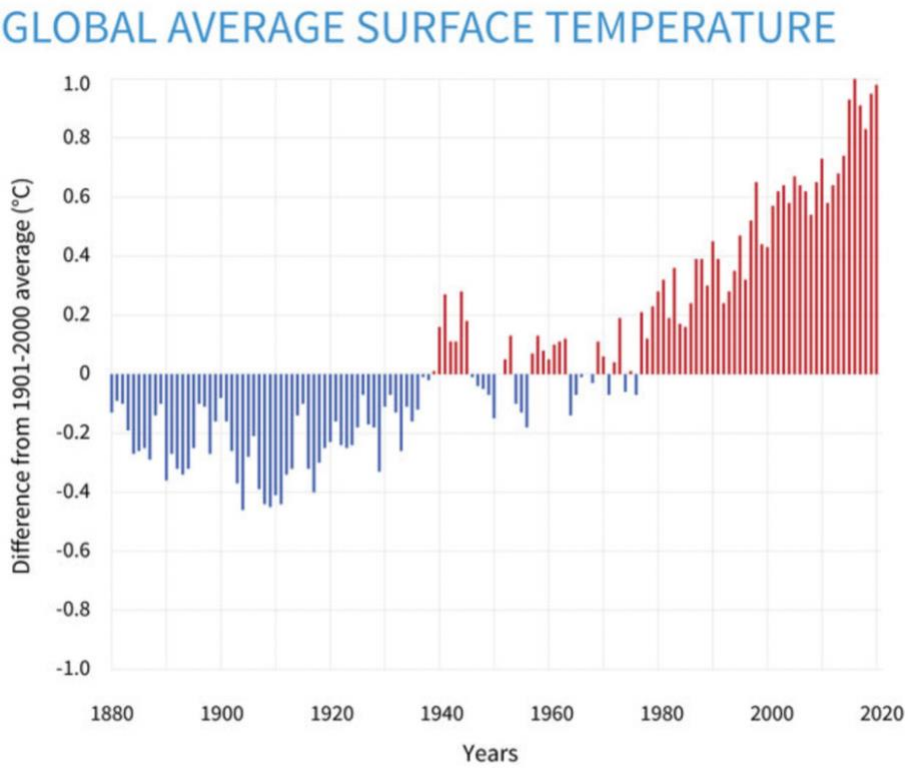

Figure 1: Yearly surface temperature compared to the 20th century average from 1880 – 2020 (National Oceanic and Atmospheric Administration, 2021)

The main consequence of the human-induced climate change is the rise of global temperatures of 1 degree Celsius from 1901 to 2020, as seen in figure 1. This leads to droughts that impact food production,

which then negatively affects the food availability and human health. The rise of sea levels is the other leader of consequences. This leads to more floods, which then spreads diseases as well as damages the ocean's ecosystem. This once again limits food availability, and the infrastructures that are surrounded by water. A list could continue to form itself, with more and more consequences for a lot of different sectors. With all the physical damages that climate change brings, the economic and social gap between rich and poor could continue to grow (National Oceanic and Atmospheric Administration, 2021).

On December 11th, the European Commission released The European Green Deal. Climate neutrality in Europe by 2050 is the main goal. For the first milestone, the Fit for 55 package details the polices. The aim is to reduce Co2 emissions by 55% for 2030. The European Green Deal considers massive challenges. With the detailed policies and a strong measuring of the results, Europe could turn around positively for sustainability, but also socially and economically. The research and development for alternative fuels and sustainable technology could be a big competitive advantage for Europe compared to the rest of the world (Jaeger, Mielke, Schütze, Teitge, & Wolf, 2021).

1.2. Purpose and relevance of the research

The European Green Deal can be resumed in seven actions: path to climate neutrality (climate), a clean energy transition (energy), a healthy food system for people and planet (agriculture), an industrial strategy for a competitive, green, digital Europe (industry), preserving the environment (environment and oceans), providing efficient, safe and environmentally friendly transport (transport), investing in a green future (finance and regional development), and research and innovation driving transformative change (research and innovation) (European Commission, 2021a).

One action is regarding transport. There are four main transport modes: air, rail, road and maritime. The maritime industry is the last added to the regulations of the Co2 emissions. For this reason, this thesis will focus on the maritime industry. It is a brand-new challenge to see how to measure emissions for Europe and around the world, since it is an international sector. As the European Green Deal has multiple policies, not all of them relating to the maritime industry. Therefore, I will further explain 5 policies made to reduce the maritime industry's emissions.

The thesis' objective is to analyze the opinions of the workers in the maritime industry. The aim is to understand if they believe that the regulations of the European Green Deal are good enough to achieve carbon neutrality by 2050. This analysis will be based on 11 interviews with people that work in the maritime industry, but from different sectors. This thesis compares theory and practice to understand, from the point of view of workers in the maritime industry, whether the European Green Deal will be revolutionary.

1.3. Research question

The research for my thesis will be based on the follow research question:

Is the application of the European Green Deal on the maritime industry effective to reach climate neutrality in 2050?

To compare theory and practice, here are the sub questions that were discussed during the interviews:

- How is the European Green Deal revolutionary and different from other older climate policies?
- Will the Carbon Border Adjustment Mechanism protect the maritime industry from carbon leakage, because of the decrease in allowances from the Emissions Trading System?
- Is the Energy Taxation Directive taxing the fossil fuel compared to alternative fuels?
- With the Alternatives Fuels Infrastructure Directive, will the ports be ready to accommodate vessels that are being pushed to switch to alternative fuels with the FuelEu Maritime?

1.4. Structure

This thesis is structured into 9 chapters.

- Chapter 1 introduces the background information regarding climate change and the European Green Deal, the purpose and relevance of it.
- Chapter 2 presents the maritime industry and how it is comparable to the other modes of transport.

- Chapter 3 details the position of the different sectors of the maritime industry and how they could impact sustainability and climate change.
- Chapter 4 demonstrates the rise of climate change over the years and its impact on the social and economic parts of the world.
- Chapter 5 entails what he European Green Deal, its policies, and regulations mean.
- Chapter 6 details the 5 policies from the European Green Deal and the Fit for 55 package that impact the maritime industry.
- Chapter 7 indicates the method of the gathering of qualitative data through interviews.
- Chapter 8 compares the theory explained in chapter 6 with the opinions of the people interviewed that are working in the maritime sector.
- Chapter 9 concludes with the positive and negative points of each policy, based on the opinions from the interview.

2. The Maritime Industry

Maritime transportation is a vital part of the global economy. It is one of the main channels of international trade (Christiansen, Fagerholt, Nygreen, & Ronen, 2007). It is an essential part of the supply of energy, food, and commodities. Maritime transport, being international, is the main transport mode for raw materials (oil, coal, cereals…) for long distance travels. Maritime vessels transport 90% of all merchandise that is traded around the world. It is the key to the international economy (GEFCO, 2021). Numerous cities rely on their ports as a major source of revenue. The maritime industry also brings employment, as well as entertainment, for around 400 million passengers every year. In 2017, around 4 billion tons of goods were transported to European ports, which represents 70% of the European trade. Regarding the entertainment, the cruise ship industry contributed around €47.86 billion to the European economy. It has also created 43000 news jobs between 2015 and 2017 (Gebraad, 2020).

There are four main modes of transport: sea freight, air freight, rail freight, and road transportation. Each of them has their own advantages compared to the three other modes of transport, as seen in table 1. The maritime industry is the go-to option for global cargo shipping. The first important advantage of the maritime industry is that the vessel is the mode of transport that emits the lowest amount of Co2 per ton per kilometer. Second, maritime transporters can handle all types of cargo, such as oversized, heavy, or

bulk cargo. The cargo includes large vehicles, equipment, construction materials… Third, compared to all other modes of transport, vessels can carry large volumes of goods for short and long-distance voyages. If you look at the price of transportation per good, the maritime industry is often the cheapest option regarding the price per ton of merchandise (Hillebrand, 2021).

Table 1: Advantages of the four modes of transport

Sea Freight	**Air Freight**	**Rail Freight**	**Road Transportation**
Lowest Co2 emissions per ton/km	Lower cost of packaging – lightweight packaging	On time performance	Last mile transportation
Big quantities	Speedy delivery	Sustainable	Cross border facilitation
Cost effective	Higher standards of security	Easy intermodality	Flexibility regarding the destination

The maritime industry has a long supply chain and a lot of different sectors. In the next chapter, a detailed explanation of the function of the different sectors shown in figure 2 will be presented. As the analysis of this thesis is to see how the maritime industry will be impacted by the regulations and policies of the European Green Deal, it is important to understand the vocabulary and function of each sector.

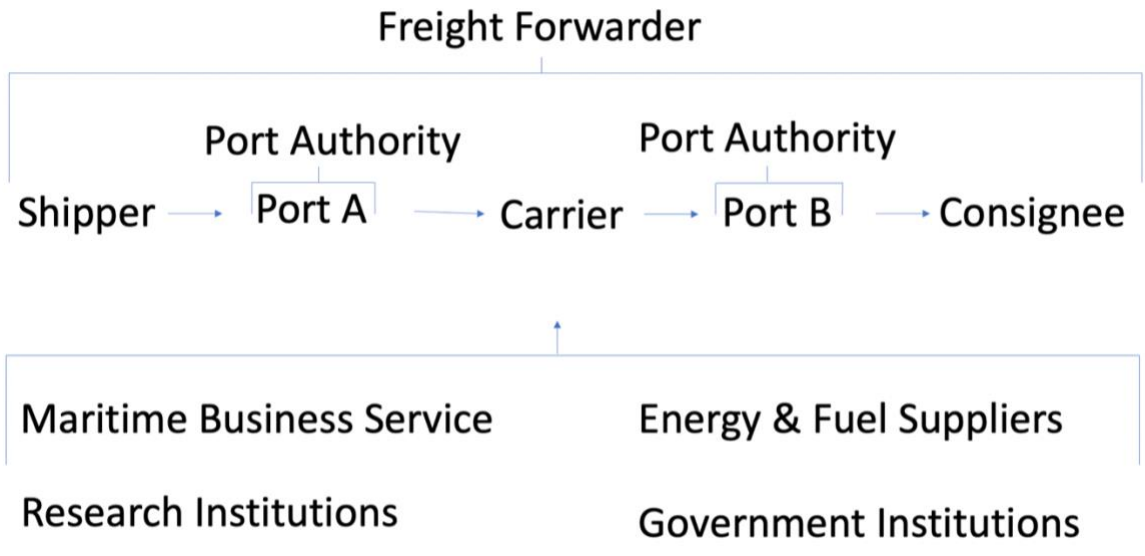

Figure 2: Maritime Industry Supply Chain

3. Different Sectors of the Maritime Industry

3.1. Shipper

The shipper is the entity that wants their goods transported and pays the transportation of the goods. They can hire a freight forwarder to arrange their transportation of the merchandise with the carriers. The shippers are the entities sending the goods to the consignee, which is the entity at the end of the maritime supply chain in terms of transport. They are at the departure of the supply chain. They send their products to the end of the supply chain, to the consignee (MI News Network, 2021).

3.2. Port Terminals

Terminals are used as points of interchange for the same mode of transport. They are also points of transfers to interchange shipment between different modes of transport, such as a ship and a truck. The importance and performance of a transport terminal depends on three categories: location, accessibility, and infrastructure. Transport terminals need to be placed in the optimal location to serve a large concentration of economic activities. It also must be accessible to the market area. If another mode of transport is not able to access the terminal, there will be no interchange to the shipment. Last, the infrastructure needs to accommodate the current traffic as well as expect the future trends that could happen with the technological and logistical changes. The land that is occupied is also an important characteristic in the infrastructure. (Rodrigue & Slack, 2020).

3.3. Port Authority

A port authority manages the seaport. The governance of the port must make sure that the interactions between the public and private sectors flow in a way that is beneficial for the seaport. There are various concepts that need to be explained in political, historical, cultural, economic relationships (Tijan, Jovic, Panjako, & Zgaljic, 2021). They need to manage property right, plan the development of the port, consider the positive and negative externalities of the port and the ships entering it. While their main goal is competitiveness, the port authorities need to achieve other objectives. They should contribute to local, regional, and national economic growth by creating employment, for example. Added value needs to be

maximized. Ports with that are within their foreland and hinterland should be integrated. As maritime transport is based on a global network, port authorities should facilitate trade. Finally, the port authorities should promote sustainability and make sure that they respect rules for climate change (Pallis, 2021).

3.4. Freight Forwarder

Freight forwarders act as the intermediary party between the party that is selling the goods (consignor) and the destination port. They must take care of, depending on the contract between the consignor, the port terminal, the consignee (the party receiving the goods) and the freight forwarder, the inland transport, the port, and customs documentation. They are the reliable party for planning and coordinating the movement of the cargo from the point of loading to the destination point, while considering the port terminals. If the cargo is not directly loaded on the ships, freight forwarders take care of storing the merchandise in warehouses that they either own or rent. They can be described as the second-party logistics providers (Menon, 2021).

3.5. Carrier and shipowner

The carriers are the companies that are operating the vessels. They are the transport companies. There are also the shipowners that fall under the same category. The shipowner is the entity that owns the ship used to transport the goods. The shipowner can be the ocean carrier or another business that owns the vessels and leases them.

There are five broad categories of vessels in the global maritime shipping industry. Regarding the transport of goods, there are three types of carriers: container ships, general cargo ships, and bulk carriers. We then have the carriers that are made for passengers, the passenger vessels. The last category is the connection between the ocean freight and the inland freight, that can be done with roll on-roll off (RORO) vessels (Rodrigue & Notteboom, 2020).

Container vessels are vessels that carry the compacted merchandise and stored in different types of containers on the vessel. These carriers are the ones that carry approximately 90% of seagoing non-bulk cargoes. This type of carrier is the most used in the world. With its different standard sizes, it is easy to

calculate how many containers can fit, as well as how to transfer the merchandise off the carrier. The biggest container vessel, the post-Suezmax, can transport up to 18000 TEU (Jha, 2021). The General cargo ships carry non-bulk cargoes, such as agricultural machinery. They normally have their own gear, giving them the possibility of being more versatile for smaller ports and terminals. However, before the 1960s, they were extremely slow in loading and off-loading cargo. They were replaced with container ships, which are more rapid and efficient at loading and off-loading. Economies of scale are better used in this case (The Maritime Industry Knowledge Centre, 2018). Bulk cargo is the goods that are not pre-packaged, such as oil, grain, iron,… The ships that carry these shipments are called bulk carriers. This type of cargo has a single origin, destination, and client. Break-bulk cargo is a shipment that is more unitized than the bulk cargo. Break-bulk carriers are equipped with pallets, bags, straps, bundles, and crates to contain the shipment that is being transported while the boat moves, such as vehicles,… Compared to bulk cargo, these ships have various origins, destinations, and clients (Manaadiar, 2020). With the technical developments of today, less distinction is made between those two types of cargo. Both can now use pallets and containers (Rodrigue & Notteboom, 2020). Bulk carriers can be divided into two types: liquid bulk and dry bulk carriers. As the name indicates it, liquid bulk refers to the transportation of all liquid goods that are used in everyday life, such as oil, gasoline, fruit juice… Dry bulk cargo is bread, cereal, coffee grains, sugar… (The Maritime Industry Knowledge Centre, 2018).

Passenger vessels are the ones that carry passengers on national and international trips. Historically, they played an important road because they were the only mode of transportation for crossing the sea to arrive on another continent. Initially, it was only passenger ferries. These ships would travel on relatively small bodies of water, such as rivers of straits. Then the commercial side of the industry arrived, and cruise ships were born (Mohit, 2020). The last type is the roll on-roll off vessel. They are made for the transition of the shipment between the ship and other modes of transport, such as cars, trucks, and trains (Rodrigue & Notteboom, 2020).

3.6. Consignee

The consignee is the party that will have the ultimate ownership of the goods at the end of the vessel's voyage. In some terms, the consignee can also be the party that receives the goods at the destination and then resells the goods to their customers. Consignees need to be aware of the departure and arrival of the ocean carriers, to know where their merchandise is. They are the main contact for organizing the

delivery of the goods, whether it is at the port terminal or at another location. They are the ones that make the payments for the travel of the merchandise, but also for the custom duties and taxes, unless stated otherwise (Menon, 2021).

3.7. Maritime Business Suppliers

There are a lot of maritime business suppliers that can be explained for the maritime supply chain, such as consulting, insurance companies, banks, lawyers. I will focus the explanation on one of these suppliers: banks and lawyers. Banks are an important part of the list of suppliers because the changes' financing in the maritime supply chain are needed to advance towards climate neutrality. The explanation of the role of lawyers is also relevant for this thesis. They are the ones that look at all the legal regulations and to whom the limits need to be applied.

3.7.1. Banks

Having objectives is the start towards a greener world. However, with no financing, these goals would not be achievable. Banks have a big impact on whether the zero-emission goal of 2050 will be met. Banks decide which projects to finance in order to produce new ecological technologies (World Maritime News, 2019). Therefore, the Poseidon Principles was founded in 2019. 11 banks created this global framework. They have agreed on the terms regarding the financing of maritime institutions regarding the climate regulations. The banks measure the climate imprint of the portfolio of the shipowners, based on fuel consumption, sailing distance and cargo capacity. Based on how these factors affect climate change, a loan will be given to them. Shipping companies will also get a better loan if they decide to make an investment in sustainable vessels, regarding their technology and the fuel, preferably alternative, that is used. Even though the European Commission has planned funding for the sustainable changes, most of it is expected to come from private entities, such as banks (Eliassen and Truyen, 2020).

3.7.2. Lawyers

The legal part of legislations is an important part of the maritime supply chain. The administrative frameworks must be able to help all the sectors of the maritime supply chain regarding the

implementation of the maritime legal policies. If a question is needed regarding limits, restrictions and standards, lawyers need to understand each text and how this applies to different parts of the maritime industry. Lawyers can also apply these policies to an international level, as the maritime industry is global. Shipping companies can be registered in Europe but have non-European workers and dock in non-EEA and EEA ports. With the different policies inserted by the European Green Deal, it is important to know which policies apply to which parts of the world (World Maritime University, 2022).

3.8. Energy & Fuel Suppliers

To power their motors, most of the maritime vessels make use of heavy fuel oil. This type of fuel is considered highly polluting. It has been proven that is causes respiratory diseases, as well as an accelerating factor for acid rain that has a damaging effect on vegetation and wildfire (Crown Oil, 2022). The demand, financial, and social future of oil and gas companies needs to change a lot. The fuel is still needed, as they are still an important part of the sustainable energy mix. Fuel suppliers need to adapt in the changing policies to follow and be able to evolve according to the sustainable guidelines. They need to rethink their business models. Energy suppliers will be more and more demanded due to the potential increased use of renewable energy as a source of fuel. However, the infrastructure to store that energy is not ready. Energy suppliers need to come up with a business plan to invest in the storage capacity of these new renewable energies (Bell, Blakemore, and Johnston, 2020). The heavy fuel oil is not a proper source of energy under the regulations of the European Green Deal. The use and different kinds of alternative fuels will be discussed in length in a further sub part of the European Green Deal chapter.

3.9. Researchers and Government Institutions

Researchers are essential players when it comes to developing and testing of new technologies, concepts, and scientific research. Authorities (international, European, national, regional, local) work well with the researchers because once findings have been discovered, the correct authorities are able to develop policies, legislation, and strategies, as well as monitor its implementation. There are multiple areas that researchers must focus on when it comes to the maritime industry. One of the most relevant one for this thesis is the environmental impact of maritime activities. Researchers must assess the effect of maritime

activities on the natural environment. Once that is done, they can discuss with government institutions, such as the European Commission, on which policies to adopt to limit the negative effects of maritime activities. Another important area that will be discussed further in this thesis is the maritime energy management. With the researchers' development of new technologies and alternative fuels, authorities can implement maritime energy policies and governance, as well as consider the economics and social dimensions of energy management. The circular economy to produce renewable energy from waste reduction is based on the innovation and technology that researchers can discover and government institutions are able to put in place regarding legislations (World Maritime University, 2022).

4. Climate Change

Climate change, in terms of environmental economics, is a negative externality. The problem with greenhouse-gas emissions is that it is a global concern that has spread all around the world. (Nordhaus, 2019) One of the first things we talk about when we hear the world global warming is the rise of the global temperature. Since the discovery of fossil fuels in 1960, there has been an increase in global temperature by 1°C. The greenhouse gas emissions that come from burning fossil fuels are the cause of this increase. For a long time, scientists have stated the global temperature should not rise above 1.5°C. During the Paris Agreement in 2015, it was decided that the increase of global temperature could not go above 2°C (Vox, 2019). A link has also been made between climate change and global conflicts. With the scarcity of the availability of natural resources, such as food and water, some political scientists view climate change as more than just a menace to the environment. It also seen as a threat to peace. With the lack of basic needs, desperate populations could revolt against the government, which could lead to intra- and interstate conflicts. The risk of violent conflict, the lack of agricultural production and the increase on food price, leads to geopolitical instability. Discords between nations hinders the prosperity and wellbeing of the economy. These disagreements then lead to nations not working together against the global problem of climate change. The vicious cycle continues to worse every step. Climate change leads to conflicts due to scarcity of resources, which leads to no common agreements between nations, which comes back to the increase of climate change (Bowles, Butler and Morisetti, 2015).

More specifically, how does global warming affect the sea? Ever since the industrial revolution, carbon dioxide has been building up in the atmosphere. It's a direct result from using coal, oil, and natural gas for our energy. Carbon dioxide and other gases are rapping in an extra blanket around the planet, trapping heat inside the climate system that would otherwise radiate out to space. Where is this heat? Over 90% of it has been going into the oceans. The world's oceans are warming at much higher rates than previously thought, both at the surface and at depth. These record-breaking ocean temperatures we have seen in recent years have been fueling stronger hurricanes, altering the weather and affect the marine ecosystems. Climate change also affects the bottom of the food chain and how they travel around the ocean to avoid these warmer oceans. This is problematic for humans because about 1 billion people around the world depend on fish for their primary source of protein, mostly in poor developing countries. Another important factor of warmer water is the lower oxygen content. For each degree Celsius that the world warms, oxygen levels in the oceans will go down by 2%. Where it really matters is in the oxygen minimum zones, that lie of the coasts, just under the most productive fishing areas in the world. Global warming is shrinking valuable habit for fish, affecting commercial fishing areas and the global economy (Global Weidring with Katharine Hayboe, 2017).

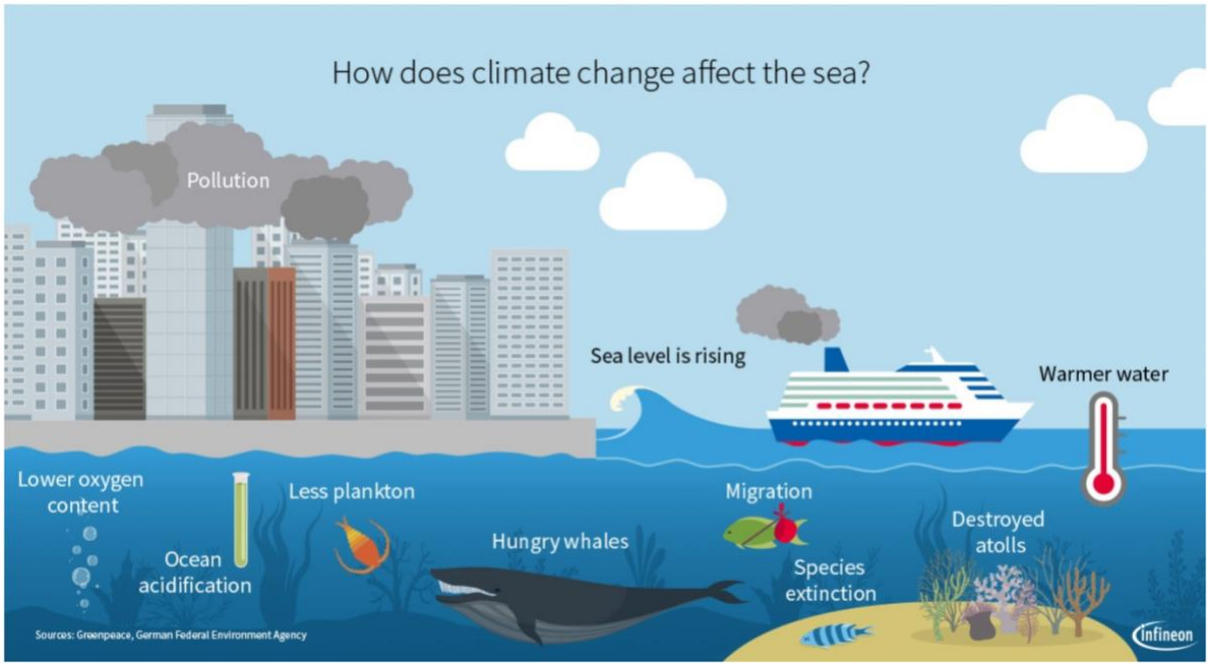

Figure 3: How does climate change affect the sea? (Infineon Technologies, 2022)

5. European Green Deal

To understand how member states took action to fight against climate change, and how the European Green Deal was signed, we need to go back all the way to 1997, in Japan. For decades, environmentalist groups had been lobbying to make a change. With the pressure, the Kyoto Protocol was finally signed. The Europe Union was put in the Annex I category, along with countries such as Russia, Japan, the United States, Canada, and Australia. These were the countries that had been emitting the most Co2 and needed to cut down. After 20 years, the reduction of Co2 emissions was only of 20% for the European Union. This decrease was not seen as an achievement as this decrease was mainly due to the relocation of Europe's manufacturing industry to the rest of the world. Climate conferences were made, but the global temperature due to Co2 emissions continued to rise (Into Europe, 2021). In 2015, the Paris Climate Agreement was signed. It seemed like a hopeful agreement, by limiting the rise of the global temperature to 1.5 degrees Celsius, maximum 2 degrees Celsius, compared to pre-industrial levels. 196 countries agreed to sign this international treaty (United Nations, 2021). However, the UN Framework Convention on Climate Change has stated that the COP Paris (Conference of Parties) is not entirely legally binding. There are no penalties or fees if a country does not follow on its promises. This posed problems, as countries were not living up to the standards. The United States opted out of the agreement in 2019. However, the European Union continued its research and development (MacLellan, 2021). This is when the European Green Deal was created.

The European Green Deal was acted in December 2019, right before the COVID pandemic. It has set goals to combat climate change and environmental degradation, as well as digitalizing Europe's economy. There are three main goals to convert the European Union into an economy that is modern, resource-efficient, and competitive. The first and most important one is that "there are no net emissions of greenhouse gases by 2050". This target is reaffirmed by the Fit for 55 Package, the 2030 goal for a 55% reduction in CO2 emissions (European Union, 2020). This objective is in line with the Paris Agreement, another agreement between the countries of the European Union that aims at limiting the global warming to 1.5°C (European Union, 2017) The second objective is that "economic growth is decoupled from resource use" (European Union, 2020). If nothing changes it is estimated that, by 2050, humans will make use of 140 billion tons of minerals, ores, fossil fuels and biomass per year. That is three time bigger than what is utilized today. To avoid this increase, the economic growth needs to be separate from the rate of consumption of natural

resources, especially in developed countries (Fischer-Kowalksi & Swilling, 2011). The third goal is to make sure that “no person and no place is left behind”. The change must be made everywhere in the world. If change only happens in certain countries, the goals will not be met. A team effort must be made to make sure that everyone is able to make the European union’s economy more sustainable (European Union, 2020).

These three main goals will be achieved through the various elements in figure 4. In a nutshell, the goal of the European Green Deal is to decarbonize transport, heating, and the industries in the European Union. There will be no more greenhouse gas emissions by 2050.

Figure 4: The European Green Deal

The elements in figure 4 are an initial roadmap to know which policies and measures need to be reviewed and added to achieve climate neutrality by 2050. All EU actions and policies are writing in order to achieve the European Green Deal objectives (European Commission, 2019). The European Green Deal is 15 pieces of legislation. There are two types of legislations: regulations or directives. A regulation is a legislative act that is binding across the European Union. Directives set binding targets but there is some room to play for individual member states to decide the precise route to that target. If you look at these 15 proposals,

there are 8 regulations and 7 directories. Not all these proposals are completely new. They're 4 regulations that are brand new. (CirclNL, 2021)

Regulations:

- Stricter binding annual greenhouse gas reduction targets by member states
- Stricter performance standards for new passenger cars and light commercial vehicles
- Stricter rules regarding land use forestry and agriculture
- Updated alternative fuels infrastructure law
- Carbon border adjustment mechanism (new regulation)
- Social climate fund (new regulation)
- Proposal to boost the production and uptake of sustainable aviation fuels (new regulation)
- Proposal to use renewable low carbon fuels in the maritime transport (new regulation)

Directives

- Full update on the taxation for energy products and electricity
- Stricter rules for the EU emissions Trading scheme and the market stability reserve
- Higher amount of allowances to be placed in Market Stability Reserve until 2030
- Amendment regarding offsetting for aircraft operators
- Aviation contribution to reduction targets and implementing global market-based measure
- More ambitious renewable energy targets regarding Promotion of Energy Renewable Sources
- Full update of the Energy Efficiency Directive

As this thesis aims at seeing how the European Green Deal applies to the maritime industry, I will not describe all the regulations and directives stated above. Since there are many regulations and directives of the European Green Deal, I have decided to focus on 4 targets, and their policies, when it comes to the maritime industry. The four targets are the ones for Co2 reduction (stricter binding annual greenhouse gas reduction targets by member states, stricter rules for the EU emissions Trading Scheme stability reserve), for renewable energy (proposal to use renewable low carbon fuels in the maritime transport, full update of the Energy Efficiency Directive), the taxation and Co2 pricing (carbon border adjustment mechanism, full update on the taxation for energy products and electricity), and the alternative fuels

infrastructure (updated alternative fuels infrastructure law). The last point I will discuss is the funding (Higher amount of allowances to be placed in the market stability reserve until 2030) that the European Green Deal has put in place. I have chosen these 5 subtopics of the European Green Deal, as they are the ones that include regulations that apply to the maritime industry.

6. The European Green Deal and the Maritime Industry

As the maritime transport industry represents around 75% of the EU external trade volumes, as well as 31% of the EU internal trade volumes, big changes need to be made to achieve climate neutrality by 2050. Overall, global shipping emits around 3% of the world's annual carbon emission. This reduction can be achieved with two requirements: use less energy, by increasing energy efficiency, and use cleaner types of energy, such as renewable and low-carbon fuels. (European Commission, 2021a). With the European Green Deal, the maritime industry can become a leading player in the international shipping industry, with innovation and deployment. The European shipping industry wants to show the rest of the world that they can stay competitive while moving towards a zero-emission world in 2050. Even though big changes need to be made regarding the working of this industry, it is still the mode of transport, compared to air, road and rail transport, that emits the less Co2 per ton-kilometer. With the shipping industry being so international, it is a big step for Europe to have to first advantage when it comes to decarbonization. The trade volume has increased quite a lot in the last decade, but it has been reported that Co2 emissions of the global shipping industry have decrease by 19% between 2008 and 2018. This is a good start, but not enough to arrive at carbon neutrality. A zero-emission shipping industry requires a change from the entire supply chain of the maritime industry (ECSA, 2019). The big changes can be made regarding the fuel that is used in vessels. However, the immense practical challenge that is presented for the moment is first the choosing of the type of fuel that is the most efficient regarding zero-emissions. Once that type of fuel has been chosen, fuel providers need to be able to produce it in sufficient volumes and port terminals and port authorities need to invest in infrastructure that allows these new vessels to dock in the ports (Adler and Brooks, 2021). This change must be made by the entire maritime supply chain, not just one part of it.

Before the inclusion of the maritime industry in the European Green Deal, the greenhouse gas emissions were controlled by the International Maritime Organization (IMO). It is a specialized agency of the United Nations consisting of 175 member states. The conventions and protocols that are put in place are for the

safety and security of shipping as well as the decrease of the pollution caused by vessels (Parroquin-Ohlson, 2017). The IMO had the goal of reducing the emission by half, based on the 2008 levels, by 2050. However, not interim targets were set. Many reviews were done, and it was decided by the European Commission, and it was stated that the IMO's measures were not ambitious and tight enough. The IMO's long term plan regarding fossil fuel use is not taxed enough to give the incentive to shipowners to switch to more alternative fuels (Adler and Brooks, 2021). This is where the European Commission stepped in regarding the maritime industry. A set of measures are being discussed between the European Commission and the International Maritime Organisation, as they are not agreeing on all targets and limits that can be set on the shipping industry. During the Marine Environment Protection Committee 75th meeting in November 2020, measures such as global standards for energy efficiency, certification and auditing of vessels according to a mandatory code, were agreed upon (European Commission, 2020). The MEPC are being held quite regularly and being reviewed in next 3-4 years. The last MEPC, the 77th Edition, was on December 1st, 2021. The main points that were developed was the further reduction of GHG emissions, the special attention that should be paid to developing countries, incentive for ships to voluntarily use cleaner fuels close to the Artic (Black carbon in the Artic), the guidelines for the discharge of discharge water from exhaust gas cleaning system (EGCS), plastic litter, … (IMO, 2022). With the pressure of the European Green Deal, the IMO is trying to fit the requirements of the European Union. As the IMO also includes non-EEA countries, it is a struggle for them to find targets that apply both to the strict regulations of the European Green Deal and the more lenient regulations of other non-EEA member states.

A big addition that was made to the European Green Deal was the Fit for 55 package on July 14th, 2021. This package reset the 2030 target from 40% to 55% reduction of Co2 emissions. (O'Brien, 2021). The Fit for 55 claims to achieve a balance between regulatory policies and market-based carbon pricing to avoid the pitfalls of each. Fit for 55 pushes EU decarbonization into higher gear, marking the visible entry of climate policies into the daily life of European citizens and companies, and starting to impact global trade partners. (Drishti IAS: English, 2021). I have decided to focus on 4 proposals that were updated by the Fit for 55 package, as they are the ones that are directly linked to the maritime sector. I will detail each of these 4 proposals, their goals, how the maritime sector is impacted by them and how the European Green Deal is making a change in this proposal. The first one will be regarding Co2 reduction for the element achieving climate neutrality. It is the Emissions Trading System (ETS). The second proposal is the FuelEU Maritime, which looks at the innovation and development of renewable energy. The third proposal

focuses on a clean, reliable, and affordable energy. The pricing and taxation of Co2 emissions in the shipping industry can be elaborated in the Energy Taxation Directive (ETD). As seen in figure 5, lower rates will be applied to avoid carbon leakage. This term will be further explained in the next chapter, along with the proposal of the Carbon Border Adjustment Mechanism (C-BAM) that aims to prevent carbon leakage. The last proposal in the Fit for 55 package is the Alternative Fuels Infrastructure (AFI). This last proposal is more pushed towards the ports themselves and the steps that need to be taken to remodel their infrastructure.

EU ETS	**C-BAM**	**Energy Taxation Directive (ETD)**	**FuelEU Maritime**	**Alternative fuels infrastructure directive (AFID)**
Ships of 5,000 GT and above to be included in the EU ETS from 2023. Applicable to all intra-EEA voyages and 50% of voyages to/from countries outside the EEA.	Risk of carbon leakage. Will become an alternative to carbon leakage protection measures, notably free allocation of emission allowances under the ETS. Ensures same carbon price for domestic and imported goods.	Remove tax exemption on bunker fuels sold within and for use within the EEA from 2023. Low rate compared to other sectors to prevent carbon leakage.	Aims to incentivize uptake of renewable and low-carbon fuel (RLF) by setting increasingly strict limits on the GHG intensity of fuels used from 2025 onwards.	Sets requirements for adequate LNG bunkering infrastructure by 2025, and for minimum electric shoreside power supply by 2030.

Figure 5: Short summary of the relevant policies from the European Green Deal (Mfame, 2021)

6.1. Targets for Co2 Reduction – Emissions Trading System (ETS)

The European Union has been able to reduce its greenhouse gas emissions by 23% from the years 1990 to 2018. However, that is not enough to achieve climate neutrality by 2050. The first target that had been set for 2030 was a decrease of 40% of Co2 emissions by 2030. However, this goal is not enough to reach carbon-neutrality by 2050. Therefore, a target for 2030 has been set. (European Commission, 2021). The

European Union's greenhouse gas emissions ought to be lowered by 55% for 2030, according to the Fit for 55 package that was presented and acted in 2021.

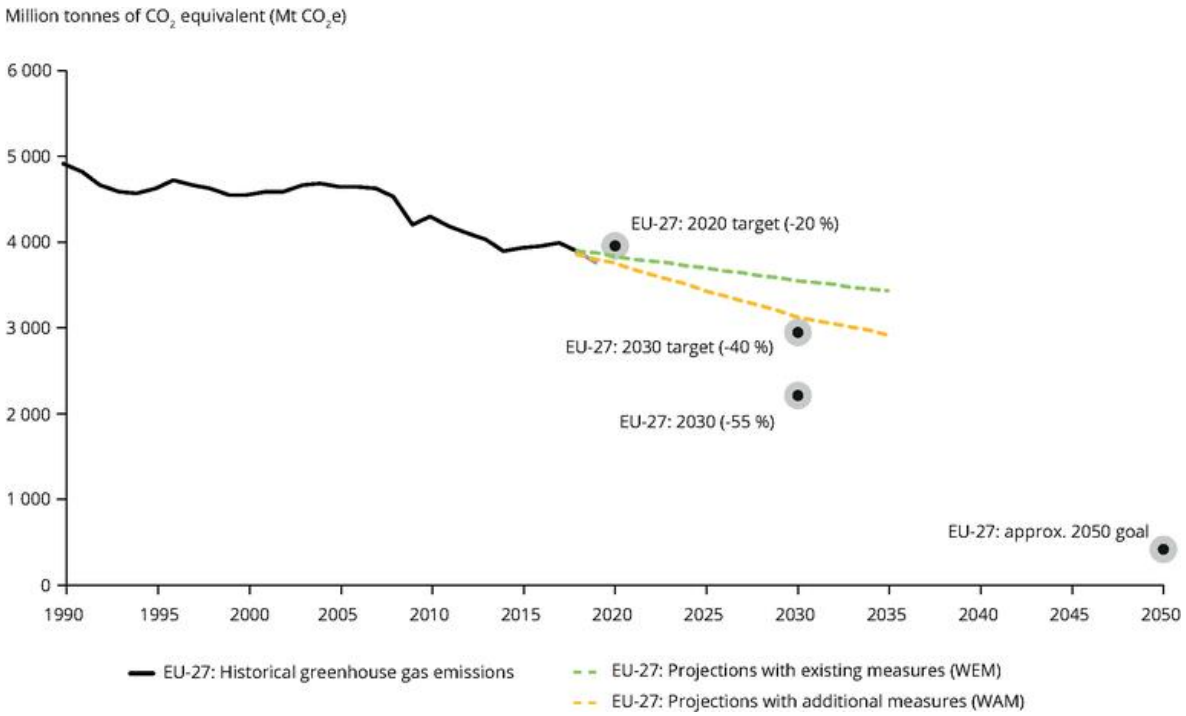

Figure 6: Greenhouse gas emission targets, trends, and Member States MMR projections in the EU, 1990-2050

One way to regulate the Co2 emissions in the world is through the Emissions Trading Scheme (ETS). The Emission Trading Scheme is the instrument that ensures that all these companies are exposed to the same carbon price (CirclNL, 2021). The big change made by the European Green Deal and Fit for 55 package was the inclusion and application of the ETS to the shipping industry in 2023. The ETS is now in its phase 4, that started on January 1, 2021. It will end at the first goal of the Fit for 55 package, in 2030.

The European Emissions Trading System (ETS) was created in 2005 and became the world's largest carbon trading market. For more than a decade, the European Union has worked hard to limit the amount of greenhouse gas that can be emitted by setting a cap for the total amount of greenhouse gas that can be emitted. Several allowances, that are the currency of the carbon market, are issued. One allowance is equal to 1 tone of Co2 emitted (O'Brien, 2021). Each year, companies keep a certain amount of allowances to cover their emissions or face significant penalties that have to be paid. If the companies don't have enough allowances, they can cut your emissions or buy allowances from another emitter. On the other hand, if the companies have extra allowances, they can keep them for the next year or sell them to other

environmentally friendly companies. This flexibility makes sure that emissions are cut where it costs the least to do so. Overtime the cap is reduced and fewer allowances are issued. Companies have a financial incentive to cut emissions or pay others to do so. This cap-and-trade system covers around half of the EU's emissions and more than three quarters of the international carbon market. This flexible, cost-effective, and business friendly approach is helping the EU moves faster to a lower carbon greener future (CirclNL, 2021).

The European Green Deal reviewed the ETS in 2021 and decided that emissions allowances must decrease by 2.2% from 2021 onwards, instead of the 1.74% goal that was placed since 2005. Since the pace of emissions cuts has been increased, allowances will also follow that lead and be increased until 2024. The European Commission is planning an investment of 6 billion allowances in the maritime industry from 2021 to 2030. (European Commission, 2021d). The inclusion of the maritime transport sector into the ETS is planned for 2023. The ETS will be applied to vessels of 5 000 tones or more, which represent 85% of the maritime vessels (O'Brian, 2021). This concerns emissions from all trips that are made inside the European Economic Area (EEA). For extra-EEA voyages, trips that are made between an EEA port and a non-EEA port, 50% of the emissions will be taxed. ETS obligations will be gradually phased in. Ship operators will only have to surrender allowances for 20% of their verified emissions reported for 2023, 45% for 2024, and 70% for 2025, 100% for 2026 (Jones and Piebalgs, 2021). The sanctions for not respecting the allowances quota can go up to 100 per extra tone of CO2 that is emitted. If the offense is repeated multiple times, the offenders could be banned from entering EEA ports for a certain number of years (O'Brian, 2021).

6.2. Co2 pricing – Carbon Border Adjustment Mechanism

The European Union is at the forefront of international efforts to fight climate change. But climate change is a global problem that demands global solutions. For maximum effect, the EU wants to inspire industry and trading partners outside of Europe to take steps in the same direction. This will also help avoid carbon leakage. Carbon leakage is the risk that industry moves from the EU to countries with lower environmental standards, or that the EU market gets flooded with carbon-intensive goods (EU Tax and Customs, 2021). Therefore, the European Commission has added the Carbon Border Adjustment Mechanism (C-BAM) to the European Green Deal.

To understand the CBAM, we must go back to the ETS regulations. The critical thing for companies that still emits CO2 is how to get their hands on the remaining emission allowances. There are two options. The first one is auctions by member states and buy emission allowances at the going rate. The second option, so far, on that ETS is free allocation. Many companies in Europe compete with non-European companies. The reason behind the free allocation of emission allowances was introduced to limit the competitive disadvantage of European producers and prevent them from leaving the European Union to settle in pollution havens. How does free allocation work? Let's assume we have a European factory and another factory outside the European Union. They both produce the same good at the same production costs and they are selling it in Europe. The factory producing the merchandise in Europe will have to pay an extra fee, under the ETS scheme. Suddenly, this factory is no longer competitive because the consumer is no longer willing to buy the product due to its higher prices. This leads to companies moving outside the EU to avoid these emission taxes. Therefore, the free allocation emission allowances are applied to specific sectors that are open to this risk. However, the amount of free allocation emission allowances that are allocated for free is decreasing overtime (CirclNL, 2021).

There are multiple ways to have carbon leakage in the maritime industry. During the voyage between a non-EEA port and an EEA port, an extra port that is not in the European Union but close, such as Morocco, could be added to the schedule of the trip. The ETS solely taxes the emissions of vessel that dock in the ports of the European Union. With the regulations of the ETS, only 50% of the emissions will be taxed because the port of loading or unloading is not in the European Union. However, if the vessel has traveled from China to Morocco and then Morocco to Rotterdam, only 50% of the emissions between Morocco and Rotterdam will be taxed. The emissions between Morocco and China will not be taxed under the ETS. Another point that could lead to carbon leakage is the fact that the ETS only applies to the vessels that are 5 000 gross tonnes or more. The merchandise could be transported with container vessels and just before arriving at an EEA, the merchandise is transferred to a vessel that is 5 000 gross tones (Faber, Leestemaker and van den Berg, 2022)

This is where the Carbon Border Adjustment Mechanism (C-BAM) arrives. The change with the European Green Deal is that now producers from outside the EU must pay the equivalent price at the border. As mentioned, European emitters by emission allowances that allow them to emit one ton of CO2 per allowance. Producers from outside the EU must buy CBAM certificates that is the equivalent of the price European producers are paying. When they are in possession of this certificate, they are allowed to export

to the European Union and sell goods to European consumers. There is a 10-year introduction path associated to the CBAM that is proportional to free allocation emission allowances. For example, in a specific chemical sector or industrial sector that is under the ETS in 2022, they get 80% of their allowances through free allocation and 20% via auctioning. In that case, its non-EU competitor would have to buy CBAM certificates for just 20% of its emissions. 10 years can be seen as a long time to treat carbon leakage and the move of European companies outside the EU but there is a slow effect. What this 10-year introduction path effectively does is decrease the period substantially over which it is profitable to move your factory to a non-EU country (CirclNL, 2021). The C-BAM and the ETS should be careful when it comes to the first port of call, to avoid carbon leakage. If the companies can schedule their voyage by avoiding that the EEA port is the first port of call, the ETS and the C-BAM is not as effective (Faber, Leestemaker and van den Berg, 2022).

6.3. Taxation on fuel – Energy Taxation Directive

The tax is set per liter of fuel that is used. These rates were decided in 2003, which is why they are a bit outdated. Each member state applies these rates with the amount that they deem fit, but the EU sets a minimum for these rates. Since the prices in the market have increased, the minimum set in 2003 is not effective anymore. Over the past few years, more and more sustainable alternatives have become available. The energy density of one liter of the sustainable fuel is typically lower than a liter of fossil fuel. So, if the same rates are applied to sustainable and fossil fuels, the person using sustainable fuel will have to pay more taxes on the same distance travelled by a person using fossil fuels, because the sustainable fuel vehicle will have to use more liters. This puts sustainable fuels at a disadvantage compared to fossil fuels (CirclNL, 2021).

The European Commission reviewed the Energy Taxation Directive, as it was created in 2003. The revision of this proposal was acted in the European Green Deal and the Fit for 55 package. The main point that was changed is the problem that was stated above. Taxes will be higher on fossil fuels than on renewable fuels, to incentive vessels to make use of more sustainable alternative fuels. This decreases the price gap between fossil fuels and alternative renewable fuels. The big difference between the ETS and FuelEU is that this taxation on fuel, compared to the FuelEU that taxes greenhouse gas emissions, is that this tax is imposed on bunker fuels that are used for intra-EEA trips. Each European Member State is free to decide whether they apply this tax on the extra-EEA voyages, and at which rate if they decide to tax them (EU

Tax and Customs, 2021). To remove the relative price advantage of fossil fuels, the member states will no longer charge per liter, but per gigajoule, as seen in table 2. This represents the energy content per number of kilometers that a vessel can travel on it. This makes it also a much fairer way of applying taxes, based on their environmental impact and their energy content. Each category has their own tariff per gigajoule. For the fuels with the extra € sign above on figure 7, the tariffs will gradually increase over the ten years after 2023. It is called the Transition Period. (CirclNL, 2021).

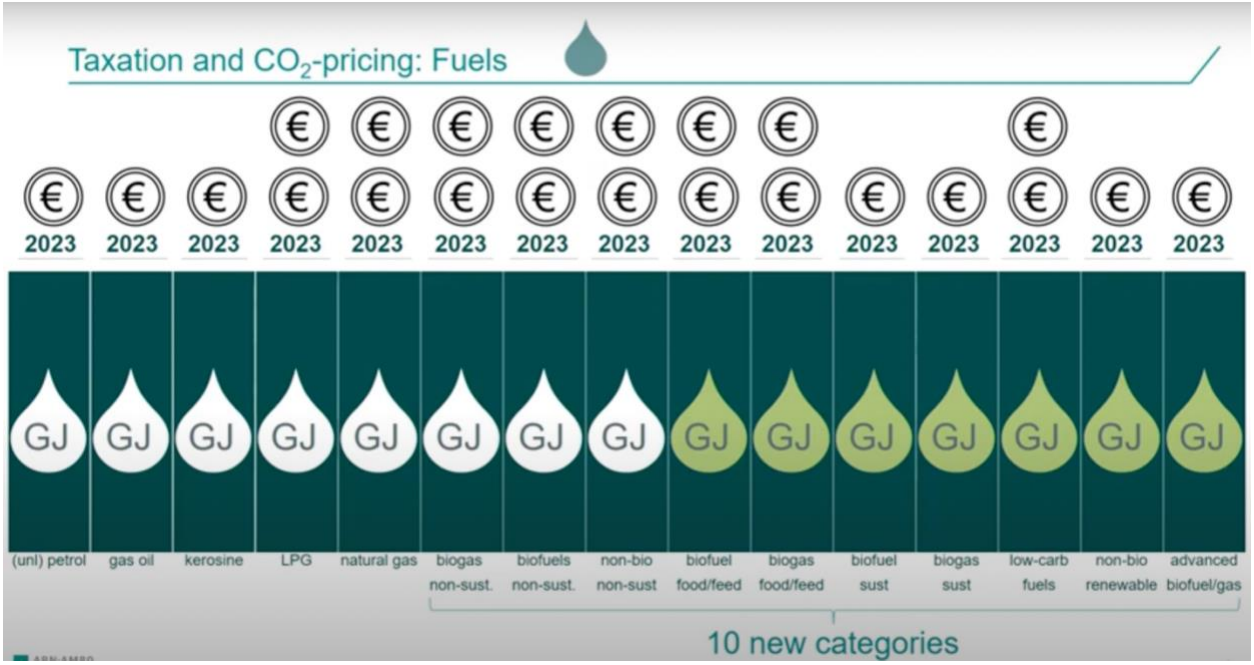

Figure 7: Taxation and Co2-pricing on fuels

Table 2: Fuel Rates based on the Energy Taxation Directive (Hansen & Roche, 2021)

Fuel	**Rate**	**Change after the Transition Period?**
Gas oil, Kerosene, HFO, non-sustainable biofuels	0.9€/GJ	No
LPG, LNG, non-sustainable biogas, non-renewable biofuels	0.6€/GJ	Yes, increased to 0.9€/GJ
Sustainable food and feed crop biogas and biofuel	0.45€/GJ	Yes, increased to 0.9€/GJ
Sustainable biofuels and biogas	0.45€/GJ	No
Low carbon fuels	0.15€/GJ	Yes, increased to 0.45€/GJ

6.4. Targets for Alternative Fuels – FuelEU Maritime

The fuel that is used for vessels is called “bunker”. The terminology of this word comes from the fact that the first vessels were powered by coal and bunkers were the storage space for coal. In the 20th century, there was a drastic change from coal to fuel oil because marine diesel engines were more efficient. Currently, most of the large merchant vessels make use of heavy fuel oil (HFO). However, this fossil fuel contains air pollutants that leads to CO2 emissions and the rise of climate change. For the 2030 target, the use of HFO with reduced navigation speed with the mix of technologies is still possible. However, at this rate, the 2050 target of zero emission will not be achieved. Therefore, alternative fuels need to be used (Takahiro, 2021).

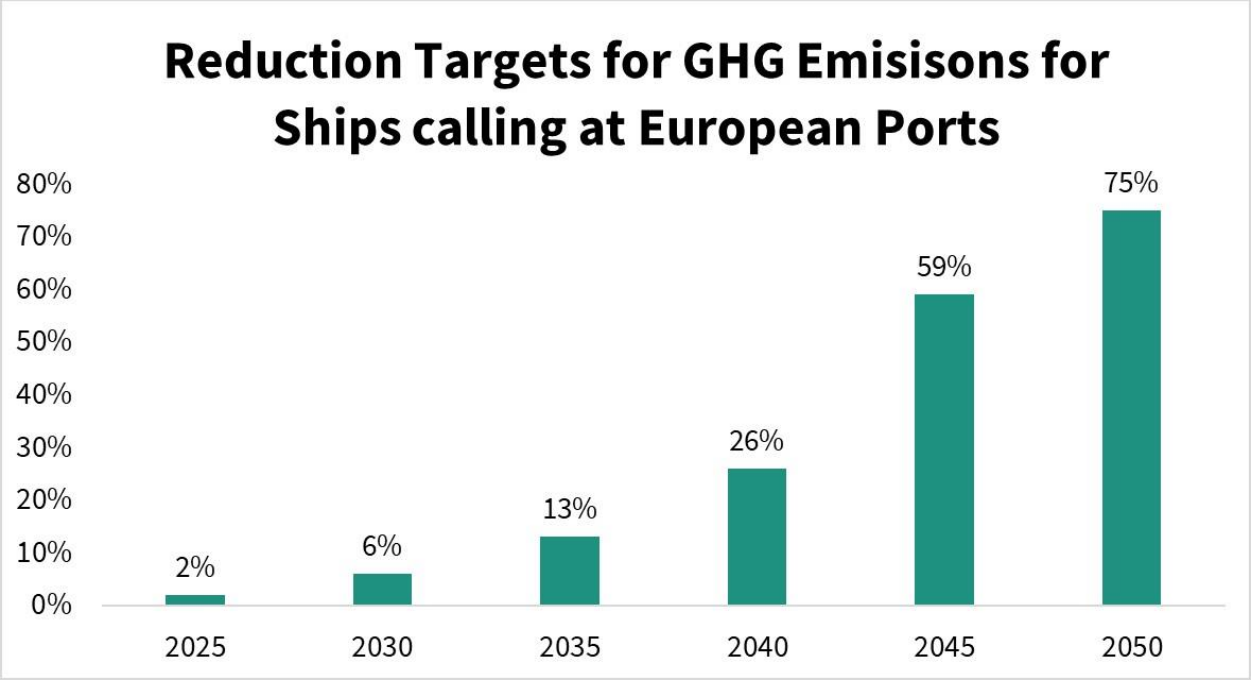

Figure 8: Reduction Targets for GHG Emissions for Ships calling at European Ports

The Fuel EU maritime is a new proposal that was added through the Fit for 55 package and the European Green Deal. This proposal is the first requirement and limit regarding greenhouse gas intensity on shipping fuels that are used on-board, but also when the vessels are docked at the port. For vessels to be able to reduce their GHG emissions, the FuelEU Maritime gradually obliges ports to install zero-emission technology and for vessels to be equipped with an onshore power supply (O’Brian, 2021). With the limit, the goal is to stimulate demand for renewable and low-carbon fuels in maritime transport. (Bjerre, 2021).

The limits regarding the reduction of greenhouse gas emissions will gradually increase overtime, as seen in figure 8. Just like the ETS, the regulation applies to all the energy used for all intra-EEA voyages. For extra-voyages, meaning that either the departing port or the arrival port is not in an EEA member states, the regulations will only apply for half of the energy used. Another point that is comparable to the ETS is the reselling of allowances. In the case of the FuelEU, there are no allowances, but shipowners can transfer some of their surplus GHG emissions to another vessel in their possession. The reduction target for shipowners is the average of all their vessels. If one vessel has a higher GHG intensity, this surplus can be compensated by another vessel, of the same shipowner, with a lower GHG intensity. The shipowner is the one responsible for making sure its vessels are compliant, at sea and at berth. If the annual greenhouse gas intensity of the energy used for all vessels of the shipowner are compliant, a FuelEU certificate of compliance will be given. This certificate must be carried by all vessels. Regarding penalties, they will be calculated based on the extra amount and cost of renewable and low-carbon fuel. The revenue of the penalties will be used to fud research and development projects for renewable and low-carbon fuels. (Rein, 2021). Regarding the person responsible for paying the penalties, it is stipulated that the shipowner is responsible for the greenhouse gas emissions. When signing a contract with the shipping companies, it must state the shipping companies are responsible for the greenhouse gas emissions that the vessel they use emits. If that is not the case, the shipowners will be responsible for the penalties, according to the FuelEU maritime (O'Brian, 2021).

In figure 9, we can observe the different types of alternative fuels, as well as their advantages (green points) and disadvantages (red points). They can be divided into three categories. First, we have the carbon fuels, with LNG (Liquified natural gas) being the most important. This alternative fuel produces low GHG emissions, between 7% to 22% depending on engine cycle. It is possible to combine it with diesel/carbon fuel, which enables the vessels to reduce their GHG emissions up to 80%. However, even though LNG is a long-term solution regarding the availability, the sustainable side of this fuel is not a long-term solution. LNG is still a fossil fuel and it big disadvantage is methane slip. With the combustion of LNG in the vessel's engine, methane, a potent greenhouse gas, is emitted, which leads to Co2 emissions. A second challenge, but that seems to be decrease, is the infrastructure and cost of LNG. This will be discussed in the next point, regarding alternative fuels infrastructure directive. The other carbon fuels, such as LPG (Liquified Petroleum Gas) and methanol and ethanol are not that different from LNG. LPG also emits methane slips, and the infrastructure is lacking a lot more than for LNG. For methanol and ethanol, they are very easy to handle but the infrastructure is not ready for these toxic and flammable

gases. The second category are the carbon neutral fuels. Biofuels/biomethane are becoming more and more available in the maritime industry. The bid disadvantage is the mass production of biofuels, as it is not sustainable. Regarding substitute natural gas (SNG), synthetic methane and bio-methane, they are a good solution when it comes to mixing them with LNG. As explained above, this is not a sustainable long-term solution due to the risk of methane slip. The last category are the alternative fuels that emit zero carbon when sourced renewably but need the most developing and financing to reach the 2050 goal. These zero carbon fuels were not directly adopted because they have a much lower energy density than fuel oils. This possesses a big problem regarding the storage of hydrogen or ammonia for long distance travels. The availability and infrastructure of ammonia is much more available than hydrogen. However, the toxicity of this fuel is a major concern. If handled well, the storage for long-term voyages would be the best option, under strict guidance rules (Marine & Offshore, 2021).

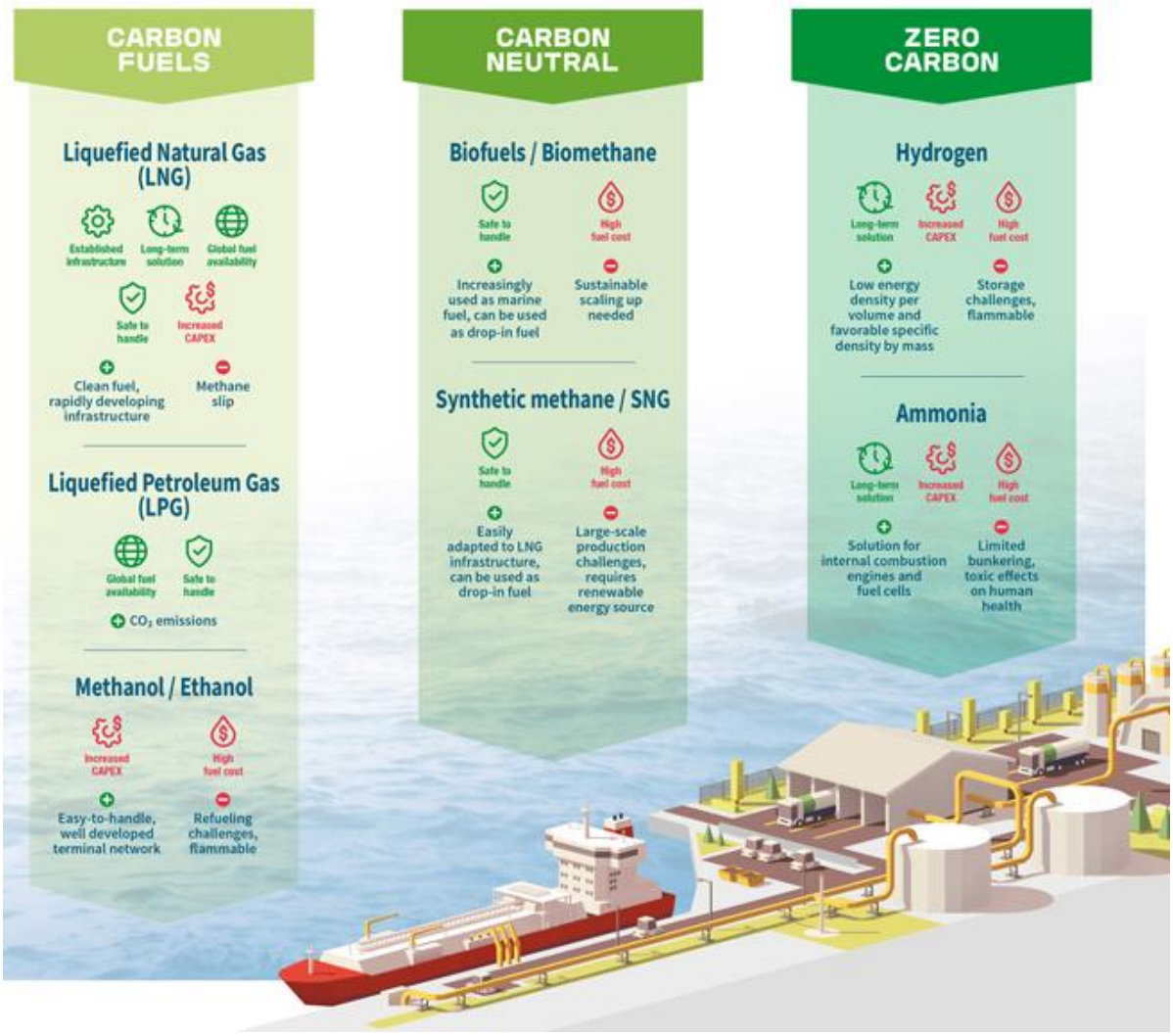

Figure 9: Different types of alternative fuels

6.5. Alternatives Fuels Infrastructure Directive – Trans-European Networks for Energy Regulation

Since the 90s, the TEN-T (Trans-European Transport) Network has been available, as seen in figures 10 and 11. This was a strategic agenda to make sure that any region in Europe would be reachable. Traveling from side to the EU to the other side would be easily possible and that there is some sort of structural development along those trade routes. The maritime industry has a core and comprehensive network. There is a distinction between the core and the comprehensive network. The core network allows vessels to easily travel in the European Union. The comprehensive network makes sure that every region in

Europe is reachable and connected, to make sure that there is good coverage. This distinction is critical because it makes a clear distinction for the rules that apply. (CirclNL, 2021)

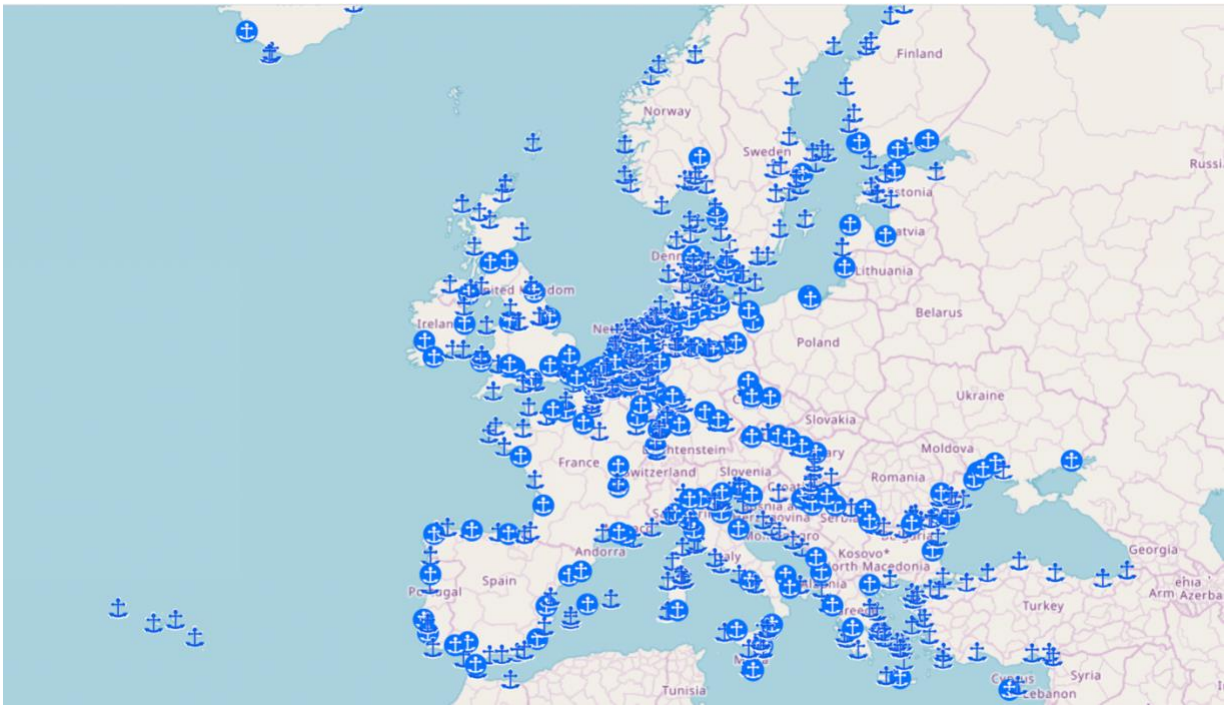

Figure 10: Core network of the Trans-European Networks for Energy Regulation

Figure 11: Comprehensive network of the Trans-European Networks for Energy Regulation

Core Network Comprehensive Network

Through the Alternative Fuels Infrastructure Directive in the European Green Deal and the Fit for 55 package, the TEN-T has been updated. There are a lot of inland ports and some ocean ports. By 2025, LNG is still a very possible alternative to move away from even more polluting maritime diesel oil equivalents, which is really the dirtiest fuel. By 2025 and onwards, there should be an LNG refueling installation in ports allowing seagoing ships along 10 core networks. Also, shoreside electricity power should be installed, both for inland and ocean-going ships, adapted for containerships and passenger ships (O'Brian, 2021). Specifically for inland ships, by 2025 along the core route, there should be at least one shore power installation and along the comprehensive network by 2030. For oceangoing ships, by 2030, along core and comprehensive networks, so all harbors, 90% of the demand for shore power should be met by harbors. This is 90% of the demand from ships greater than 5000 gross tones. They will also be inclined mostly to switch to more sustainable alternatives and 90% of their demand should be met by 2030 in terms of shore power (CirclNL, 2021). LNG infrastructure is the one that is pushed the most because it is the preferred fuel source now, according to the FuelEU Maritime. Other alternative fuels that were mentioned above, such as ammonia, need to be discussed further in 2023, as the technology for the infrastructure is not completely developed, compared to LNG (O'Brian, 2021).

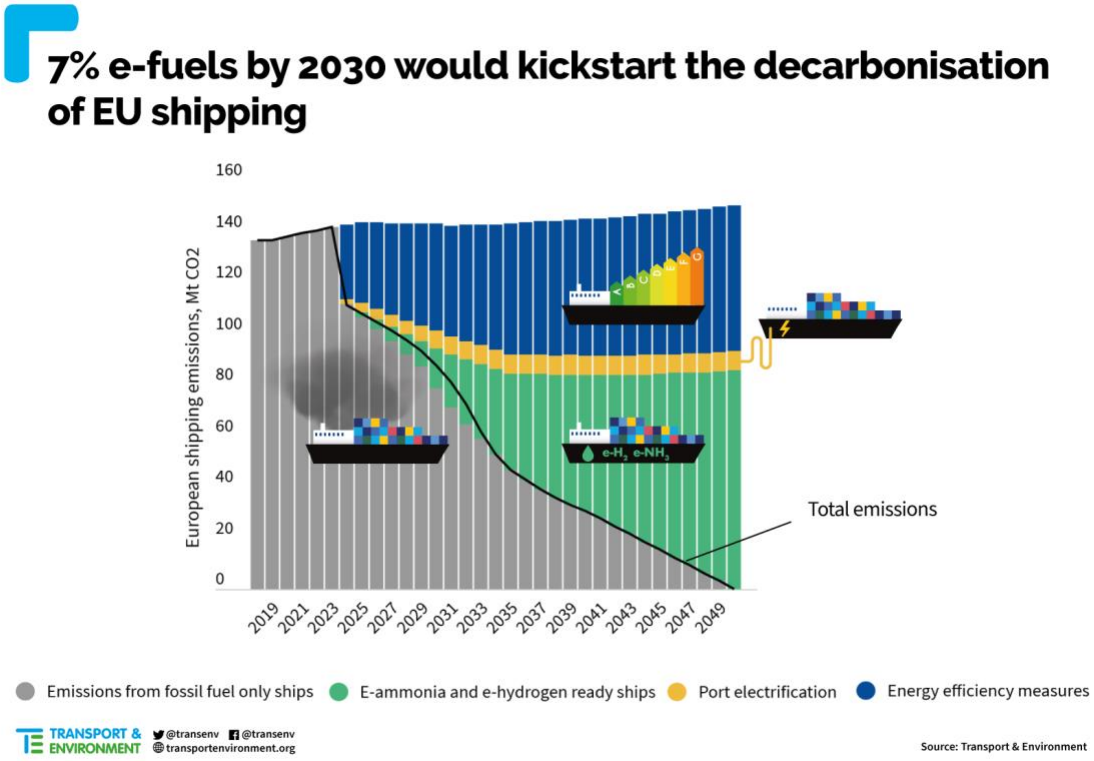

Figure 12: The use of e-fuels for the decarbonization of EU shipping

7. Methodology

For my qualitative data, I decided to interview people that were working in the maritime industry, under various sectors. I carried out 1 interviews. The table 3 summarized all of them, with their name, the position, and the company where they work. For each interview, I presented my thesis and recapped in a short summary each of the 5 policies that I was interested in my thesis and their targets. I then asked the question "What makes the European Green Deal revolutionary compared to other climate policies?" to start the conversation about their opinion of the European Green Deal in its whole. Once they had answered the first question, I would bounce back on what they said, keeping the same process of thought behind each interview; to make sure that they give their point of view on at least three of the five policies above. I decided to not push for the opinion of all the people on all the five policies, as some were not comfortable to make a statement about certain regulations, due to their lack of knowledge on them. I made sure that an opinion was given each policy was at least by 4 people in the maritime sector. That way, I would have multiple point of views, negative or positive, from multiple sources. As the conversations from my interviews represent my qualitative data, I wanted to make sure that not only one opinion would be used to judge the limits and targets of the policies.

Table 3: Summary of the people interviewee's name, position, and organization

Name	Position	Organization
Anink, David	Policy advisor maritime and economics	Ministerie van Infrastructuur en Waterstaat
Depredurand, Philippe	Europe advisor in charge of biodiversity	Cabinet of the Secretary of State to the Minister of Ecological Transition
Di Marco, Galliano	Senior Advisor	Port Authority of Venise
Folmer, Henk	Senior Vice President, MSc., Head of Customer Led Solutions Europe	Prologis
Lurkin, Nick	Senior Advisor – Climate and Environment	Koninklijke Vereniging van Nederlandse Reders (KVNR)

Machu, Pascal	Elected representative of Seine et Marne in charge of sustainable development - Climate expert	City Hall of Seine et Marne
Mogni, Andréa	Senior Financial Consultant on EU affairs in Sustainability	European Commission
Ponis, Marta	Director	RINA Consulting
Scholten, Daniel	Strategic Advisor Energy Transition	The Netherlands Authority for Consumers and Markets
Virlet, Alban	Advisor in charge of industrial affairs, air transport, maritime sector, and ports	Office of the French Minister for transport
Interviewee does not want to be mentioned	Solution Design Manager	DHL – Transport Supply Chain

8. Results from the interviews

8.1. The European Green Deal

From all the interviews, the main conclusion that comes back is that the European Green Deal can be implemented and could be successful, but at what cost for the European economy? If other major countries do not follow, such as China, the United States and Japan, the European industry is penalized with obligations that others do not have, obligations that have a cost. According to Alban Virlet, that maritime decarbonization is something that is being played out at the international level, then at the European level, and then at the regional level. David Anink says that before we even think of applying the European Green Deal to other countries, it is very important to have all member states of the EEA supported and on the same page. There are some regions in Europe that need more support than others. He states that “If Poland doesn’t get rid of their coal power plants, then we have a problem. We need to support these European countries in making this transition as well. On the other hand, if you want to create energy from the sun and then in central Spain you are in a much better place than you are here in the Netherlands.” Daniel Scholten follows the trend by saying that if other countries outside of the EEA sign up to follow the same regulations, there will be a group pressure to perform. With individuality, we will get nowhere regarding sustainability. Climate is a global issue and only a global solution can have real

results. Philippe Depredurant really pushes on the point that the European Green Deal is not just a motivation for the rest of the world, but also a test. With all the different policies and measurements that need to be kept track of, the European Union needs to see if the organization is possible. There are often a lot of diplomatic negotiations, and if the member states of the European Union do not first agree, how will the rest of the world follow? Pascal Machu has a much more radical saying, stating that the root of the problem is the international trade and that the European Green Deal will not make that big of a change for climate change. There is a human factor that must be considered. If people continue to order goods from the other side of the world, climate change will always be there.

Andréa Mogni insisted on stating that the European Green Deal is a package of regulations that could leave to the change of the intermodal transport. “If you consider road and air transport, maritime transport is the most efficient system in terms of CO2 emissions per ton of goods transported per kilometer”. With the new technologies and alternative fuels, the transfer of goods between ships and truck or rail could be completely changed.

One of the biggest problems of the European Green Deal is the constant need for the update of the regulations. The maritime supply chain is willing to make changes, but the costs will be high. The war in Ukraine is the best example of how one event can have a huge impact on all these regulations. The war in Ukraine will affect Europe’s entire energy supply (Adrianna Tibuzzi and Pascal Machu). The carriers have seen an increase in fuel prices but the price the customers will pay did not change so it is not profitable anymore. If a meeting needs to be taken every six-month due to problematic events, the maritime supply chain will not be able to survive the switch to more expensive alternative fuels. The meetings take too much time. This claim is also supported by Alban Virlet, stating that “we are in a period where there is uncertainty about the cost of energy in view of the war in Ukraine”. COVID was the perfect example for these changes. The European Green Deal was acted in December 2019 and then the pandemic hit. The Fit for 55 package was then inserted into the European Green Deal on July 14th, 2021. There were a lot of changes made. Galliano Di Marco and Henk Folmer, on the other hand, believes that the COVID and the war in Ukraine can have some sort of positive impact on the push towards innovation. With the need to review the strategic implementations all the time, the European Commission will be able to assess whether the limits are working and adapt in time if not. Philippe Depredurant is under the impression that

the war in Ukraine is causing a kind of J-curve. He states that “In the energy organization of the Member States, the investment curve is J-shaped. Then, little by little, it goes up and we exceed the initial investment. Afterwards, we benefit more and more”.

Nick Lurkin points out that all the policies that have been discussed in this thesis are geared towards punishment and not reward. There is not a real reward for the sectors that made the first move, which decreases the incentive to accelerate the conversation of our industry even more. He fully agrees with the base principle of the European Green Deal. The ones that do not follow the rules should be penalized. However, there is no mention, in the policies, about the principle of rewarding the first movers. If the maritime industry must compete with the other heavy Industries, such as aviation, which is also currently on the ETS, then they are behind in the queue. Especially with the fact that there are a lot of small and medium sized enterprises that would make the extra step if incentivized.

8.2. ETS

One of the positive points that was reinforced by Alban Virlet was the use of the revenues from the penalties of the ETS. Within the framework of the ETS innovation fund, which is a European fund that receives a certain amount of income from the ETS, there is a capacity to support maritime projects. Multiple studies regarding cap-and-trade systems, for all modes of transport, were made to look at the advantages and disadvantages that allowances bring. Gains from the penalties are stated as one of the main advantage (Flachsland, Marchinkski and Edenhofer, 2019). For Pascal Machu, the world needs to be set on limits and pay for penalties, otherwise no one will be doing anything. The world revolves around money. He believes the ETS is a good way to start because the delivery cost of goods will increase more and more if companies continue to buy from the other side of the world. If people can already start buying goods only in the EEA, this will help reduce the emissions. The maritime industry will be able to reinvent itself in Europe, while still decreasing its CO2 emissions. He states that “At some point, we must also educate the consumer. Pineapple, mango, avocado, it should not be an everyday product. The only way to make it an everyday product is to tax it. People will understand that.” If people can reduce consumption, this will also help the European Commission to update domestic policies, making them easier to apply for European vessels. There could be an enhancement when it comes to perfecting

domestic policies. According to Andréa Mogni, slowly decreasing the number of allowances is a perfect way to trap companies that will make no effort to change their way of shipping. David Anink believes that with the decrease of allowances, shipping companies will be able to invest in new tonnage, hopefully hybrid. The ETS is now entering in its phase four (2021-2030). The European Commission strengthen the investment driver for the development of adequate technology (Abdel-Ati, 2020).

However, the problem with shipping is that it is a cost intensive industry, very high cost, small margins on the benefits. It's normal to have 2% or 3% margins on the investment. Therefore, it is so important to make sure that their cost structure is at least the same as their competitor. The cap-and-trade system often leads to the risk of pushing reduction targets that are not able to be applied in the whole world (Flachsland, Marchinkski and Edenhofer, 2019). On the other hand, Marta Ponis believes that companies can plan ahead all they want, but if the technology is not there according to their time frame, it will not be possible. The basic timeline is the decrease of allowances, which allows companies to think of the alternatives. But if these alternatives do not follow the same timeline as the decrease in allowances, companies will not be able to follow. They will have to pay penalties and that will have a huge toll on their investments, especially for small companies. Tightening allocations may harm small actors in the maritime supply chain.

8.3. Carbon Border Adjustment Mechanism

The Carbon Border Adjustment Mechanism is indeed the policy that considers the problem of carbon leakage that could arrive due to the strict rules of the ETS. Will there be a risk that a ship coming from the United States or stopping in the United Kingdom or in Tangiers, and then ending up in Europe to circumvent the ETS regulation? This is the question of carbon leakage. According to Alban Virlet, the commission made the calculations, estimating that there would be additional port fees to pay when you stop twice, that there are pollution costs, and additional travel costs. The commission considers that the risk is rather measured.

The main problem that the C-BAM is trying to fix is the regulation of European vessels that register in non-EEA countries, to avoid the increased tax from the Energy Taxation Directive and the Emissions Trading System. This problem has existed for a long time. The IMO's regulations regarding the ship's registrations is the best example in the last 10 years. A scheme resembling carbon leakage was developed, called the flags of convenience (FOC). Shippers, consignees, and carriers would register the vessel in a different member state that the one from the shipowner. This would allow them to decrease operating costs, as well as avoid the regulations of stricter countries regarding taxation. It was calculated that between 2014 and 2018, 80% of vessels around the world were sailing under a FOC (Pape, 2019). The surprise came, when the countries that supposedly had the most amount of tonnage were Bangladesh, India, and Pakistan. However, the countries with the highest revenue made with the maritime industry were the European Union, the United States, South Korea, and Japan (Schiermeier, 2021).

With the flag of convenience still being an issue in 2021, how will it be possible to enforce the Carbon Border Adjustment Mechanism? The C-BAM will be very difficult to enforce, as we live in a global world. Daniel Scholten gives the example with a Chinese company: "However, if you are a Chinese company, you have coal fired power plants and you have renewable offshore wind parks and then you're going to use coal that to make a product, but then on paper you can just make it show that you bought it from the wind farm and then it's green." However, as the goal of the European Green Deal is to inspire the rest of the world to follow in their footsteps, a coalition could be made, imposing the same C-BAM regulations and measurement details. It was estimated in 2019 that 96% of the EU-owned ships were able to register in low-income countries (Schiermeier, 2021). Phillipe Depredurant reinforces this point by stating that it is already complicated to keep track of emissions on a European level. Since the shipping industry is international, where the carrier can be from Spain and the shipper from the Netherlands, it is hard to know under which country and company the emissions fall. This means that the European Union would have to trust the authorities of other countries to measure and tax the same way that they do with the C-BAM. However, most "flag of convenience" nations are the member states that tend to have a small interest in regulations. (Schiermeier, 2021).

8.4. Energy Taxation Directive

The Energy Taxation Directive crucially needed to be updated. In the last 10 years, alternative fuels have been researched and developed for vessels to run in a greener manner. The renovation of the rates and the change of the measuring from liter to gigajoule was big a step that helped a lot. Just like for the ETS, David Anink, along with Andréa Mogni and Nick Lurkin, believe that with an update taxation system, companies will also update their business plans. They can prepare for the future taxation of fossil fuels and already decide how they will handle it by gradually switching to alternative fuels that allow the decrease of Co2 emissions.

Marta Ponis, Philippe Depredurant and Alban Virlet believe that the taxes on alternative fuels, especially LNG, should not be increased because we have no concrete solution. The European Green Deal is planning too far ahead with too many "if" situations. LNG is the best alternative fuel for the moment. Once another alternative fuel is developed with the same storage capacity, availability, port infrastructure, then the talk about increasing its tax will be dealt with. LNG can be used to mix with ammonia or to convert it into hydrogen. At least, the ship owners will start ordering ships with dual fuel engine which can be easily converted to hydrogen or ammonia in the future rather than putting on board a diesel engine. LNG should be pushed as a long-term solution, and not as a temporary solution. There is not enough to switch directly from diesel to hydrogen or ammonia. The International Chamber of Shipping (ICS) and the European Community Shipowner's Associations (ECSA) confirm this fear that a too large emphasis will be put on LNG, and the rest of the biofuels will not be as much developed as wished (Editioral Team, 2021). She states that "The big companies that can be seen as pioneer, such as Maersk, are developing pilot projects, which is helping the development of the technology. They are ordering test engines with ammonia. This is a testing phase. However, if you must order a ship and you are not a big company such as Maersk, that can afford a ship just for the sake of testing, it is harder to adapt."

8.5. FuelEU

By creating an area in which shipping is forced to substantially reduce its greenhouse gas emission, it will also create a market for clean ships. That is very important because without that market, without the demands, the supply will not follow. The FuelEU has the potential advantages of stimulating demand regarding low and zero-carbon marine fuels. David Anink, Marta Ponis and Philippe Depredurant all refer

to the chicken and egg problem. Should the demand or the supply take the first step regarding the investment in alternative fuels and the infrastructure for ports and vessels? The beginning of the market is the difficult one. At certain point you get to a level and then it starts to roll out automatically. Then, it becomes fireball, the business cases become more attractive, which could lead to the building of economies of scale. The FuelEU can identify the IMO GHG Strategy barriers, making it a policy that tackles known problems and develops adapted solutions, based on the barriers of the IMO (Editorial Team, 2021).

There is one big problem. Companies are always trying to push the greener solutions towards their customers. If the final customer has an interest in products that are made and shipped in an eco-friendly manner, the company will adapt. However, in the FuelEU, it is stated that the shipowners will be the ones to pay the penalties in case the vessels emit more greenhouse gas emissions than permitted. In her point of view, the final customer will be the one that is taxed, rather than the service provider. In the case of DHL, it is very hard to see who must pay the extra penalties. Is it DHL themselves because they are the ones that make use of the vessels or the customers that ask for a non-sustainable solution because they do not want to pay the extra price for sustainable fuels? Most of the time, customers are always looking for the cheapest option. The pressure and penalties should always be on those requesting non sustainable solutions.

The FuelEU maritime focuses mainly on new alternative fuels and how new vessels can be created. However, Nick Lurkin is worried that the policy does not consider the existing fleets and how they can be adapted to the new alternative fuels. There's no one size fits all solution. There are different solutions. The developing technology needs to look at how to compensate with the existing fleet. There is slow steaming but after a while, this is not a solution anymore. The shipping industry cannot reduce or be more efficient than what they are already doing. There is concern that if the costs of fuels increases and these alternative fuels are pushed too much, resources for other alternative measures will not be invested (Editorial Team, 2021).

8.6. Alternatives Fuels Infrastructure Directive

The restructuring of ports is also the possibility to optimize the access of ships to terminals. Andréa Mogni states that “When a ship arrives in a port, it should not wait to unload its cargo. It should have direct access to get out as fast as possible. If you keep a ship in front of the port for 10 days and you don't allow the unloading, the ship is stopped but it consumes. It produces CO2 and therefore it is a source of pollution.” Even with the use of alternative fuels, such as LNG, the Co2 emissions that are emitted when a boat is docked at a port are playing a big role. Philippe Depredurant believes that the rate of decarbonization of the road transport will also a big factor for intermodality. “Everything will depend on the main rate of decarbonization of road transport, which is the most frequent and most massive means of transport, whether in terms of value or even quality of goods. If decarbonization lags on road transport, maritime transport will benefit.”

According to Alban Virlet, the big issue is the electrification of ports. The challenge is to determine the number of stopovers per year that the port will have to install charging stations. Not all ports can be treated the same. The expense of buying a charging station for a small port is a much bigger percentage of it expenses than for a bigger port, such as Rotterdam or Antwerp. The small ports will charge higher fees for charging, and vessels will not want to dock there anymore. They could decide to have a big port as their end destination and ship the merchandise through inland transport for the destination. Small ports could lose a lot of competitivity if the same regulations apply for alternative fuel infrastructure applies to all types of ports. On the sustainable side, the intermodality does not necessarily decrease the Co2 emissions, making the alternative infrastructure obsolete. This reasoning was already backed up by the European Federation of Inland Ports in 2020. The Alternatives Fuels Infrastructure Directive is the policy in the European Green Deal that is the least limited when it comes to objectives and goals. For example, inland ports goals are not specifically determined. The AFID is not well designed for inland ports, for example. There will be an oversupply in some areas, and in consequence, undersupply in others (The European Port House, 2020).

9. Conclusion

This master thesis makes an analysis to answer the research question: “Is the application of the European Green Deal on the maritime industry effective to reach climate neutrality in 2050?” To answer this

question, I based myself the theory regarding the limits, targets, and regulations for 5 policies that directly affected the maritime industry in the European Green Deal, more specifically the Fit for 55 package. Once the theory was examined, I interviewed 11 people that work in the maritime industry to understand if the zero-emission goal of 2050 was achievable through the policies of the European Green Deal. The discussion with these 11 people is my qualitative data.

Regarding the subquestions, each policy has its positive and negative points. Regarding the fact that European Green Deal was revolutionary, the conclusion is that if we see a reduction of Co2 emissions in Europe in a couple of years, this means that the policies implemented by the European Green Deal give good guidelines to the industries on how to be more sustainable. The European Green Deal is in itself a test to see if this sustainable path can be implemented to the rest of the world.

The Carbon Border Adjustment Mechanism will be very hard to implement in Europe, let alone the rest of the world. The basic calculations and risk analysis make it a good policy to avoid carbon leakage from the decrease of allowances of the Emissions Trading System, on paper. The Europe Commission must trust and check that the measures made by non-EEA companies are accurate. With the FOC issue being resembling the problem of carbon leakage on a taxation level, the outcomes of the C-BAM are not optimistic. According to the interviewee's answers, if the European Union is not able to solve the FOC problem, how will they be able to enforce the C-BAM? The Emissions Trading System has the positive point of gradually decreasing the emissions allowances, making it possible for the maritime industry to plan. The ones that do not change will be penalized and the revenues from the penalties will be used for the innovation of maritime projects. However, there is a concern regarding the competitive side of EEA companies.

The Energy Taxation Directive was well updated to equal the price disadvantage that alternative fuels were having. The calculation of taxes based on gigajoule and not liter will incentives companies to choose for alternative fuels. The requirements that will be set also push towards the creation of demand, which will at the same time increase the innovation regarding supply. However, it is believed that the Energy Taxation Directive is based on too many uncertainties regarding the development of alternative fuels. There is a risk that too much emphasis is placed on LNG.

The FuelEU introduces a market for clean ships, along with the Energy Taxation Directive. This creates more demand and supply, pushing the research and development regarding alternative fuels. With the help of the Alternatives Fuels Infrastructure Directive, the switch towards the maritime industry being a main component of intermodality is incentivized. However, the FuelEU is still not clear on who must pay the greenhouse gas penalties, the shipowners, or the shipping companies. The other point that was not really addressed in the FuelEu and the Alternatives Fuels Infrastructure Directive is the conversion of existing fleets. There is also a growing concern for the economic disadvantage that small ports will face when it comes to the electrification of ports. It was already researched that the inland ports would not be able to adapt to the rapid changes in infrastructure.

The main answer that was common to all the people that I interviewed is that the European Green Deal's policies that were put in place all have elements that would make this regulation effective to reach climate neutrality in 2050, regarding the maritime industry, but a strict follow of the limits and follow is needed. The ETS uses the penalties' revenues and reinvests them in the research and development of the infrastructure and alternative fuels, increasing the demand and supply. The C-BAM can anticipate the carbon leakage problem that could arrive with the regulations of the ETS. However, it is the weakest link in the European Green Deal. The maritime vessels should be closely monitored to avoid vessels from docking in other ports close to the EEA ports. The ETS penalties' revenues used for research and development are effective for the FuelEU maritime regulations. These regulations push for the increase of supply and demand regarding alternative fuel vessels. With the alternative fuels infrastructure directive, the maritime industry's infrastructure can be standardized, making it more accessible to vessels. However, a change needs to be made regarding the regulations for smaller and larger ports. Small ports will not be able to survive the change in infrastructure if clear goals and investments are not made into them.

However, what will be the cost of the EEA maritime industry's competitiveness? If the rest of the world does not follow the same regulations as the European Green Deal very soon, then the EEA industries will not be able to survive cost wise. Even if it is believed that Europe could gain a significant advantage in the far future if the right sustainable technology is developed, the different sectors of the maritime industry

will suffer the economic consequences. The second main reasoning is that, even if Europe has zero Co2 emissions in 2050, this switch will not have a big impact on climate change and the decrease of global temperatures if the rest of the world does not follow. Europe represents around 17% of the world's Co2 emissions, while North America represents almost 18% and Asia around 53%, with China emitting 27% of Asia's Co2 emissions. Europe's sustainable path must be adopted by the rest of the world. The development of a stricter C-BAM is the first step. With the problem of flag of convenience, countries that are not as sustainably inclined as Europe will be able to evade taxes.

9.1. Limitations

There were some limitations. Regarding the people that were interviewed, they were around the same age range, between 30 and 50 years old. I believe that the opinion of younger and older generations would have been interesting. Younger generations are more pushed towards sustainability, as the problem of climate change has been a problem since most of them were born. With the first acknowledgement of climate change in 1997, most of the people that were born around this year are just starting to work. Their choice of university education and the company that they work at could be very much influenced by how motivated they are to fight for climate change. For the older generation, the people that are retired, they are more often reluctant to make a change, as they will probably not see the impact the catastrophic events if climate change is not dealt with. Two sectors that I was not able to interview people in was the bank sector. I tried to reach out to multiple people working in big banks around Europe, but they were less willing to agree to an interview with me, as they wanted to keep the numbers confidential. I would have liked to understand how they decide the amount of funding that is given to different sectors of the maritime industry, who is allowed to take out a loan, do they often refuse loans to companies that are not taking a sustainable path?

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Appendix – Interviews

Appendix 1 – Anink, David

Policy advisor maritime and economics - Ministerie van Infrastructuur en Waterstaat

The Hague, The Netherlands

29/03/2022

How is the European Green Deal revolutionary compared to other policies?

In general, normally, we would favor international measures to deal with international shipping. That's a very broad point of view. The reason for that is because shipping is an international business. You're always dealing with international companies with ships and their foreign flags. They sail from one point to the other, inside, and outside European waters. Because the climate is a global issue, the best way to solve this would be by having international measures which would apply to shipping all around the world. Secondly, the problem with negotiation of these measures is that you need to get an agreement with, I think now, 137 or 140 countries around the world. That's a bit problematic. We're working on that at IMO. There's the international initial strategy with goals to 2050. We now have an agreement on our first set of measures, but it's going slowly. The European Union has been pressuring IMO to come up with measures for international shipping already 10 years ago. They threatened the international shipping industry that they would set up an ETS for shipping, or make sure that shipping becomes part of the European ETS. They gave IMO some time to work on the agreement and measures, but now when the European Green Deal was there, they said that they waited long enough, and they can't move forward without considering emissions of shipping. Therefore, they proposed a set of measures which will also apply to international shipping. I think that, although it's suboptimal to try to regulate shipping by regional measure. I think it's an important step in the right direction because at least European countries show to the rest of the world that it is very important that we now do something about your missions of ships. Second, also, for example with aviation and with other measures, in the past, we've seen that once Europe threatens to start to make steps in a certain direction or is making steps in a certain direction, it will pull the rest of the world also to move into that direction. Hopefully we will manage to do so, because if it is only this set of measures from Europe and the rest of the world wouldn't do nothing then we won't solve

the problem. We need the rest of the world to really achieve something. It is more from a shipping perspective. Of course, we will reduce emissions around Europe but it's more of a symbolic step towards the rest of the world. In Europe, we really want to make a step in the right direction then that the matter itself will solve and create a greener shipping industry. The second part of this is by creating an area in which shipping is forced to substantially reduce its greenhouse gas emission, it will also create a market for clean ships. That is very important because without that market, without the demands, we won't see any take up of supply. That is on two sides. One is the side of the technology on board of the ship. We need modern ships which can run on methanol, hydrogen, wind propulsion or maybe even CCS on board of ships. If we want to support this take up of this technology, we really need to have these requirements which the shipping industry is forced to do so. The second part is the actual development of the fuel. Although there are still a lot of points on which we think the instruments could improve, but in general the way they've approached is by setting a set of measure on the fuel and set of measures on the emissions on the ship. This creates a market for sustainable fuels. That is also very important. You just can't solve it by just putting the right technology onboard of the ship. You also need the market of green sustainable fuel to have this whole maritime chain which needs to become carbon neutral. Hopefully, by doing so, Europe is a substantial market. If you look at international shipping, there are three main areas which determine how shipping will look like. Europe is the big one, we are one of the biggest markets in the world. Therefore, from a shipping perspective, we're very important. A lot of ports, a lot of shorelines. The other one is the United States of America. The third one is Asia, dominated by China, Japan and Korea. These three areas together can decide whether we move on with the decarbonization of shipping. Europe has now set a step in the right direction. Hopefully the others will at some point follow, because even if we do not get an agreement on substantial measures at IMO, if at certain point the United States and the important countries in Asia and Europe would decide to somehow align their regional measures, then we would achieve the same.

The infrastructure in ports is not ready for the moment. Is it hard for vessel companies to invest in new technologies? Will that delay the timeline for carbon neutrality for 2050?

The requirements set on shipping show when a certain amount of availability of certain fuels is necessary. If you for example look at the FuelEU maritime, you see that the increase of the reduction of the carbon

intensity of greenhouse gas intensive fuel is slowly but it's clearly going down. If you are a region or company or an industry where its market is the sustainable fuels, you now can develop your investment program based on the requirements in FuelEU maritime. Second, you are supported by the measures of the Alternative Fuel Infrastructure Directive. Thirdly, you have the Renewable Energy Directive, which will set requirements on the amount of mix of your carbon intensity and of your fuel. There are clear drivers, which do not say that from tomorrow on everything needs to be sustainable but it's fading in. Therefore, they're creating the demands. Also, by setting a price on fossil fuels by the ETS, there's also a very clear incentive to the shipping industry. Of course, you can't just rebuild your existing ship. However, if you are at a point to invest in your new tonnage, well these are the requirements for the coming years, if you don't do that, then you have very big difficulties to meet the requirements of the FuelEU maritime. Also, your price of shipping will increase tremendously because you must pay for ETS. These combinations of, in the beginning let's say all the way to 2030, the incentive for the maritime industry to really be able to invest is based on the Fit for 55 package is low. After 2030, you'll see a substantial increase in the pressure to really start to use sustainable fuels and to invest in in in cleaner ship. I think if we have this package and we also wisely put in place some stimulation measures, from individual countries or from EU funds, in which they can for example stimulate some routes to even go a step further, for example to start to work with sustainable hydrogen. Then we will build up this market. The beginning of the market is the difficult one. At certain point you get to a level and then it starts to roll out automatically. Then, it becomes fireball, the business cases become more attractive. We've seen that in wind power as well. We have had to subsidize wind power for a long time, but at this moment they don't need any subsidy anymore. We are at the beginning and it's a long a long track from now to 2050. The important part is, between now up to 2030, to make sure that we really get started. The incentive to get started all the way up to 2030 is a bit too low. We need extra stimulants between now and 2030 on the infrastructure, on the availability of fuels but also on the technology on board of ships, to make sure that way before 2030, we see already a substantial number of vessels becoming operational, which can run on sustainable fuels, and which can deal with the future requirements. Then after 2030, I think we will see a speedy replacement of old-fashioned tonnage. Hopefully we will manage to 2050. That's how it should work, let's hope it works that way.

Since Europe has very strict rules, especially the C-BAM, will they be able to stay competitive against the United States and Asia?

For shipping I don't see the problem that much. That's more an industry problem. If you are producer in Europe, you must pay all these all these extra ETS cost or higher price for your energy, then your competitiveness will be decrease, not for European markets but if you produce for markets outside Europe, you'll have disadvantage. If the others don't come to Europe, they must pay their C-BAMs fee and then then the level will be the same. But if you produce in Europe for outside Europe, you have a disadvantage. The shipbuilders are complaining that ship owner now can easily buy a ship for example in China and once they start to operate it, they do not import it in Europe, so they do not fall under the C-BAM requirements. They have disadvantage compared to Asian country for producing ship here because they're will still fall under C-BAM requirements, and they'll have to pay for the import of this steel into Europe. There is a problem, there is a slight competitive problem for the maritime industry in Europe. If you look at shipping, if you want to do business with Europe and you want to be able to bring your products to the European market, which I think still will remain a very attractive market for many of these companies in Asia and in America, it is just an extra thing. Second, it is a temporarily disadvantage. Once we get it speed and we have implemented all these sustainable energies, I think the price of the sustainable energy will drop, even maybe arriving at the price level of the fossil fuel. We've seen in the past that new technologies, at certain point, even become cheaper than the old fashioned. We could be the frontrunners on this issue and therefore we might, at some point, even become more competitive compared to other parts of the world, if they don't make the change. We all know that we must solve this problem this. At the certain point, we all must make this change even China, even in the United States of America. If they don't make the change, we have a far bigger problem than a distortion of the level playing field of certain companies

Is there a difference regarding the advancement of sustainable technologies between the northern and southern countries of Europe?

Depends on how we divide the funds we have around Europe. Of course, if you look at that, there are some regions which needs more support than others. If Poland doesn’t get rid of their coal power plants, then we have a problem. We need to support these European countries in making this transition as well. On the other hand, if you want to create energy from the sun and then in central Spain you are much

better place than you are here in the Netherlands. It also always creates some new chances in where you can develop your technology. We need a real big amount of sustainable produced electricity for everything, for our industries, for our households, … Even the future fuels of shipping will be based on electrolyzed fuels. Where is this electricity coming from? Probably the South of Europe maybe the north of Africa. We need to transport it. Southern countries of Europe are the countries with a good location to be the imports of these new sources of energy. We are going to change the way we run our countries. This will have an influence on whether Rotterdam will remain the energy port of Europe, maybe this will change. That's a part of a transition. There will be some changes. We will see what happens in certain time.

What makes the Fit for 55 package reliable as the goal for 2030 has already been changed?

Up till now, shipping was not part of any greenhouse gas reduction measure whatsoever from European perspective. Now they are going to be included and that will have a tremendous effect on how the ships will be operated. That will influence the shipping itself, on the maritime industry, on the fuel. My hope is that we really are going to be able to make this step to sustainable ships. The problem is, now, without good requirements, you can't make a business case for sustainable ship. There's this company in the Netherlands who runs sailing vessels towards the Caribbean and back to carry some amount of cargo. That is subsidies by people who have a lot of money. You can’t compete with the grey container lines running on fossil fuels. Hopefully, we will create with these measures the grounds for a sustainable shipping business case. If that's there, every ship owner I speak to is willing to invest in clean ships. I've never spoke to ship owner who said I don't want to do that. The problem is shipping is a cost intensive industry, very high cost, small margins on the benefits. It's normal to have 2% or 3% margins on your investment. Therefore, it is so important to make sure that your cost structure is at least the same as your competitor. If you are 2%, 3% or 4% more expensive than your competitor, they'll choose the other one. That is the problem with shipping. We've put shipping on the cost side of production, and we squeezed it all the way to the maximum. There's no room there for investment itself. Maybe now in the container line because the prices went through the roof. That's always a temporary situation. In five years, it will probably be back to normal, or the container price will have collapsed. Then, suddenly, they run out of cash soon and quickly. That is the lifecycle the shipping industry is in. Therefore, if you really want to

change the industry, to make different investment, we really need to create this clear pathway in which they can earn back their investment and then they will do it.

How is the war in Ukraine impacting the shipping industry and the advancement towards a zero-carbon industry?

Shipping on the Dutch flag vessel is impacted by this war tremendously. We have a substantial amount of a Russian seafarers on board of Dutch flagships. In most cases, these cruises exist of a Russian and Ukraine crew together on one ship. A lot of practical problems, how you going to pay your Russian seafarers, how are you going to deal with these two nationalities in one ship, are you still be able to you send them home, replace them. That's the crew part of the shipping industry. I read that the ICS, the international Chamber of shipping, said that about 14% of the full international crew is Russian. You just can't replace 14% of the crew worldwide. We don't want to have Russians anymore running our shipping operations. This just continues and depending on how this war will evolves, whether we must deal with the issue of do we have to replace all these Russian seafarers and from part also Ukraine seafarers for others. That's a difficult discussion because nobody knows when these wars going to end and whether we we're going to manage to deal with Mr. Putin. Second, there's this big area around Ukraine and Russian waters where it's difficult to go there, some areas you're not allowed to go there, the discussion whether you still can't continue sailing with Dutch flagged vessels on Russian ports. On the other hand, the trades for the cargoes which are still allowed outside the section regime still needs to be carried. With shipping, you are always in the middle of a crisis.

Appendix 2 – Depredurant, Philippe

Europe advisor to the cabinet of the Secretary of State to the Minister of Ecological Transition, in charge of biodiversity

Brussels, Belgium

05/04/2022

Original interview in French - Translated to English

Why is the European Green Deal revolutionary?

Why is it revolutionary? I think that first it is revolutionary for 2 reasons. I don't know if it's the right word, but in any case, it clearly stands out for 2 reasons. On the one hand by its ambition and on the other hand by its transversality. For its ambition, it is clear on the climate law carbon neutrality in 2050, a reduction of 55% at least 2030. Beyond the climate law an objective that is, I would say, extremely ambitious. We can see its ambition because it is declined through an extremely important number of texts. The Green Deal is not just about decarbonizing industry. It is much broader than that. It involves the twin battle of biodiversity, the fight against chemical pollution and the development of the circular economy. Everything comes together a little bit, because the development of the circular economy will also promote decarbonization. Another reason is, precisely complementary to what I have just said, that this now affects all sectors, in a systematic way. That is, you have the big partition between carbon emissions, the big partition between sectors covered by the ETS, non-ETS sectors, and then we refine for non-ETS sectors in different modes of transport, different ways to reduce emissions from the building sector, we also refine on agriculture, on strikes,... Double ambitious by the figures which are a multitude of sub figures, so there is a lot of impetus, and a coverage, as they say in Brussels, a holistic program.

The infrastructure of the ports is not completely ready to accommodate the new boats, but the innovation in relation to fuel for the boats is not ready either. Without supply and demand, which innovation should come before the other?

In fact, this is the classic chicken and egg question in all decarbonization projects. I think there is no way to give an answer that favors the chicken or the egg. We have the same issue for decarbonization of road transport, which is even more documented, because it is harder, and we have more and more electric vehicles that are sold. For ships, the cycle is a little different because it is a longer cycle. The ownership of ships is obviously much longer than that of road vehicles, even heavy trucks. We have a little less maturity. Maritime transport can afford to invest more in hydrogen than air transport. You have more possibilities to install hydrogen tanks on a ship. Should we start with the electrification of the docks, for example, or the electrification of the ship? I think we should do both. Logically, those who manage to get into the dynamics faster will have a head start on future technological developments. I would like to take this opportunity to say that the image of a major port is where you can develop the full advantage of the Green Deal, in the sense that you will of course have a very strong emphasis on decarbonization. For ports, it is the FuelEU Maritime text, plus the AFIR regulation and then you complete with the ETS, extended version for maritime transport. You can add to all this several texts that will increase societal requirements in terms of biodiversity, in terms of non-CO2 emissions, so all polluting emissions such as nitrogen oxides, circular economy ... the Green Deal takes in a homogeneous whole that imports a dimension that is extremely broad, which can be illustrated by the various points. Everything is built so that everything fits together. Everything is put in place with funding at the end, you have a much greener society economy.

Is the Green Deal equal for all European countries? Will all European countries move forward together as one continent, or will each country have its own innovations?

In the European negotiations, there is always the consideration of the so-called national circumstances. We can talk about the Mediterranean and the subject of energy solidarity. We must consider the exception of Malta and Cyprus. For example, for Malta, the gas regulations will be different. This is a way of answering by saying that there will be differences, even divergences. This is also sanctioned by the treaty since the treaty leaves it up to the Member States to define energy change. You have possibilities of specialization somewhere, but the objectives are common.

Is the C-BAM a good solution to limit the decrease in competition with non-European countries?

This is not a fiscal issue; it is an industrial location issue. The ETS is based on an emission calculation that is done on an industrial site by industrial site basis. In this case, the carbon footprint is to avoid that a steel site, therefore with a company, located in France for example is relocated in Turkey, because in Turkey there is no ETS. The C-BAM would be mechanically effective because otherwise third countries would not be so composed, and Germany would not be so cautious on the subject. I think it will be effective, but once again, the competitiveness of an industrial site does not depend only on carbon emissions, there are many other factors that come into play. It's a way not only to rebalance the competition and make it fairer. It is also a way of encouraging third countries to pursue a slightly more ambitious environmental policy. This is what the C-BAM is all about. It is effective in terms of the challenges associated with C-BAM.

With the European Green Deal, Europe can achieve carbon neutrality by 2050. However, if non-European countries do not follow this initiative, this European change will not have the impact needed to stop the 2 degrees Celsius temperature increase. Will the European Green Deal motivate other countries to take the same actions?

In terms of carbon emissions, Europe is about 10% of total emissions. 10% is not much in absolute terms, because if you gain one degree it is only 0.1 degree on a global scale. On the other hand, this shows the virtue of the example on the one hand and the virtue of the test on the other. Saying that what is tested in Europe works, it can then be extended or not. It gives an idea of the size of the project, which is also very interesting. This is an element that is often overlooked, to the detriment of the virtue of the example. We are entering into diplomatic negotiations, involving all the states of the world. On the other hand, you have another factor that is somewhat neglected in my opinion, but the technological and technocratic experimentation side. The carbon market, before it is effective, is extremely hard to set up. It has been drafted 3 times in Europe in an efficient way. It stabilizes at 80€ per ton of carbon, and now it is a tariff that becomes efficient. It took more than 12 years to find the other formulas, allowing to have a carbon price that is an incentive and not too volatile. Then, it can be shared either directly by coupling a third country to the European carbon market, which is the case of Switzerland and maybe one day the United Kingdom. Another option is to create the equivalent of the ETS, for example in China or the United States.

What is the impact of the war in Ukraine on the maritime sector and the objectives of the European Green Deal?

The war in Ukraine is causing a kind of J-curve. In the energy organization of the Member States, the investment curve is J-shaped. Then, little by little, it goes up and we exceed the initial investment. Afterwards, we benefit more and more. For one or two years, we will inevitably go back to things that are a bit dirty, so we will probably use more coal. This is an extremely welcome reinforcement, which will multiply by 10 the efforts to make the energy mix greener and above all to control consumption. In other words, we are going to hunt even more for waste. This will encourage, not only for climatic reasons but also for independent national or European reasons, to do more insulation in buildings, for example. You have a short-term agenda with increased use of coal for one or two years, while we increase the rate of decarbonization of society's economy

Will this time frame for the short term stay about 2 years or are there several factors that may lengthen the time frame?

I think so, the time frame for the short term will remain around 2 years. Everyone has clearly understood that the Fit for 55 will help to get rid of Russia. I refer you to the conclusions of the Versailles summit, about a month ago.

Can maritime transport be a more widely used mode of transport in the future, to replace road transport for example (short sea shipping)?

It is quite possible; it is called short-sea shipping. It will depend on the competitiveness differentials. I would tend to think so because maritime transport, contrary to what people think, is still a very green transport, in terms of audio weight and volume. After that, it requires infrastructure, port development, which is extremely expensive. Not everyone can afford them. Everything will depend on the main rate of

decarbonization, which is the rate of decarbonization of road transport, which is the most frequent and most massive means of transport, whether in terms of value or even quality of goods. If decarbonization lags on road transport, maritime transport will benefit.

Appendix 3 – Di Marco, Galliano

Chairman & Chief Executive Officer / Managing Director - Venice Yacht Pier spa (V.Y.P.) / Venezia Terminal Passeggeri Spa (VTP)

Venice, Italy

17/03/2022

Opinion about sustainability in the ports

The war in Ukraine, which is a huge humanitarian tragedy and a threat to the global economy I think we'll force the EU to rethink the situation, the policies in energy, climate, and transport policy. That will have a huge impact. In Italy, we have decided many years ago to shut down the carbon industry. Now, given the fact that we import 45% of our gas from Russia, the government is speaking about reopening for three to four years these industries, until we will have enough renewable energy. For the moment, the country runs on 28 to 30% of renewables. It is tough to achieve, with eolic energy or sun energy, 60 or 70% of our needs with that renewable energy source. You need a lot of eolic plants. You need four or five hectares of sun panels to make one megawatt of energy. Here in Venice, we use the carbon industry since it is state owned. To replace that industry with renewable energy, with the solar panel or eolic plants, you would need so much space, it's difficult. However, the European Green Deal was a good step forward. It is mainly based on the pressure from many angles on the climate change. If the question is that the European Green Deal goals are achievable, I'm not sure. I work in the cruise industry but also, I used to be chairman of the Ravena Port in Italy, which is an important port in Italy for the cruise industry but also bulks, container ships. Many of them are looking at the LNG fuel to reduce the pollution, to try to achieve the targets. They are also thinking about using the cold ironing. The main cruise companies, MSC cruise cruises, Royal Caribbean, Carnival corporation, they are equipping all the new ships. By the way, covid was another factor that is really slowing down all this process. It’s like that for two years, we stopped everything. Anyways, these big companies invested in big new ships big ships, for 5000 to 7000 people. These ships were going to be fueled by LNG. However now, it Is said that LNG could not really meet the criteria to have a full decarbonization of the environment, so they are looking more to the cold ironing. Still different states are not providing them with enough facilities, enough infrastructure.

Are the goals of the European Green Deal achievable?

I don't think that in terms of time, by 2030 or 2050, that the criteria's that need to be met according to the European Green Deal will be achieved. There are three factors. The first one is covid. The second one is the war in Ukraine that could last months or years. However, the effect on the policies is already there because all the Western countries of Europe are rethinking their policies to have a sort of independence from Russia's gas, from the other risky countries. The third is that some of the companies are not up to date. The new ships can be powered by LNG, but these companies are looking at cold ironing because it's probably really the only type of power that has sort of 0 pollution. This will really allow them to reduce the carbonization according to the European parameters.

Differences between European countries

The Scandinavian countries are already even more ahead than Germany. They already have tougher for the ships that are trying to navigate in the North Sea. In the Mediterranean, we are behind, but we are trying to at least meet the criteria of the European new Green Deal. In the northern countries, they are almost there. If your ships want to go in the Stockholm or in Finland or in the northern city, it must have a sort of special fuel that rarely pollutes. In Venice, we were forced to use that kind of scheme because our ship used to go through the Giudecca canal, just before in front of San Marco square. Now they are no longer going through there since July of last year. We were forced basically to use the criteria of the northern sea. We did the single agreements that I was forced to sign with the different companies. I used to have 42 different companies docking in Venice for cruises, plus we have 25 to 50 spots for mega yacht, which are also an issue. The majority of them are equipped with cold ironing or LNG. The issue is more for the cruise ships, the container ships, the dry bulk ships. Bulk ships, that are very old, should really be eliminated to instead of trying to make them more sustainable.

As you stated, northern countries are more advanced than southern countries. Do you think the European Green Deal considers that some countries are more advanced than others?

I think that there will be a big push for the southern countries. As you know, with the covid, the countries like Italy Greece Spain, we were able to have this European. For example, Italy will have through that next generation more or less €210 billion euros. Mr. Draghi, the current Prime Minister of Italy, that used to be the chairman of the European Central Bank, has a very open mind. Almost 40% of the total amount will be used for green projects. For instance, based on the European Green Deal, in the Italian ports are trying to adjust to the regulations. However, the Port Authority is slow when it comes to presenting new projects. The big ports, Venice, Ravenna, Trieste, Genoa, are working on the European Green Deal. This Green Deal, along with the next generation, will put a big pressure positive pressure on our different state entities, port authorities, region, and local towns. Within 2026, you must finish more or less all work for the €220 billion euros.

Covid Situation

The European Green Deal was finished in December 2019, where we were supposed to have normal years. Then, we had two years of covid. Our ships, they are not empty, but they only have a 25 to 40% loading factor. In Venice, we used to have 95% loading factor, they were so full before COVID. Even 2022 will still be, for us, a sort of COVID year. 2020 was a terrible year for Italy, 130,000 fatalities. Mr. Draghi has clear ideas. He will ask for an extension of the funds until 2028. I'm very optimistic that all these green goals will be achieved, even in the southern countries. Due to the European Green Deal and the next generation, the southern countries will probably be in 10 to 15 years aligned to the northern counties.

Comparing Northern and Southern Countries

The new generation is saying that nuclear energy is safe. In Italy, they will never accept it, especially the left parties, to use nuclear energy. Therefore, we need to reopen the carbon industry for at least three to

four years. One side, we must go green with our vessels. On the other, 3 miles from my office, they are talking about reopening the carbon central by June. This will probably be due to the war in Ukraine, for three to five years. In the medium and long term, we will put in place the European Green Deal. Most of the ships coming from China to commercial ships go through Suez Canal, so it's time for the Italian ports to do a real competition with Rotterdam and the North ports. For the moment, the container ships go through the Suez Canal from China and instead of docking in Venice, they prefer to go to Rotterdam because Rotterdam is much more efficient than the Italian ports. Rotterdam has a lot of money because the Rotterdam ends at different scheme from our ports. They are stated-owned but also have stakeholders. Our ports are managed by fully by the state. It's a different scheme and we need to achieve level of efficiency, which can be achieved through the European Green Deal and to the next generation. The Mediterranean Sea has 65% to 70% of the cruise market, where Italy has 50% of the European cruise market. We were limited to 2 million passengers, but we could have welcomed 5 to 6 million easily if we didn't have those limits. From a tourist and cruise ship point of view, all the big American corporations are still looking at Mediterranean, especially in Italy Spain Greece to deploy their ships. Another important cruise destination is Alaska. They were very smart, because for five years, they suspended the cruise ships from entering their ports. They equipped themselves with a lot of renewable energy, especially water energy. Now, they are back in business, and they only accept the ships that are equipped with cold ironing.

Infrastructure in ports

I think the big push with the big financial booster for to this development will be created by the next generation, more the European Green Deal. The ports, Ravenna, Venice, Taranto in the Adriatic Sea, as well as Athens, Piraeus, Barcelona, are all working on cold ironing. Most of these countries will get subsidies from the covid and use these funds for green development. The Roll-on/roll-off shipping is a very important part in these ports also, to ensure a good intermodal transport system. They have robust ferries for trucks that are adapted for intermodal transport. Spain is more advanced because they were much smarter than Italy when it came to using the European funds.

Conclusion

Money is a very big factor. Western Europe, in recent months, is facing high and volatile energy prices. That will have an impact. If this situation doesn't change, it is not cost effective to use cold ironing. The problem is to equip the ships and pay the local operators. The energy bill is very volatile for my house, so try to imagine for 7000 passengers. It is a lot of money. The gas and oil prices are going up. The solution to stop the volatility is to aim for renewables and have your own pipelines, not from Russia. The EU is too dependent on Russian gas. If the energy prices continue to increase, all these green plans will fail.

Appendix 4 – Folmer, Henk

Senior Vice President, MSc., Head of Customer Led Solutions Europe at Prologis

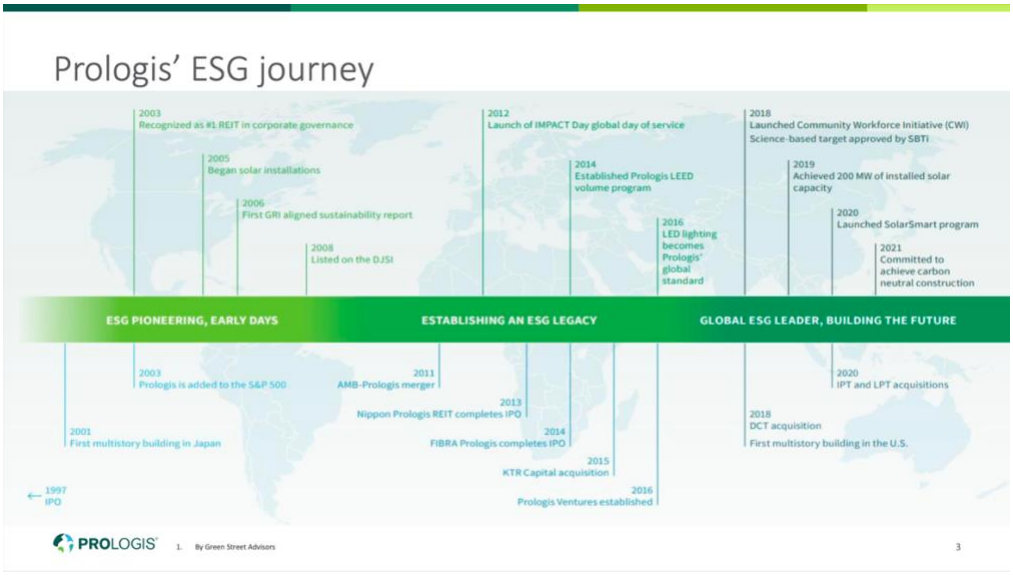
Amsterdam, the Netherlands

28/03/2022

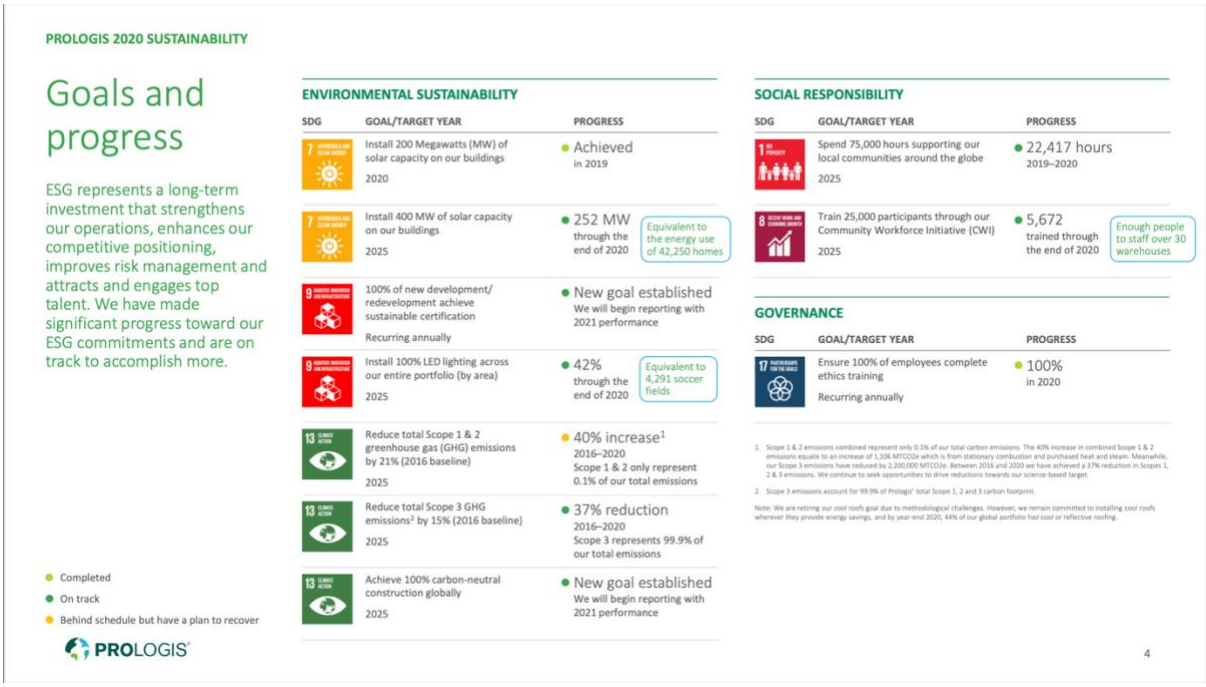
Jumping straight into sustainability

ESG is something that's important to our business. I would also recommend by the way that you look at our websites and go to our investor section, where you will find our latest sustainability report that we bring out every year, that talks about all our activities around environmental and social responsibility. It is also important for our investors, not just for us, and then thirdly for our customers, the people who are using our spaces. We can look at our users that are large companies, for example Khuene & Nagel, DHL. Many of those very large logistics companies have zero carbon strategies. They can be driven by the fact that the companies are big believers in zero-emission and feel that's necessary, or by the fact that some of these companies are owned by governments.

Prologis ESG Strategy/Framework



We have always tried to have buildings as green and as efficient as they can be. We have various activities that are related to buildings, for example LED lighting programs or solar programs, that directly influence the sustainability of the building. We do a lot more to educate, to train people to do all sorts of things that make us a more responsible company, as it relates to ESG. This is the journey that we've been on from 2001.



PROLOGIS 2020 SUSTAINABILITY

Goals and progress

ESG represents a long-term investment that strengthens our operations, enhances our competitive positioning, improves risk management and attracts and engages top talent. We have made significant progress toward our ESG commitments and are on track to accomplish more.

- Completed
- On track
- Behind schedule but have a plan to recover

PROLOGIS

ENVIRONMENTAL SUSTAINABILITY

SDG	GOAL/TARGET YEAR	PROGRESS
7	Install 200 Megawatts (MW) of solar capacity on our buildings 2020	Achieved in 2019
7	Install 400 MW of solar capacity on our buildings 2025	252 MW through the end of 2020 Equivalent to the energy use of 42,250 homes
9	100% of new development/ redevelopment achieve sustainable certification Recurring annually	New goal established We will begin reporting with 2021 performance
9	Install 100% LED lighting across our entire portfolio (by area) 2025	42% through the end of 2020 Equivalent to 4,291 soccer fields
13	Reduce total Scope 1 & 2 greenhouse gas (GHG) emissions by 21% (2016 baseline) 2025	40% increase[1] 2016–2020 Scope 1 & 2 only represent 0.1% of our total emissions
13	Reduce total Scope 3 GHG emissions[2] by 15% (2016 baseline) 2025	37% reduction 2016–2020 Scope 3 represents 99.9% of our total emissions
13	Achieve 100% carbon-neutral construction globally 2025	New goal established We will begin reporting with 2021 performance

SOCIAL RESPONSIBILITY

SDG	GOAL/TARGET YEAR	PROGRESS
1	Spend 75,000 hours supporting our local communities around the globe 2025	22,417 hours 2019–2020
8	Train 25,000 participants through our Community Workforce Initiative (CWI) 2025	5,672 trained through the end of 2020 Enough people to staff over 30 warehouses

GOVERNANCE

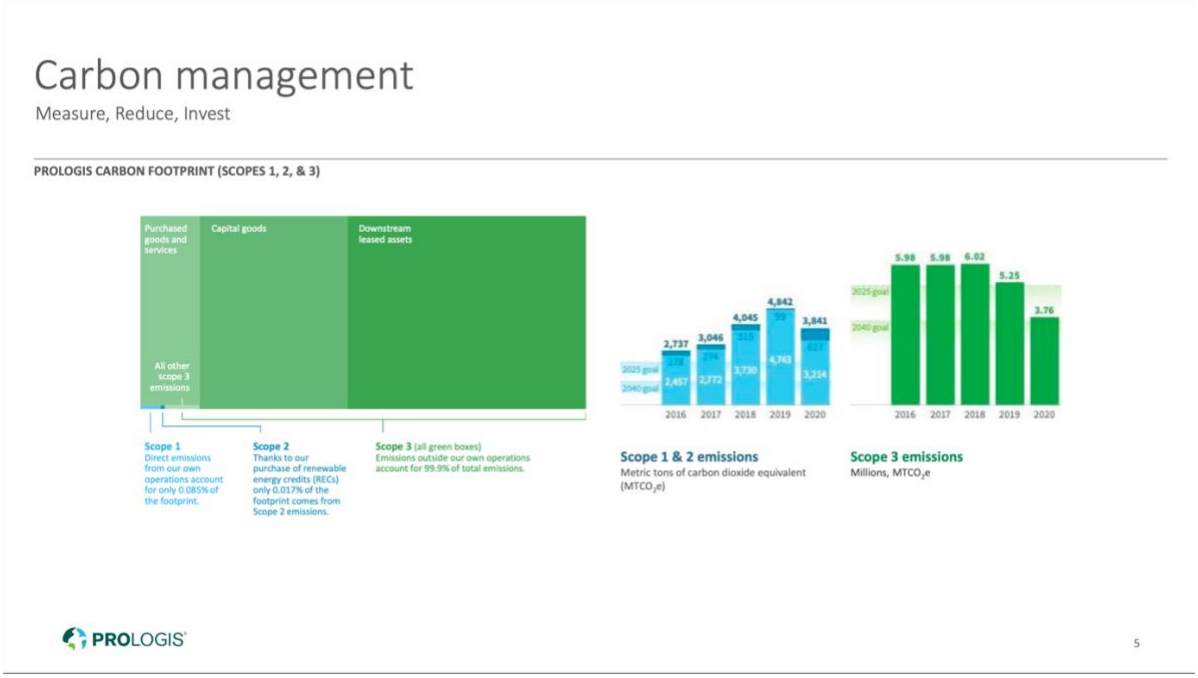
SDG	GOAL/TARGET YEAR	PROGRESS
17	Ensure 100% of employees complete ethics training Recurring annually	100% in 2020

1. Scope 1 & 2 emissions combined represent only 0.1% of our total carbon emissions. The 40% increase in combined Scope 1 & 2 emissions equate to an increase of 1,106 MTCO2e which is from stationary combustion and purchased heat and steam. Meanwhile, our Scope 3 emissions have reduced by 2,200,000 MTCO2e. Between 2016 and 2020 we have achieved a 37% reduction in Scopes 1, 2 & 3 emissions. We continue to seek opportunities to drive reductions towards our science-based target.
2. Scope 3 emissions account for 99.9% of Prologis' total Scope 1, 2 and 3 carbon footprint.

Note: We are retiring our cool roofs goal due to methodological challenges. However, we remain committed to installing cool roofs wherever they provide energy savings, and by year-end 2020, 44% of our global portfolio had cool or reflective roofing.

4

We have started, since 2018, working with science-based targets. We do not only have an ambition that says we're going to be a sustainable and green company. We have very hard coded metrics that we want to achieve. If we look at the environmental and sustainability, there is a goal to install a certain amount of megawatts of voltage for the capacity on the roofs of our buildings, new development needs to be you know circular, we want that carbon footprints to be to be as minimal as possible. All of those are science-based targets, they have been developed and have been approved by institutes. We report our targets, to see if we are in line with our target or if we are behind. We have a plan on how to how to fix that targets that are behind.

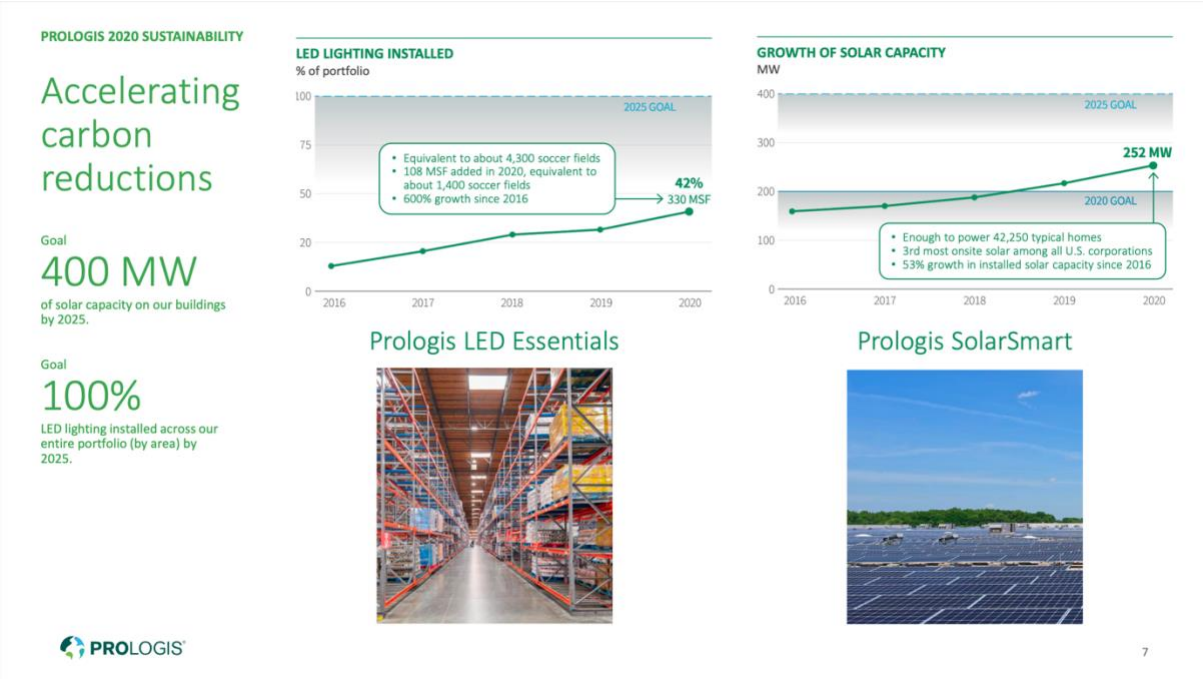


When you look at a green building, a green logistics facility, then there are various elements of that. Most companies, that stay in our spaces, that claim that they are sustainable, they mostly talk about the procurement of materials that ultimately are used in buildings. They want to we used environmentally friendly manufacturers. However, there's always an embedded carbon portion in these materials, so you could never make them completely green. They are ways in which you can reduce that impact and there are ways that you can make those buildings reusable so therefore they become in tune with a circular philosophy. There are multiple levels, we call them scope 1, 2 and 3, where we look at our carbon footprint. Some has to do with our purchased goods and services, some are in terms of the capital goods, the stuff that we invest in, and then the assets that are that operated by a user. That last portion, we have no control over, that's the user. We can offset. For example, we have a program at the UK whereby for every building that we build, we buy a certain amount of forests in Brazil. That’s offsetting or a compensation measure that we can take.

We can see three different parts in this map. Some are clearly directly related to sustainability. Some are more related to technology that you use to make a building efficient, but often that also equates too environmentally friendly. There are things that we do to make a building more pleasant for a person to work in it, it's just a human centric element. For example, skylights, daylights, is a pleasant thing for a human being who works in in the facility. If you look at sustainability, recyclable lighting, green groups, for example, you have literally no plants on your roofs that generate better insolation, that is better for rainwater drainage. There are things you can and install, solar panels, transportation options. If people travel to and from a building, we make that more sustainable, by sharing a car or public transportation. There are ways that we can support our customers to operate in a more environmentally friendly manner. The next step for many of our customers is the storage of energy. When you have solar facilities, that’s a great first step. However, you are not able to store solar power, it must be used immediately. What normally happens if you generate that power, it goes into the power grid and the user gets a certain compensation for that. It would be nicer if that energy that you are generating on the roof of a building would be directly used by the user. For that to happen, you must have batteries, storage capacity, technology that allows to do that. That technology is in its infancy still, it doesn't really exist in a way that's useful and efficient. The bigger step is how to make a 15-year-old building greener. We have so many buildings that have been developed in the past 20 years that don't have LED lighting, or that don't have

solar, or where the insolation values aren't as ideal as if you would build that building today. That's a much more difficult targets and something we must think about. You can’t dismantle a building and put new installations.

You mentioned that you tried to make your older buildings as environmentally friendly as possible without dismantling them. How big of an investment is this change?



On this page, you can see that 42% of our buildings currently have been equipped with LED lighting. The way we do that is we have a program called LED essentials. Initially, years ago, if a customer would come to the end of its lease and would have to make the choice to renew their contract or not, we would use that opportunity to offer him, as a commercial gesture, the investment in LED lighting. This way the operating costs of the customers can decrease, and we offer to take the responsibility for the equipment and so on. So, we do that as an incentive. We've changed that by saying to the customer that at any point in time, during your lease, you can come to us, and we can offer you LED essentials. What that means is that we will still install that the LED lighting for you, you have the benefit of the operational benefits of better lighting, also cheaper energy, and you pay us a euro per square meter per year during your lease.

We've turned it into a service payment. They don't have to invest. They can pay us as they use. We do that until they walk away. For example, if they have a two-year remaining lease with us, we calculate this on a five-year basis. However, if they leave after two years, they don't have to pay us, there's no penalty. If they renew after five years, they don't pay this anymore it's been paid. It works in most of our buildings but obviously energy is very expensive and that differs a lot across Europe. For example, energy in Germany is very expensive. In France, it is not because of the nuclear power. Sometimes we have power collectives. We have agreements with larger providers of energy that we procure as a business, and we sell that to our customers. They get a cheap group deal for their energy. So then LED essential sometimes isn't as interesting because the saving isn't minimal. If you are a customer that is serious about your apartment footprint, and you have your own commitments, then obviously you're not only looking at this as a cost benefit, but you're looking at this as an environmental investment. I think LED will continue to be successful. We are gradually working through our portfolio. With solar, it's a bit more difficult. Solar is very much dependent on tax incentives by the respective governments. In some markets, it is very attractive to do it, for example in Italy, the Netherlands, Spain. There are markets where it doesn't make any sense because the government just doesn't help us or the customer to invest. Plus, there is the other problem with the saving of the energy that is generated. It's not always a direct benefit to the user. Potentially if the financial elements of this would be working alongside us, we have an immense opportunity to do something. I think with LED we're probably going to be there in a few years from now. Solar and electric vehicle charging will take a bit more time.

Is the infrastructure for solar and electric charging stations ready or being invested in enough?

Let's say technologically speaking, you can do it. Most of our roof's buildings the roofs need to have a certain useful life. If you must replace the roof within now and 15 years, then you don't want to put panels on the roof. If your roof life is more than 15 years, typically 30 to 40 years, then normally you can do it. It's mostly tax incentives from the governments that make this a good thing to do. When we have a parking and there is a bike shed, we could very easily put solar panels on the bike shed that will then allow for charging of three or four personal vehicles. However, clearly what you want to be doing over time. I can't really give you a road map where I expect that to go, but it's clear that the agenda of the investors, the

developers and the users are much more aligned now than they were three years ago. The Green Deal, I think, has put it on the map. It has accelerated everybody's awareness and willingness to do this.

Do you consider not working with customers that are not on a sustainable path?

I think that probably would be to taking it too far. We must be careful that we're not discriminating customers based on what they are willing to do or not. We can only make it easy for them in terms of the offering and the ease of implementation. Maybe, at some point in time, we will be looking not only at the financials of the company but how they are treating their buildings, are they good environmental partners. There are clearly companies that aren't as advanced as some others. Also, Europe is ahead of America. For example, solar in America is only available in New Jersey and in California.

Do you believe some countries in Europe are much more advanced than others?

I think we're getting there. Europe is in a pretty good shape. In Europe, we operate in 12 countries, I would say that largely the commitments, the philosophy and the willingness is the same. I don't think there's a part of the European continent that is sort of an outlier. Italy is very sophisticated as it relates to solar program. It is the country where we have our largest footprint of buildings that we put solar systems on the roof, even more than in places like Sweden. A lot of the customers that I know and work with who are very serious about it, they are clearly northern based. I'll give you the best example I have. DHL, a very large operator of course, globally, they have made commitments even at a personal level, at board member and at an individual personal level. People have committed to do these things. That's advanced right. If you make the goals a personal commitment and a divisional commitment, as opposed to the group, then I think you're on it. I think there is maybe that difference today with state and non-state-owned companies. State-owned don't want this right to not be committed. The employees must be aligned with the corporate organization says and does. There's still a long way to go, we're at the start of this. You need a few of these leading companies to lead the way. There's no other way to do this.

Talking about the human factor in companies. Is there a difference regarding the sustainable motivation between younger and older generations?

I think the younger the new generation, the people who will be stepping in my role, are probably more committed or believe in it more strongly than maybe some of our more elderly colleagues. However, you choose to work for a company because of its identity and its strategy. We have a good mix of the various generations in our business. We have just deployed now somebody in Europe to be the head of ESG. We never had that. In the board of Prologis, there's a person whose sole commitment is to run after this program. Put your money where your mouth is. It's not about what you say, but about what you do. I think young people, generally, are very passionate about it and committed.

How is the war in Ukraine impacting you?

We do not operate in Ukraine, Belarus, or Russia. In that sense we don't have an immediate impact. Where we will have an impact, and that's absolutely going to happen, is in the price of construction materials, the availability of raw materials, and a lot of the employees. A lot of them work in our buildings in Slovakia, Poland. There is a massive amount of people that work in logistics in central Europe who come from Ukraine, who spend a couple of months in Poland and then go back to their families. That for sure is going to be impacted, but especially on the construction side. 15% of European cement comes from Ukraine. The largest production facility of steel is in the Ukraine. It has been bombed. You will see the ripple effects of that in the coming. Construction was already a lot more expensive in the last two years than it was before. I think you're going to see that going forward. It will have a big price impact price effect on real estate, not just for us as a company but across the market. Fourthly, energy pricing could help this solar program. If energy prices go up, and particularly gas prices, since most of our warehouse buildings are heated by gas, users will probably see their bill go up by 20% or more. In turn, this will make them more open to these discussions. It’s potentially an opportunity to advance particularly solar programs, who have been a little bit on the sort of all on the sideline almost because there are questions such as is it effective, is it beneficial, is it attractive economically. With energy prices going through the roof, hopefully, that's going to be an incentive in the right direction.

Appendix 5 – Lurkin, Nick

Senior Adviser Climate & Environment KVNR (Koninklijke Vereniging van Nederlandse Reders)

Rotterdam, the Netherlands

18/03/2022

How do you think the European Green Deal is revolutionary compared to other climate policies that were put in place?

I am speaking on behalf of the shipowner's community. The European Green Deal and especially the fit for 55 package is quite revolutionary for our sector. Until now, we have been regulated by the International Maritime organization, so global regulations for environmental affairs as well as for safety, security, and labor conditions with the ILO (International Labor Organization) in Geneva. There are three measures that have a direct impact on the shipowners: EU ETS, FuelEU Maritime and the Energy Taxation Directive. Shipowners sailing to, from, and between European ports will indeed feel that the impact of those measures, in a positive or negative way.

Do you think three policies that you mentioned, that impact the most the shipowners, have good guidelines to reach the zero-emission goal of 2050?

The goal is clear. It is carbon neutrality in 2050. That's also our goal from the Dutch shipowner's perspective, but also from our international partners. The measures are OK to meet the targets. As I already mentioned they will have an impact on shipping. However, what I really feel is that, looking at those measure, it feels like a base principle is there. However, there's no principle of rewarding the early movers or the shippers which make use of green ships, the ones trying to decarbonize the industry. We fear that we just paid. Of course, one pays more than the other depending on how green you are. However, there is not a real reward. We really need that reward also to incentivize ship owners and to accelerate the conversation of our industry. For example, the EU ETS revenues we really want them to be

allocated and returned to the sector. It should be spent on decarbonization concepts of ships. That's still unclear to us, since the European Commission says that they don't want to allocate a certain amount of revenue for every individual sector. That's what we were now really striving for together with the NGO transport and environment

So, you believe the European Green Deal is more on looking at sanctioning industries that are not respecting the policies rather than rewarding the ones that take the first step?

We fully agree with the base principle but there should be also a principle of rewarding the first movers. If we must compete with the other heavy Industries, such as aviation, which are also currently on the ETS, then we're behind in the queue. Especially we have a lot of small and medium sized enterprises working with us. We don't have a Maersk in our fleet. The burden for them to apply nowadays already for subsidies from Brussels, it's quite high. It's quite high to apply for refund and to get that fund. We would rather see a different instrument that will close the gap between the more expensive greener fuels and the cheaper dirty fuels. We really allocate more to individual shippers to close the gap between these two different types of fuels, so that we really incentivize cleaner shipping.

Do you believe there is enough innovation for the moment for the use of an alternative fuel?

LNG is really in a transitional fuel. WE have quite some LNG powered festivals nowadays in our fleet, which still will be sailing at 20 years from now. In the Netherlands, at least, we're also looking at the programs to see how we can deal with current LNG powered vessels. For example, there's no huge program intervention program in the Netherlands, which is called LNG 0, where carbon capture is used and to look at methane mitigation, to reduce the emissions from these ships. I really think we should not only focus on new bills, but we should also look on the existing fleet. Ships last economically for more than 25 years and technically even longer.

Do you think the European Green Deal considers not only the new fleet but also the ways to adapt existing fleets?

Yes and no. FuelEU maritime really focuses on the upcoming new fuels. What I really like is that they look at the entire life cycle of the fuel, so not only what the ship is burning but also how are the fuels produced. That's good. However, in the end, what do we do with the existing fleet? I think carbon capture could be a good way forward for the existing fleet, not for the new build ships. For these, we should really focus on E-fuels such as e-methanol, hydrogen or maybe, for the deep-sea shipping, at least ammonia, not for the short sea shipping. Batteries packages are still not ready yet for longer hauls. There's no one size fits all solution. There are different solutions. The important thing is that we not only focus on new builds because then we are making a huge mistake. We need to look at how to compensate them with the existing fleet. They need to do something. There is slow steaming but after a while, this is not a solution anymore. We cannot reduce or be more efficient than we can be.

Some are stating that alternatives fuels are very flammable and dangerous to use.

Methanol is not that exciting. Those ferries between Sweden and Denmark standard make use of methanol. Every fuel has it's a pros and cons. They say methanol is poisoning, of course if you drink. For low gasses fuels, there is the IGF code, electrical code, safety code, how to handle with different fuels. There's one for LNG, methanol. There are international safety procedures which are agreed.

You mentioned batteries and electric as a sort of alternative fuel. Do you believe fleets for long-term travels will be able to run solely on batteries or electricity?

It depends on how you define long hauls. For example, from Rotterdam to the south of Spain, that will take a while. For the standard line from Hoek van Holland to Harwich in the UK, Hoek van Holland has onshore power supply. I think the UK ports are now also investing in onshore power supply. For the standard line ferry, they are now exploring whether they could make use of a battery that is charged by

the onshore power supply. However, I've been told that this ship can only leave the ports 0 mission and then at sea it must switch back to the main engines. The capacity is so low and the power that the ship needs is too high for the battery nowadays. It also depends on the battery developments, likewise with the cars. They should be lighter. We started with a big phone to call each other and then nowadays, we have these small things which have more memory than our computers. I think it will solve itself hopefully the sooner than later.

The European Green Deal is about the continent Europe as a whole. Some countries are more advanced than others. Does the European Green Deal take that into account when it comes to the application of policies, funding, and research for innovation? Will all European countries move together?

The countries in the northwestern part of Europe, the Nordics, Belgium, Netherlands, France, Germany, will be the first ones to innovate. The south European states will follow. That's normally how it goes. There are also some things out of the control to ship owners. That's how it used to be. It will be faster than it was before, the fact that the rest will follow, so that will not be behind schedule for decades.

Do you believe the European Green Deal should favor a little bit more the southern countries for all the European countries to reach the zero-emission goal in 2050?

I hope that the technologies, especially when it's funded by the EU, will be public. Try to reward projects which are not only between north European member states but also the ones that are trans-European. For example, Italy together with the Netherlands or Greece with Belgium. Some partnerships to avoid the division between the northwest European community and the south European community. They are doing different things. It's important, for us as shipowners, that there will be a kind of standardization for the infrastructure, alternative fuels, onshore power supply as well as safety regulations, for methanol, LNG, and hydrogen. What's important is that we keep talking to each other as a shipping community together, what are the developments within the shipping industry, fuel producers. In the Netherlands, I am glad that we have that conversation every quarter a meeting with the fuel suppliers and the ports. We exchange regarding the developments but also the regulations, especially the Fit for 55 Package for the

moment. In other countries, it seems that such meetings are quite rare. The dialogue is very important, because in the end we need each other. If we ask for A and they offer B, no one benefits.

As you mentioned there are other heavy sectors, such as the aviation sector, the trucking sector, the train sector. Do you think that the maritime sector will become more important regarding international logistics?

We are the cheapest modality of transport. Trucking will also become part of the EU ETS in the different phases, in 2026. What I like in the European Green Deal is that it looks at short-sea shipping. After the Italians, the Netherlands is the champion in short-sea shipping. There is already a percentage that will be allocated for a shift in transport to waterways, oversea or inland, instead of railways. There are no regulations for the moment regarding which mode of transport can be used in certain parts of countries. The maritime sector is very flexible. Although we emit 3% of the entire Co2 emissions globally, per ton/mile, we are still the most efficient transport mode compared to other transport modes. Of course, with nitrogen oxide, it is a little bit different. There is the string report that compares the C02 emission on different routes with different modes of transport. We have a huge opportunity there. However, a lot of people don't think directly at the maritime industry as a transport mode, but we transport more than 90% of the cargo oversea. Since people don't know much about it, unlike planes, then they don't use it.

Conclusion

The Fit for 55 package contains the most important regulations for the maritime industry. We much prefer global regulations since we are a global operating sector. One of the main concerns we have is, for example with the UK that is not in European anymore, that cargos will shift to the UK instead of the EU to avoid extra costs and be more competitive. The UK ports are very old fashioned. They are not like Antwerp or Rotterdam. However, if they make changes by investing, there will be a huge competition. From the shipping perspective, we go wherever the cargo is. We are looking at IMO, but they are behind when it comes to global regulations to the cargo pricing scheme. We will welcome European regulations if we can see it as an opportunity. It should not only be a penalty, but there should be a reward for the early movers.

Appendix 6 – Machu, Pascal

Elected representative of Seine et Marne in charge of sustainable development - Climate expert

Seine-et-Marne, France

01/04/2022

Original interview in French – Translated in English

How is the European Green Deal revolutionary?

Is the Green Deal revolutionary? I would say no, because for me what is not revolutionary but exceptional is that the margin is increasingly high. In 2030, we need a 55% reduction compared to 1990 emissions. But what are we doing to do that, knowing that our emissions continue to rise? We are at the foot of the margin and the margin is growing, so it seems normal to get closer to it. It's growing in two ways; it's growing because we're getting closer and it's growing because we're not meeting our targets. As it is not more revolutionary than the others, I would like to believe in it, but still, it is necessary behind that there are demonstrations which prove that we are going to arrive there. For me, it is an ambitious goal, but it does not represent much compared to the whole world. Everyone should do the same thing. Europe is first in class in reducing greenhouse gas emissions, but we see that the Ukrainian conflict has shown our dependence on fossil fuels, Russian among others, with not necessarily usable substitutes immediately. It is already, in relation to the Green Deal, the Ukrainian event to show that when we are in the concrete, and it goes a little in all directions. Among others, the Germans are saying that they are going to use coal a little more because they are 50% dependent on Russian gas, so they will have to find another good way to produce electricity. I would like to see an inflection of our greenhouse gas emissions. When we see that a container port represents 500,000 vehicles in pollution, it doesn't scare anyone. It raises questions for me, and I think that small measures such as the Green Deal do not cut the evil at the root. The root is the international trade. In Rotterdam, there is a wind turbine and some electric plugs. When we see that the international convention obliged the ships to put Sulphur filters in the chimneys, but that at the same time they are allowed to throw the residues of the filters in the sea, it is incoherent. We have more small measures. It is necessary to hit the system and to hit the system is hit in the international trade. I am a supporter of the carbon tax. The further the product comes from the more expensive it is. Capitalism is based on consumption. When there are more consumers, there will be no more capitalism. The capitalist must be reasonable, and he doesn't know how to do that. In my opinion, we will go all the way to the end

where COVID will make us think of a small momentary flu, because the effects of climate change will be considerable and will make us think of a human cataclysm. There are bound to be deaths and we can see that in terms of climatic events, we are not playing in the same league. The people do not seem to be annoyed by the rise in sea level. When we know that the Antarctic is melting, because the Arctic is already done, that we will see a rise of 60 meters, the ports will be an old underwater memory. The greed of the capitalists in general, which leads the transport, makes that anyway they will go to the end and if there is a last drop of oil it will be for them or the air. They will transport goods to the end. To summarize my thoughts, we must attack the evil at the base, and it is not maritime transport, it is all transport. Maritime transport, which is a mass transport, and which claims to be ecological, should be reduced to the ton kilometer. This means that it is a transport that knows how to massify and reduce to the ton kilometer, is the most ecological compared to others. But the problem is not there, the problem is that it is reasonable to cross the whole world with goods that are weak on the other side of the world?

Will the ETS and C-BAM be effective?

You must game the system. There are more other systems in the world than capitalism, so that means we must play with the system. It's the money system, so to regulate greenhouse gas emissions, we must introduce a carbon tax. This carbon tax will of course look like protectionism for the Chinese, but at some point, it will perhaps lead them to build factories in Europe so that they can no longer import and therefore tax their products. The best transport is the one we don't make. If we rationalize this with a carbon tax, it means that we must make things locally, even if they are patented or manufactured with Chinese patents, they must be made locally. At that point, it will be complicated for the transport industry, but it will be a different kind of transport. Let me give you an example. A luxury brand has asked us, for 2024, to transport their goods without carbon emissions. They are only doing this for the commercial side. Of course, there are subterfuges, that is to say eco compensate, plant trees to absorb the carbon that will be generated by the transport. This has a limit. First, we must involve the customer, by asking him to transport the goods in more time but in a more ecological way, not by air but maybe by sea. It is a society that needs to be completely modified. Europe is asking for things that even France is not able to do. France is very late on the law, on water, on the conversion to different things, among others on gas. I am in Seine-et-Marne, we are a department that produces a lot of biogases, so we are quite decarbonized. But at some point, we must be aware that we have a completely obsolete system to drop. There is a resistance to change, that at a given moment when you are told that it is necessary to change completely because it is too

carbonated. It's a business that needs to be completely revised. It is a mutation that is necessary. It's not going fast enough for my taste, but it can't be done suddenly either. We are replacing one energy with another and the other must be available. It must be done slowly but surely. I think that all the agreements between Europe and the world need to be reviewed because they push international trade, and I am in favor of abandoning international trade.

When you talk about local trade, are you talking about a European trade or a national trade?

It's Europe because at a certain point it's limited. We also export, so we must not cut ourselves off. I think that the European dimension is already sufficient. And it should be a criterion for the absorption of a country into Europe, that it is clean. We still have problems with the Eastern European countries, which are sitting on coal mines. Switching to green energy is a very big sacrifice made with European budgets, of course, but it is a big sacrifice all the same.

Does the European Green Deal consider the biggest sacrifices, such as those made by the Eastern countries as you mention?

Europe is injecting billions of dollars into these countries. That's why I would say that it is important to have a strong Europe made up of several countries. If it was not in Europe, it would not have done it. France is somewhat cited as an example because we have nuclear power, and we have the cleanest electrical energy in Europe. We must keep this leadership and look at the carbon footprint of megawatts in different countries. Today, there is a ratio of almost one to 10 between the Eastern European countries and France. They still have a long way to go to reach this decarbonized electricity in France. This means that it necessarily involves wind power, hydraulic power, methanization and nuclear power. People are surprised when I talk about nuclear power, but for the moment we have not found anything better in terms of decarbonized energy. It's waste that we can't eliminate, but the emergency today is greenhouse gases. It is really a global economy that needs to be reviewed because at some point in the supermarkets you find everything. You want to buy tomatoes today, you find tomatoes, you can even find organic tomatoes. You must imagine that this organic tomato in March was grown in a greenhouse heated with fossil fuel and that it is not the right time. At some point, we must also educate the consumer. Pineapple, mango, avocado, it should not be an everyday product. The only way to make it an everyday product is to tax it. People will understand that.

The infrastructure of the ports is not completely ready to accommodate the new boats, but neither is the innovation in terms of fuel for the boats. Without supply and demand, which innovation should come before the other?

We now have container ports with liquefied gas. Liquefied gas is better, but it remains a fossil fuel. We can see that these are small steps. Today there are 30,000 ships on the seas and a ship has a life span of 30 years. The demand cannot be there because they are waiting for the obligations of the legislation. As it happened with the air industry where the most polluting and noisy planes were gradually banned from certain airports. It's the same, at some point we'll tell an old container port that it can no longer dock in Dunkirk because it pollutes the atmosphere too much. It's up to the shipowner, but he will say that it's too expensive, it's not imaginable, so we'll invest in something else. If the demand is not there because the legislation is not yet in place, there is no point in making ships with old diesels. Initially, it must be subsidized. Europe is willing to subsidize. But when you have shipowners who are in tax havens, it is a bit of a waste of public money. The effort is not enough. However, I was seduced and somewhat dubious when I saw tests with ships with sails, either in the vertical wind mode or with big seals as we see in the regattas. It made me smile because we realize that we are poor in innovation and that it does not advance much

Is there a difference between the younger and older generations? The marine industry is an old industry that requires a lot of change. Is this change accepted by all generations?

It's the resistance to change. When you are told that the port is submersible anyway, so that means that the person will lose his job, it is not possible. These are complicated human events. But you must stay in transport because it's a business that will have to be rethought every day, so it's bound to be highly innovative. Before, you were asked for transit time and price, and now you are asked to be clean. This is an equation that you didn't care about before and now you're going to have to take that into account. The end customer will not want the CO2 emissions. Today, if you look at the CO2 dose, it is only fed by companies that are regulated by the state. The state, which follows the European directives, sets ceilings. If the ceiling is exceeded, the company, which are often big companies, has the obligation to go and get carbon. If a company makes less carbon than it thought it would and Europe gives it as a quota, they will put this part of their production on the carbon exchange. With Ukraine, the price of a ton of carbon has

exploded. I am in favor of all companies that consume energy being affected by the carbon exchange. For example, when you have supermarkets that are taxed because they are big consumers of energy. Before when you went to the fresh food departments, all the refrigerators were open, so a phenomenal energy consumption. When they got infected by the energy saving certificates, they started to put doors on the fridges. It's because they were taxed that it made them move. We are in the management of the patrimony and in the transfer of the patrimony to the descendants. When you bought a house and you have a house with 5 bedrooms because you have a family with 3-4 children and then the children leave the house and then the retired couple stays in the house that is completely oversized compared to the family coefficient, so it continues to heat. They stay so that at some point they can give this heritage to the children. It is completely crazy. If we had a system of carbon footprint according to the family situation, it would push them to change and go to an apartment or a house adapted to their new situation. That's something to look at, like our foreign policy. I think that synthetic gas is a good start. It works very well. The problem is that the state does not give a clear answer and is slow to validate the system. For the producers it's a benefit because the syngas plants buy their waste in this case while otherwise, they must pay to throw the waste away. Unfortunately, it is only when there is a directive from the state that actions are taken. It's all very political. There is a gap between the state and Europe. Europe puts it down on the French State and the French State then instructs its civil servants who have responsibilities to take and who do not necessarily take. The reluctance of new technologies that are ready, but that we can't unlock. The case of Ukraine, it is nevertheless something interesting in the sense that it allowed another glance on these new technologies. The problem is that it is done in a hurry. Between a puro-gasification furnace, which is an experimental furnace, and the standardization and industrialization of the process, you must wait several years.

What do you think about alternative fuels?

I only know one alternative fuel. Well, as a fuel. We are not going to make electric boats. As a fuel, I can only think of one today, and that is biogas. I can't see myself filling a boat with biogas. We are in volumes of availability which are not in adequacy with the production. So apart from adding sails, for the moment, I don't see any alternative fuels. You've probably heard of railroad highways, electrified highways. There is a study on electric transport, hybrid trucks that are obviously more expensive because they are thermal, hybrid and electric. In my opinion, this is an interesting solution, but you must know that if we were to switch to electric mobility, we would need to produce an additional 90 gigawatts of electricity per day,

knowing that 90 gigawatts is what France produces in winter when it is very cold. We are unable to do that today. That's why Macron wants to relaunch nuclear power, because if we put wind turbines everywhere, it would not be enough. We must continue the mixed wind, nuclear, biomass, hydraulic, gas, coal is almost abandoned. Making mobility entirely electric will be complicated. In 10 years, my point may be different, but today it is not possible.

Appendix 7 – Mogni, Andréa

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Brussels, Belgium

21/03/2022

I will give a global presentation on the role of IMO. Shipping is a global and international issue. The shipping issue is taken up by the European legislation, but it is an international issue.

IMO

That is why we have a United Nations organization, IMO, which is the international voice. The commitments made at the time of the Paris COP and the Glasgow COP are the objectives of the IMO. The FMI strategy is a strategy that was created in 2018. It is a strategy that has been agreed upon by the FMI member states and the 27 member states of the European Union. The IMO member states that have made this commitment are those that have made the commitment to the IMO MARPOL Convention. There are quite important objectives, on the one hand the intensity and on the other hand the quantity of CO2 emissions. For the intensity of CO2 emissions, there is a target for a 40% reduction by 2020, and a 70% reduction by 2050. The basis of 2008. All this refers to the international maritime activity and its growth. These targets must be reached as soon as possible. The IMO strategy will be revised in 2023. The objective is of course the total decarbonization.

The maritime industry

International shipping contributes between 2% and 3% of all greenhouse gas (GHG) emissions. If nothing is done, global emissions from the maritime sector could increase by 50% by 2050. Something must be done. Of course, this scenario is related to economic development. If we do nothing, the maritime sector will contribute to an incredible increase. We must intervene as soon as possible. Emissions cannot be attributed to states. Shipping is not considered in the commitments made in the Paris COP. It is not covered in the nationally determined contribution. These are the commitments that each country has taken in Paris. It must be said that, now, the commitments made by the IMO member states are more ambitious than the commitments made at the Paris COP. Maritime transport is the most economical and

efficient way to transport goods. If you consider road and air transport, maritime transport is the most efficient system in terms of CO2 emissions per ton of goods transported per kilometer. I'm talking about intensity here. Efforts should be made to reduce road and air transport to shift goods to sea transport. All logistics and intermodality are important. When you talk about investments, you must look at those for intermodality as well, the transfer of goods between ship and truck or rail. There is a whole logistics that is very important.

Where are we at the moment?

Maritime transport has already contributed to the reduction of CO2. There was an 8% reduction in CO2 emissions between 2008 and 2015. There are already efforts underway. All this will create a significant development of maritime activities. The efficiency of the industry to reduce CO2 has increased by 30% in the last ten years. This is a global industry, so the role of IMO is crucial. It has been well found that regional type regulations are suboptimal types. They can determine for carbon leakage. All this can determine distortions. It is necessary to try to find a global agreement in the case of IMO and each regional code should be compatible with the general framework of IMO regulations. Of course, one should always keep in mind the short term, the medium term, and the long term.

The position of the European Union

The European Union has an interest in contributing to the outcome of the COP in Paris and Glasgow. The European Union supports the United Nations (UNFCC) in multilateral rules, obviously in the environmental and climate field. There is also the objective of the European Union to improve competitiveness in the maritime industry. The idea also for Europe is to see things in terms of clusters. When I say cluster, there is energy, infrastructure, research, maritime activity, the port. There is also a human dimension, seafarers, employment contracts, ... There is also intermodality which is a cluster. The objective is to develop alternative fuels, technology. All this must be as green as possible.

Research for the development of technology and fuel alternatives

The European Union has already made progress in short sea shipping with results. Now we must deal with the big ships. Large ships, containers, cruise ships, produce 85% of maritime CO2. We must absolutely

address this type of vessel. The small ships are essentially trawlers, fishing boats. They do not contribute to CO2 emissions. We have already developed a lot of studies and results for alternative fuels, i.e., fuel, bunker. We have no solar energy, but we have wind, sailboats, ... We have mixed fuel, biofuel, biodiesel. These are always modest quantities. It is not much for the moment. We are still using fossil fuel. We still use bunkers, half diesel, half naphtha, a marine diesel that is mixed with biofuel, but only 10-15%. We have these solutions, but I think it will be complicated to get away from oil, from fossil fuel. We are making efforts in research and development on fuel and on technology. The maritime industry is quite interested in contributing, the ship owners, the big companies. They have proposed to establish a 5 billion fund for maritime development. They are willing to set up private-public partnerships (PPP). The maritime industry will finance it by applying surcharges on bunker fuel. We also have research funds on the European side. These are the funds of Horizon Europe. These are the successors of Horizon 2020. There is also another European instrument, the CEF (Connecting Europe Facility) which also has a maritime component. We are also creating a fund called OCEANS, which should also focus on the protection of the maritime environment and the reduction of CO2 emissions. The European Union should set up an incentive system to advance innovation.

Port infrastructure

At the European level, the incentive can push to create intermodality systems. We are talking about the restructuring of ports and terminals, where intermodality can be achieved. These are the logistical aspects. As I have already said, we must have a cluster approach and international cooperation. At the European level, we are setting up sites where we can carry out tests and demonstrations. We need to optimize the infrastructure side. There, you have a whole series of problems. You must mention the ports, but also the LNG and oil terminals. There is also the offshore, of all kinds of nature. There are drilling systems, oil drilling platforms are offshore. There are economic activities that are being done. We are starting to exploit resources that are under the seabed. All this requires electricity and can produce CO2. There is one thing where the European Union is a little leaning, it is the optimization of the access of ships to ports. When a ship arrives in a port, it should not wait to unload its cargo. It should have direct access to get out as fast as possible. If you keep a ship in front of the port for 10 days and you don't allow the unloading, the ship is stopped but it consumes. It produces CO2 and therefore it is a source of pollution. It is also a source of mismanagement of the boat. The boat must run. If you want to have an efficient economic activity, the shipowner must take care to have his boat running and moving as fast as possible.

This is the productivity of the boat. In terms of optimizing access, Rotterdam is doing some interesting things. They did a pilot test that lasted a month and was very successful. Antwerp, Zeebrugge, also do it, especially in the northern region, Le Havre.

Legislation

A lot had been done before the European Green Deal, for example the 2015 - 757 regulation. This is the first legislation in this sense, which came out in 2015, 5 years before the Green Deal. There is another regulation, which is an amendment. That was on February 4, 2019. It was a revision of the European system to do the monitoring report verification. This allowed the European Union to align with the IMO criteria for monitoring reporting verification, 3 years after the IMO installed them in 2016. This monitoring reporting verification system was aimed at vessels over 5 thousand tons. These are vessels that use the ports of the European Union. It is necessary to report on the use of bunkers, the kilometers traveled, the type of goods. Then there were also amendments to the legislation in September 2019 introduced by the European Parliament. The European Parliament has set other quantitative targets, beyond what we were already doing. The European Parliament has introduced a notion of environmental performance labelling, a kind of quality mark so that customers know the level of energy consumption. We would also like to introduce a kind of environmental passport for each passport, in which we indicate the energy consumption, the CO2 emission. The European Parliament has also suggested to introduce methane and other gases beyond CO2. It has introduced an important notion: ships that stop in the port to get supplies must stop their engine in order not to emit CO2. We should use the fixed energy taming system. That is, the system that is in use in the city. The parliament says that the European regulation must comply with the change that the IMO could bring.

ETS

The Parliament asks the European Union to prepare a report to include maritime activity in the ETS based on a directive that should have been put on paper. The ETS will be reviewed, in the fourth phase, in 2025 or 2026. The allowances should be paid in the future. They will be auctioned. They will be made available to polluters, but they will have to pay for them. A price is put on CO2 emissions. It is the polluter who must pay. The European Parliament proposes the creation of an OCEANS fund for the period 2022 to 2030.

These funds should be financed by the revenues of the ETS allocations. The proposal for the ETS review was made in the case of the Fit for 55 package in 2021.

Maritime FuelEU

In July 2021, the Maritime FuelEU is a proposal that also fits into the Fit for 55 package. The Fit for 55 package is composed of 12 legislative acts, proposals of the European Union. In the Maritime FuelEU, there are much stricter limits on CO2 emissions and energy intensity of ships. These criteria will be much stricter from 2025 onwards. The transition period will last 15 years. It is not something for tomorrow. It depends a lot on the shipowners, the countries, the monitoring authorities. These much stricter limits are also an attempt to promote the use of alternative fuels. They still apply to vessels over 5,000 tons, including all flags. Many European ships do not carry European flags. They are registered in other countries; these are the flags of convenience. Many have the flag of Libya, Panama, Fishing vessels are not concerned. This type of limit applies to all vessels that arrive in European ports. They also apply to ships that are sailing between European ports. These stricter rules will apply for 50%, I refer to the energy intensity, to all vessels that will leave or return to European ports. From January 2030, container ships, cruise ships and passenger ships arriving in European ports will have to connect to the shore power supply system. They will have to use this energy, this electricity, for all the needs of the ship that is docked. There are obviously some small exceptions that can be made, but in the general sense, they must use the energy generated at the quay. There are parameters for reducing the average CO2 intensity. There is an average annual reduction in CO2 intensity of 2% in 2025, 6% in 2030 and 6% every 5 years until 2050. The total is a 75% reduction of CO2 emissions by 2050, considering that the starting point is 2020. The European legislation could also monitor the different member states. All this is consistent with the principle of the IMO. If there is no compliance, there will be penalties that will be harmonized at the European level. We can see that the European proposal is currently under discussion in the European Parliament and the Council. It will be adopted in September 2022.

Are the objectives of the European Green Deal achievable in time?

In the framework of the European Green Deal, everything that derives from the European legislation, you have the green industry, biodiversity, green chemical, from farm to fork, agro-industry. You have a lot of legislation, and all these legislative acts always have quantitative points. In general, there are two

parameters, 2030, sometimes 2035, for example with nuclear gas, and then 2050. We must keep in mind that the commission has ambitions. The Commission wants to show the rest of the world that it is the most capable and efficient. It wants to show the voice. Ambition plays the role of a precursor, of a leader and above all shows the will to set an example. If the idea is well done, everyone follows. We can have other countries that do not follow. There are commitments that are more or less taken, final declarations such as the COP in Paris and Glasgow. Europe is going back to three energy sources that we had better put aside. We are returning to oil, gas in the form of gas that goes through a tower and in the form of LNG. We were not able to remove these energy sources. The cleanest one that was put aside is nuclear power, with all the problems related to nuclear safety and the treatment of nuclear waste. For CO2 emissions, nuclear is the cleanest. There is a completely different strategy with hydrogen. There are buses that run on hydrogen. However, the production of hydrogen requires pyrolysis or electrolysis. This system can only be done with electricity. Again, who produces the electricity? Certainly, there is a global interest, national plans, commitments that must be presented at each COP of each year. Every year, the states will have to show their commitment. It is a question of production, of taking, of electricity. All this has economic repercussions. If the private sector does not intervene, we will not get there. It's not public money that counts, it's private money, it's the commitment of stakeholders. You must keep in mind that between the December 2020 Green Deal and the current situation, you had the COVID. There is competition for the use of public funds with the health sector. Now that COVID is slowly disappearing, the investment in health will still be very important for technology, hospitals, preventions, vaccination, ... It is a remarkable volume of investment. Today, we have other competitors in the shipping environment. The other competitors are defense and security, the price of oil and gas which is linked to security and defense. We must think about short-term priorities, such as defense, military cooperation, protection with the war in Ukraine.

Conclusion

If we give a passport to each ship, as we give a passport to each thing that produces CO2, I am convinced that, at some point, the shipowners will make efforts. If we apply allowances that have a price, that are not free as now, for the consumption of CO2, the shipowners will become sensitive. But what are the alternatives? The only thing I can see that can be developed is the use of biogas, biofuel, for ships. On the other hand, the directive talks about second generation biofuel. Land has been taken away from agriculture to produce biofuel, which is a bit criminal. It is not very moral. You produce agricultural

products not for human consumption, but for shipping. So, we are now talking about second generation biofuel, so biofuel produced from waste. But who produces the waste, how much waste do we need? If we have no waste, we are talking about using trees to produce biofuel. So, we are talking about deforestation, which makes climate change worse. We are not going to bring waste from Peru or Cuba. It's ridiculous to have an international waste trade. In the end, the waste will not be enough to hold the amount of biofuel we need. Not only for ships, but also for cars, power plants, trucks. It's not just shipping. I wonder what the alternatives are. I don't see hydrogen. Biomass is not enough. Biodiesel is not enough either. You have wind, wind energy. Are we going to go back to 19th century navigation with sails and mills? There is the wind turbine. There is solar energy and electricity. You already have ferries in Denmark that are powered by electricity. You must have a huge battery. At the end of the day, somebody must produce the electricity. I don't know how much it will cost. In principle we are on a trend, but it could be slowed down.

The future

The trend is there, it will not be put aside, but it may slow down. None of these commission members will be alive in 2050 to verify that the commitments have been met. I don't know if the commission will still be around. It will take some effort, but the industry must continue. We must make efforts in terms of research and innovation. We will have new boats. We must insist on intermodality. We must not forget the canals and barges. The transport inland is very important for the future. It is quite difficult to establish national policies. Each ship has its own life and its own reality. Each shipowner is different. Today, a shipowner specializes in transport between Europe and the United States. Tomorrow, it could specialize in transport between Europe and the Middle East. These ports and countries have other rules. That is why international cooperation and rules are very important. My conclusion is that the European Green Deal can be implemented and could be successful if the others follow. If other countries do not follow, the European industry is penalized with obligations that others do not have, obligations that have a cost. The shipowner, in this situation as an entrepreneur in this situation, will ask for assistance and public contribution to continue to be competitive in a context that follows different rules. Therefore, it is very important for Europe to convince all the other countries to follow the commitments of the COP in Paris, the COP in Glasgow. If these countries do not commit themselves or have different timetables from a European point of view, the European commitment for the climate will penalize very seriously the European operators. That is why he is asking for protection at the European border for the European

entrepreneurs who have already paid a higher price than non-European entrepreneurs. That's why we have the C-BAM (Carbon Border Adjustment Mechanism). Any goods that arrive from a non-European country, which does not follow the same environmental rules as Europe, will be subject to a tax that applies at the European border. For the moment, it applies to a few sectors, the import of steel, aluminum, fertilizers, chemicals. Tomorrow, a European maritime operator could request the same protection. Outside Europe, the rules are laxer.

Appendix 8 – Ponis, Marta

Director at RINA Marine Consulting

Rotterdam, Netherlands

16/03/2022

Do you believe the European Green Deal will motive the push towards zero-emissions as a European initiative or more of a local initiative? We can observe that the northern countries are much more advanced regarding sustainability then southern countries in Europe.

It is both. You had European funds at the European level, and then the European Green Deal generated local funds. The climate change needs, the needs of bringing shipping to achieve not only the IMO targets but better targets to support the cop 26 goals. The shipping industry is too behind, even if they comply with all the IMO regulations. The shipping industry will not sufficiently lower their emission by 2050, so there is a need to push harder. This European Green Deal policy is helping and pushing so that you have funds at European level but then also at local and regional levels. Each country has started to receive funds from that policy. Recovery funds were also created because of the pandemic. The European Green Deal looks at the ship owners and infrastructures by checking the funds that are relevant to the European Union, the one that are relevant to the country and the ones that are needed for the recovery from the pandemic. The local funding is much more for research and development. While the European funds are both for research and development but also on projects that are going to be built. For example, you want to build a new vessel tomorrow and it will cost you 11% or 15% more because of the green innovative technology, then there are these funds that will cover up 60% of the of the CAPEX of the technology.

What makes the European Green Deal revolutionary? Do you believe there is enough innovative infrastructure for alternative fuels?

It's revolutionary because it's looking at the innovative technology and it's providing some funding. However, it still not enough in my opinion because the technology is not ready. Even if the technology would have been ready tomorrow morning, then the infrastructure is not ready. The only thing that is ready today is LNG, which is a cut out from the European taxonomy for financing because it's fossil fuel and is not considered as innovative. These green or innovative funds that are linked to the European Green Deal take a lot of time to be granted, around 12 months. This is the problem that ship owners are facing now. It's a chicken and egg situation. Now there are a lot of pilot projects financed by research and development which are testing technologies. It's going forward but it's moving a bit slower and more expensive than expected. The technology makers need the ship owners to order otherwise they don't commit, so it's a chicken and egg situation. It will move forward eventually because it has happened before with LNG so it will happen now again.

Do you think the technology will be available to reach to 2030 and 2050 goals?

Yes, it will happen in the next decade, but not all the ships will comply. There is a transition. Vessels and container vessels will have to switch to power connection. However, ports are not ready. The power of the cruise ship that you need is around 10 to 12 megawatts each. If have 3 or 4 cruise ships in a port, you need around 40 megawatts. Ports do not have this kind of power for the moment. Eventually, ships will have to become greener and reduce the CO2 emissions. They start with LNG, as it is already there, and it helps to reduce emissions. After we can use reformers to transform LNG to hydrogen, and then you burn hydrogen. There is a need of development of technology on board, rather than just switching off everything.

If LNG is already seen as a solution for climate change, do you believe innovation will slow down?

I don't think so, I think that it's opening the way to the innovation. The operations and safety of this gas need to be learned for the moment. It's the only technology available now. You can do mixture with hydrogen, or you can make into bio-LNG. The regulations are also impacting existing vessels. If an existing vessel cannot sale anymore because they can't convert, new ships need to be built. The only engine

available today is a methanol, on a couple of sizes, hydrogen on small engines, and for the rest the infrastructure is not ready, so the vessels need to be fueled by LNG. LNG can be used to mix with ammonia or to convert it into hydrogen. At least, the ship owners will start ordering ships with dual fuel engine which can be easily converted to hydrogen or ammonia in the future rather than putting on board a diesel engine. At least we are putting a foot into the future instead of staying there and waiting for NGO. There is not enough to switch directly from diesel to hydrogen or ammonia. The big companies that can be seen as pioneer, such as Maersk, are developing pilot projects, which is helping the development of the technology. They are ordering test engines with ammonia. This is a testing phase. However, if you must order a ship and you are not a big company such as Maersk, that can afford a ship just for the sake of testing, it is harder to adapt. This European Green Deal now is allowing us to have dual fuel engines. In the next 5 to 10 years, the ship can be converted eventually.

Appendix 9 – Scholten, Daniel

Strategic Advisor Energy Transition - The Netherlands Authority for Consumers and Markets

The Hague, the Netherlands

22/03/2022

What makes the European Green Deal revolutionary? (Alternative Fuels)

The EU has quite ambitious plans. This is good because we must move for the environment. However, it's also difficult because there's all kinds of assets involved which have a runtime of 30 years, if not longer. All these previous investments, you can't just ignore them, the things that we have done in the last decades. That makes it sometimes more difficult to move in towards a more sustainable energy system. I do think that for a large part, when it comes to electricity or electric appliances, I think this is the more or less low hanging fruit. It is easier to achieve. We have seen a big focus in the last decade or so on solar winds, batteries, electric vehicles. We have made huge progress. There are some concerns regarding the intensity of scarce materials that are required, and the grid is under siege from all kinds of new appliances, both on a large-scale production or on the household production side. The intermittency, the storage requirements and the agreed reinforcement, those type of issues are engineering questions that we can solve. It's a hassle and it will cost billions but they're solvable. This is a matter of not just political preference but activity. It's more difficult in the so-called hard to abate sectors, and it is not a surprise that in recent years we have been focusing a bit more on hydrogen in that regard. You don't power steel factories with electricity. You need something more powerful at least if you want to stay competitive globally. There are also all the remnants that electricity can't really do and that are picked up by new gases in various forms. If it's biogas, the people are talking about shipping methanol and ammonia and then making hydrogen out of it again or new gases. For a long time, natural gas was basically considered green or green enough. It's a transition fuel. In the current taxonomy, it is still a transition fuel. The green parties were complaining that all gases are horribly polluting. However, the requirements for natural gas are very strict if you want to still invest in it and it's quite focused on being a temporary solution. You can say the same about nuclear, but I think nuclear is less under siege in this sense. It doesn't really have the emissions. We expect to go to a more electric future. I understand why they want to have it as at least a

sort of backup. Hydrogen is for the heavy industry, for power to gas. It's for heavy transportation so mostly planes and ships. It used to be trucks but for trucks electricity works well already, better than you would expect. I think it's up to 250 or 300 kilometers, they're doing a good job. However, if you want to go from Poland to France then it's not good enough. That's where hydrogen comes in.

War in Ukraine

With the situation in Ukraine and the cutting off of gas supply leading to very high gas prices, we are looking at record high prices now. This is unprecedented in our history and, especially coming out of the COVID situation, we have a price 10 times as high basically as it was a year ago. This is quite a challenge. The market can survive high and low prices. It just can't survive the volatility of moving up and down very fast because then the suppliers can't really plan for it, they can't really offer long term contracts. High prices still put a lot of pressure on governments because so many households can't pay the gas and heat bill. It's the same for the industry. It's their competitiveness that is on the line. That type of worries is considerable. If we see an escalation of this crisis into the energy real, because all the sanctions haven't targeted energy all that much just yet, and we don't get Russian gas then it will not speed up the energy transition. We are focusing immediately on LNG, even coal fired power plants or whatever there is to fall back on. Coal is the only one which we have in Europe basically, apart from nuclear, so that's what they're going to use at first. In the LNG capacity, most of the installed capacity can be expanded but before new plants are operable, you're looking at years, two or three years at least. This is not a short-term move. Hence, the climate is the one who is going to suffer. After that backup capacity has been installed, then they're going to go full throttle and perhaps go faster with the energy transition because they might not be as willing to rely themselves on Russian gas in the future. I foresee, because of the conflict, more Co2 emissions in the short term, first couple of years, and then less in the longer term because then I think the energy transition will pick up speed again. It will take a bit of time, perhaps five years before they catch up where they thought you would be. Then they go faster than what they have currently planned.

The infrastructure of ports is not ready. How should the companies react regarding the purchase of their vessel?

The Rotterdam Port authority is looking at electrolysis hydrogen, CCS (carbon capture and storage). This is where the action is now. They see also possibilities for more LNG, a floating LNG terminal. It's basically a bunch of big ships offshore somewhere and then other ships can dock there. Rotterdam is very much a petrochemical harbor. They have a lot of coal, oil, gas, storage, shipping conversion. I think they processed 12% of the European fossil fuel. Then we're looking at molecules. That this is perhaps also more interesting for these harbors. What is going to come in really through shipping it's going to be methanol, ammonia, hydrogen, LOHC (Liquid Organic Hydrogen Carriers), different ways to ship it and to process it. It's also interesting because what are they going to do with electricity per se. All these petrochemical processes, they need hydrogen as part of their feedstock.

Equal regulations for all companies to follow the objectives?

A lot of companies are looking at how to make their ships more sustainable with less emissions. There are quite a few crazy things that they can do. They're looking at how can they use wind or solar on the ships. It's easier for the big companies to make the necessary investments. I do think that the ports themselves are quite proactive in incentivizing ships and greener shipping routes. They do have a policy in place to incentivize that. It might work a bit the same as the C-BAM, that you must comply to rules otherwise they can't go into the harbor. If it's a small company, they just don't have the financial reserves at hand as easily as the bigger ones too. On the other hand, it might also spur the innovation from the shipbuilders for cleaner vessels.

Will all countries in Europe move at the same pace when it comes to meeting the objectives of the European Green Deal?

Typically, Europe has a lot of stuff on paper but it's the countries which must execute all of that. They are communicating in there but in many ways, this is very much a national competence. You must be a bit pessimistic here when it comes to these initiatives. Countries can do a lot themselves. European countries

have done quite a bit even whether they coordinate or not. The good thing about many of these renewable, or energy efficiency targets, it's quite a scalable technology. It is not always the necessity to coordinate all that much. In the North Sea with the wind turbines, it looks like a very nice open sea but every square meter of that is basically already hired for some purpose whether it is the shipping lanes or military. Where countries are hesitant is the interconnection. Sometimes the capacity on interconnectors and electricity grids is pretty small compared to the amount of electricity used on either side of the border. This is also in in part sometimes of protectionist measure because you know if you have the physical connection for a lot of electricity from, for example Spain with a lot of solar, moving into France, then there's a lot of pressure because cheap solar would then crowd out the nuclear electricity and the French still want to pay off their nuclear power plants. There's more effort that needs to be done in integrating these markets, also physically, so bigger wires essentially. That is something that where it is lacking, not on the regulatory side. I don't see so much problem, there's quite clear drive towards the single market and the same is for energy. However, when you look at a system, especially in terms of gas, it has always run from east to West and for half of Europe. The western Europeans have a very different origin of their oil and gas. They look at it very differently. One thing that is stated is that not everybody wins equally from this energy transition. You have countries, indeed, which produce these technologies, have the know-how, have the capital to do so and export them. They earn a lot of money with the energy transition, so it's not just for the security of supply or the climate. This is the big difference between East and Western Europe. I think that is the biggest political hurdle. For Eastern Europe, the transition is not necessarily a win. Yes, they are less dependence on Russia, it's good for the climate but it's not an economic win per say. At least that is just how it is felt. If coal mines need to be shut down, this means that a lot of employers are getting laid off. This is typically a Polish argument, but you must be a bit sensitive. These people don't necessarily have all always the wallet that someone in northwestern Europe must pay for these issues. Even in the Netherlands, we're worried about vulnerable groups who are no longer able to pay the energy bill in this crisis. That is something that would really undermine. Here again, Russia has given us the excellent example of a foreign threat which unites Europe. There might be things moving more than we would have expected otherwise. These are big steps and I think this integration of the grid in Europe is something that could really, bringing it back to the Green Deal, be leading example of a step that needs to be taken and enable more steps to be taken to do things jointly. Tt's the same with gas pipelines from Algeria. These are commitments for decades. The more you have this type of physical interconnections, it's also very symbolic for people to feel they are working on this together. If someone in Romania switches on their solar panels, then the effect is felt somewhere else in Europe. These are the things that make

people more aware. Slowly but surely, it creates a consciousness on the European level about the necessity to optimize the system as a whole and not for individual member States. This will also get a feedback loop to the whole Green Deal and how it's going to be implemented across Europe. At this point, it as it has always been thank you EU for this joint idea but we are going to now do whatever we want to reach the targets. Member states are the ones which are allowed to say that they are going to invest and to reach the targets with whatever type of thing they want to use to reach it.

Will the European Green Deal block competition with the rest of the world? Is the C-BAM enough to avoid a disadvantage for Europe?

I think the Green Deal is, on the one hand, very good because it spurs innovation. Companies must do something so they get their asking that they can't be lazy and rely on cheap fossil fuels for their competitiveness. That is good for within Europe. It is only fair in this sense that you try the C-BAM, because otherwise in the short-term companies hurt their own business. However, the enforcement of the CBAM is very difficult. The carbon tax can be raised at the border. However, if you are a Chinese company, you have coal fired power plants and you have renewable offshore wind parks and then you're going to use coal that to make a product, but then on paper you can just make it show that you bought it from the wind farm and then it's green. It's very difficult to enforce these things. However, you can't simply go somewhere else, be polluting and then import it back here there. Especially if you take it a bit broader such old-fashioned pollution, soil degradation and stuff like that, it's much harder to cover up. It's a bit like what we have here in an energy market, where you have gray and green electricity. It doesn't really matter how much come goes in where, if the amount of people that buy green electricity roughly coincides with how much gray energy is generated. If I pay for green, it might mean I get gray electricity but still the money I pay goes to the producer of wind farm for example. However, I do I have sincere doubts about the enforcement of C-BAM. Nonetheless, a lot of countries do take it seriously. Also, because they want to do something themselves as well so. I think even some foreign governments might think that the Europeans are crazy enough to do it, then it also forces some of our companies to do something about it and we don't have to push him as much. There are many dynamics at play, and it might be that this space of C-BAM eventually gets expanded by a coalition of the willing who are also going to do it and then we don't need to check it anymore for interregional. I think the EU, with this type of measures, does create

itself a leadership role in this global climate discussions and energy transition. It's more about installed capacity rather than emissions. I think Germany is a good example because as far as I know the CO2 emissions are going up and but so is the installed capacity of renewable energy.

How is the European Green Deal revolutionary compared to other sustainable policies that were put in place before?

The European Green Deal is very broad, it covers a lot. National environmental policies can do the same thing and have been doing the same thing. However, I do feel is that if you jointly sign up there's more group pressure to perform. What I also feel is revolutionary about it is that there's an intention to export the Green Deal to other countries in a way. You must do a green investment abroad to have this taxonomy of what it is OK to invest in. That is quite radical and new. We know it with Kazakhstan, or in northern Africa, it does determine what type of trade contracts we do with these countries, what money is there for specific issues, do you want to invest in local companies or work together with the government. There's some active thinking about the strategic side of this of the Green Deal. That is going way beyond a usual logic type of “we have to reduce emissions”. It’s not just seen as a climate change measure or energy measure. It is also seen as a strategic statement that we have. It really determines what European companies and states are investing in and how they actively contact other countries in this new development of green relations. I think that aspect is something that individual countries usually don't do as much. For them, it used to always be energy is just business type of approach.

Conclusion

When it comes to the ports, there's a big effort especially on hydrogen to go from gray to blue to green hydrogen. There is a risk that you get stuck a lot longer with blue hydrogen than you would like. The cost of electrolysis is quite high, I think it's three times as much as steam methane reforming. Of course, it depends a lot on how cheap the electricity is that you get into it. Scholars they look at how we can use the peaks of winds to produce very cheap hydrogen through electrolysis. The thing is that we're going to use more and more electricity and probably we want to use the cheap electricity for the electrical

appliances. So how much is generally left for hydrogen production on a structural scale. It needs to be ongoing. The risk is that we move away from steam methane reforming to something with CCS. However, how long can we sustain CCS, how big is this storage underground, how many years can we keep it pumping it full of carbon, and how fast will the cost of electrolysis drop. Of course, you can always use electrolysis but then the prices go up for final consumers. These are things I'm sometimes a bit worried because I see these time scales and then they say that by 2030 or 2035 it's all electrolysis. It's good for the climate but the economics don't really support it just yet, or everybody is just OK with the fact that it gets a lot more expensive. I worry about those things. Most people they see a target, they see a measure now and they don't really think in terms of a temporal dimension. They say this is what we do now and in 2025 we have reevaluation, in 2030 we do another and look at multiple pathways how this could develop. They don't build in this type of flexibility, there is this there's a target in 2050 and then there is a measure down here and then they push that measure, and then hydrogen starts to grow because you give subsidy and then consumption picks up and it grows and grows and. Suddenly, they reach all kinds of problems in the networking. The network isn't built for it and then it takes a year to build it, and then there's a whole lot of problem. All this type of process, they're not always considering in this type of major infrastructural projects. That is something I always stressed, we have the goals, and we have the tactics, but we don't always have the strategy or the blueprint how the system should look like in 2030, 2040, 2050. That is usually where the bottleneck is at. Government should think or dare perhaps think a bit more in terms of blueprints, taking the organizational role. We have been in 20 years of liberalization and free markets and now the last couple of years people becoming more critical. You still see that big decisions tend to get postponed, where you would prefer to have a bit more vision or guts from politicians to just do.

Appendix 10 – Virlet, Alban

Advisor in charge of industrial affairs, air transport, maritime sector, and ports - Office of the French Minister for transport

Paris, France

30/03/2022

Original interview in French – Translated to English

Why is the European Green Deal revolutionary?

Maritime decarbonization is something that is being played out at the international level, then at the European level, and then at the regional level. If we take the case of France, for example, it is not the best covered sector, because there are many international routes. It is a very transnational sector, hence its vocation to be done at the European level as well. When we talk about the greening of ports, there is always the key issue of thinking about the competitive stakes that this can pose. The European Green Deal and the Fit for 55 package are finally very ambitious. It is up to the challenges that lie ahead. It's true that it requires a bit of research into gains in all segments. On the maritime side, you have two main texts, the maritime ETS and the maritime FuelEU. One is more focused on the carbon market, so with the market that has the interest in relation to a tax to control the volume of emissions regardless of the price behind it. Will there be a risk that a ship coming from the United States or stopping in the United Kingdom or in Tangiers, and then ending up in Europe to circumvent the ETS regulation? This is the question of carbon leakage. The commission made the calculations, estimating that there would be additional port fees to pay when you stop twice, that there are pollution costs, and additional travel costs. The commission considers that the risk is rather measured. So that's the first issue. At the beginning, we will be able to live with speed reductions, but quickly from 2030, we will have to look for more disruptive solutions. The major difference between maritime and air transport is that in maritime transport, we do not have as much control over technology. However, you have some innovative players, particularly in the Scandinavian countries. There are quite a few things with methanol, technologies on ferries. In France, there is the Energy Observer. France is building a second one. It's an experiment in start-up mode, but it's true that we don't have any shipyards except for cruising. There is also a challenge of industrialization in the producing countries. Regarding the use of revenues from the maritime ETS, today there are such sums to be reimbursed as part of the European recovery plan. As a result, these revenues will be used to

reimburse the recovery plan with the loans that have been taken out at the Community level. However, we are careful to ensure that, within the framework of the ETS innovation fund, which is a European fund that receives a certain amount of income from the ETS, there is a capacity to support maritime projects. We will have to be careful not to look only at R&D projects. At some point, we will also have to help some shipowners to convert their fleets. This will be a challenge. On the cruise side, the issues are a little different. There are stronger European players in Germany, Scandinavia, and France. On our side, we have tried to keep all this in the framework of an exercise called the maritime operation. It was a common approach to the Ministry of the Sea, Transport, and the Economy for the reduction of carbon emissions and the maritime sector, as well as to move forward on the social level for more equity. In this context, we have extended the scope of certain public guarantees covered by banks for greening projects for French operators with a French flag. We will not do this for all vessels, but the idea is to extend it and facilitate financing for vessels and shipowners. We have also extended the benefit of a tax credit on depreciation, which allows the financing of an additional depreciation. The last axis is also to support French innovation, which has been recently strengthened, which in fact had made, somewhat like in the aerospace industry, work together the actors of the sector, to have shared roadmaps to avoid doing the same projects. This is something that is being structured at the Ministry of Industry, Sea, and Transport.

How to decarbonize ships?

You have the possibility of using liquefied natural gas, which costs a little more but pollutes less, but you don't gain that much on CO2, only 20%. You also gain on the other types of pollutant emissions. You have methane, it's a bit expensive to produce but it's a possibility. Hydrogen, then it takes a lot of space, so the yields are not efficient for long distance. After that, there is a lot of talk about ammonia, especially in the UK. The problem with ammonia is that it would be reserved for ships with very few passengers because it is extremely toxic. There is no perfectly optimal solution; there is also the idea of reducing speed. The idea is to deploy these options. There are also biofuels, but similarly you have a conflict of use with the automobile and the airline industry. The airline industry is betting heavily on biofuels because, apart from hydrogen in the short term, there are no other ecological solutions. It is a resource that is looked at by many people and that is limited in terms of sustainable biofuels generations. You can produce fuels then 3rd generation today, it is not very developed. After there are synthetic fuels, we fall back a little in what I told you, in methane this kind of thing.

Port infrastructure

On ports, the big issue is the electrification of ports. The challenge is to determine the number of stopovers per year that will force ports to install charging stations. We will avoid installing terminals that are expensive to purchase, even if they are in operation in ports where very few ships pass through. The problem we would have in this case is that the port would charge the ship, the ship would go to a big port and then go directly to the small one. We will end up with the goods arriving in the big port and finishing by road to the small port. We make calculations but it is not necessarily in CO2. We must be careful if we impose electrification in the smallest ports, it can have counter-intuitive effects and we end up with more CO2. There are real challenges to capture CO2 and then potentially use it to produce synthetic fuels or eventually bury it in the North Sea or elsewhere in the old gas pockets. There are projects in Rotterdam and the port of Le Havre. As regards quayside connections, there is a strong desire on the part of the major ports, notably through the signing of a declaration in Brest. There are a certain number of major world ports that have prepared this declaration, ports of major countries, not only European. There are legal questions about who pays for the connection. Is it the port authority or the container terminal manager? This also touches on questions of energy regulation. For example, in France, there are reductions of 5 years on a tax that weighs on energy to finance renewable energies, which has several solidarity mechanisms for electricity. For example, on shore power connections, this tax is subject to a rather strong reduction for several years, to precipitate the deployment of electrification.

Comparison between different European countries

There are two things to innovation. First, there is the offer from the shipbuilders who are connected. Then there are the shore power connections. In any case, all the countries will have to do this as soon as there is an obligation. Currently, there are discussions on the threshold of calls from which the cost of connections is subsidized. There may be European subsidies for certain ports, core networks, overall. There will also be an issue of support for states that may have fewer resources in this area. In innovation, the countries that have some actors who are very tidal, rather the northern countries, France, Germany, I think not bad.

Conclusion

It is that in the next few years we will know how to do it well, but rather quickly. It is from 2030 that we were looking at the targets of FuelEU. We talk a little in the impact study, you need alternative fuel and that's where it starts to get a little complicated. There will be an impact on the cost of goods no doubt. We are in a period where there is uncertainty about the cost of energy in view of the war in Ukraine. It can be an opportunity because biofuels, for example, are comparatively cheaper, well the extra cost is less than fossil fuels. Electricity, the price has also exploded.

Appendix 11

Interviewee's name does want to be mentioned

Solution Design Manager for EMEA region - Transport at DHL Supply Chain

Bonn, Germany

15/03/2022

With DHL, we have a sustainability policy that has been pushed. More especially in the last years. It is a journey that started long time ago in 2011. In the last three to four years, they have really started to put the focus more on them. We do have some sustainability goals to reach to be carbon neutral by 2050 and half our emissions by 2030. We also signed some of these agreements, within the Paris framework and other frameworks. Many of our biggest customers also signed up for these frameworks. Before it was more a shelter protocol and there was the idea that we should maybe do something around the environment someday. Now we see the push from customers and internally from the company and from the employees as well. It is a whole social change that has been impacting every part of the business.

Do you think DHL is stricter when it comes to working with companies that are not in compliance with your sustainability goals, even if they are a potential big client?

In a way yes partly. As a logistics provider, we are not only being measured on the emissions of our fleet but also on the contracts we have. The emissions of the fleets we have contracts with count as our own emissions as well as the emissions of the client. One part is ensuring we use the best solution, by optimizing routes and network design. This is something we highly focus on. The second part is controlling what carriers do and the technologies they use, the fleet that they're using. There is an industry wide classification on how good carrier is. We also have our own ranking for the carriers we work with. We see more and more carriers picking up LNG and gas fuels, or some small electric vehicles in some regions. This change is especially happening for the last mile deliveries in cities, however not for longer line hauls for the moment. What I'm saying is that we can control carriers to some extent but the technology in the market is also not yet there to the extent that our entire supply chain can be electric from tomorrow on.

We try to include sustainability in proposals. We develop sustainable solutions, with LNG fuel for example. We are starting to focus a lot more on rail now. It is somewhat faster, cleaner, avoids a lot of border issues, more secure. However, when it comes to buying fleet and vehicles, there are some pilot prototypes. Especially in Europe, it's growing but for some regions, for example Turkey or Middle East. Also, the challenge is that for LNG and CNG trucks, you need the tank stations along the way. Even if you have the sustainable vehicles, you still need to plan roads according to the fuel stations.

Do you think it's moving too slowly to reach the 2050 zero-emissions goal?

It depends a lot on the industry. I'm working mostly in the warehousing and transportation sector. We have three strategies. We try to reduce as much as possible emissions. We can change all the electricity and the power types. For example, for the supply of energy, we are focusing more on renewable energy. This is somewhat easier, more controllable. It's pretty much like changing energy providers. You can do it at home, in a power plant, in a warehouse. We started switching all the lights to LED lighting. There is a lot of carbon savings coming from those things that seem small, but they are having an impact. Then the last point is that anything we cannot reduce, we try to offset it., by planting trees for example. It also became evident that we can become carbon neutral, but it will be probably difficult to not emit at all by 2050. In terms of the timeline, it is not an easy target, but I see a lot more development recently. I believe that we could still make it, but it must be not only us but also the customers, the competitors, the institutions. It's possible but it is not an easy target.

Do you think the change is affordable for everyone?

It depends on the type of change. Some green solutions are cost efficient. In some others, overall, the yearly costs can be high. It really depends on what the customers wants. If the final customer has an interest in products that are made and shipped in an eco-friendly manner, the company will adapt. It might be costly, but since the demand for ecological products is coming from the customer, it will pay out in the end. The customer is usually asking for the cheapest solution on the market. If the product is so cheap that we cannot provide our standards on sustainability, the quality standards of our service and so

on, we would just not produce it as DHL. For smaller carriers, it might be harder. However, I have a feeling that there will always be some market for those smaller companies. Most of the customers are shifting towards an eco-friendlier solution. In the end, those that won't change will be left out. Some companies are driving the change and the others will follow later.

For the ones that are struggling more with the finances and taxation, do you think the government helps enough or they are being left behind?

Smaller carriers have the issue of not having enough capital to invest in sustainable vessels for example. Some support from government could be helpful. I also see the other side of the story. If governments really want to push towards a goal, then at some point the industry change will have to happen. It is it is an issue, and it depends on the way you in which you charge fuel. In the end, small carriers do what the customer wants as well. The final customer will be the one that is taxed, rather than the service provider. Smaller companies could think even off developing or merging with other green companies. The pressure should always be on those requesting non sustainable solutions. We see even those customers that were historically very resistant, we see that they are mentioning to switch to more sustainable fuels.

Do you believe the European Green Deal will motive the push towards zero-emissions as a European initiative or more of a local initiative? We can observe that the northern countries are much more advanced regarding sustainability then southern countries in Europe.

For government policies, initiatives, financial incentives and so on, there is a European framework, but they are pretty much country driven. This is mostly because the tax systems are decided by the countries. However, if we exclude local providers, so companies only operating in one country, all the others, especially within Europe, they operate under the European agreements. In the end, it's one transport network, one transport budget, one or more than one company operating the flows, but they are still beyond the national control. If we, a customer that is operating both in, for example Italy and a Nordic country, and that is asking for a transport tender, the company would most likely include sustainability in there. Of course, the extent in which you can apply it depends also on the infrastructure, if you have fuel

electric vehicle recharging stations or LNG and CNG fuel stops. Europe is getting more uniform overtime. We also see like in Eastern Europe, for example Poland and so on, start getting more into the CNG trucks as well. Historically we had a lot of truck providers based there, or at least the drivers and many companies operating. Even there, it's becoming more popular. Government wise, it's country by country and there are some differences but, in the end, logistics knows no borders.

Do you think war in Ukraine will delay this sustainable initiative?

This is of course a wider topic. It's going to impact the overall energy supply of Europe. It's going to have an impact on the network around the development of the industry because if there is an increase in energy prices usually it's also linked to fuel prices. If you have an electric fleet or a fuel fleet, you would be impacted either way. One impact we are starting to see is on air freight because now they try not to fly over Ukraine or Russia. That has an impact on longer lead times for air freight and capacity is getting tighter, there is more of a general logic impact on logistics. There are many ways in which it can affect. It can have an impact on the energy supplies and the pricing. Logistics is a very low margin industry, especially for transport. So, if any of the cost increase, including fuel or energy, then also your profits will shrink, unless you agree with the customers to pass over some of these costs. I heard in the news for example that the transport fleet in Italy would stop services from Monday on because of the fuel prices, until the government find a solution. The carriers saw an increase in fuel prices but the price the customers will pay did not change so it is not profitable anymore. This will probably happen more and more unless they really solve this fuel story.

Do you have any additional information you would like to add?

I think we covered really most topics. One last element, which is more of a human element to this story. When we talk about sustainability in logistics, it's a lot about customers, fleet, transport systems and so on, but also the human factor plays a role. We need to have a ESG policy (environment, social and governance policies) to retain employees and attract new employees and have them be a part of the company. We had a very big training program, certified go green specialist program. If each of employee

would be concerned regarding sustainability, it would have an impact in their own realities. There is always our social aspect to it and that's the main driver. There will be many more new joiners in the company, asking what you do for green, in which way do you apply sustainability.

Do most of the employees agree with the new green initiatives that were shown throughout the trainings?

Many of the younger generations have this drive for sustainability. The training has also helped to put in a structured framework. The people always think that sustainability is a good aim, that something should be done for the world but what exactly and how was a whole other mystery. We also start seeing it being measured in KPIs of our financial reports. There is a whole section on green so the training and all the policy that we are running within the company has helped older generations, those that were a bit more resistant or maybe not aware of the topic since logistics is a very old industry, to get more involved across all functions.