**UNIVERSITY OF OSLO**


**FACULTY OF LAW**

**LLM MARITIME LAW**

**2019-2020**

**Title**

# "*SHIPPING INDUSTRY UNDER THE INTERNATIONAL CLIMATE CHANGE & ENVIROMENTAL REGIME*"

**Candidate number:** 8107

**Course number:** MARLTHESIS

**OSLO**

**DECEMBER 2020**

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## ACKNOWLEDGEMENT

I would like to express my gratitude to my supervisor, whose valuable guidance was determining in completing this thesis.

I would like to thank all my friends in Oslo, for their great support in my academic effort and the big change in my life after moving to Norway.

This paper is inscribed to my mother, who is always supporting my dreams.

## I. INTRODUCTION

It was in early 1979 that for the first time it was stated at the First World Climate Conference[1] that the ecological balance of our planet is shifting on an unprecedented scale. This new phenomenon, Climate change, identified as a problem with global dimensions which consists great threat for the whole planet and is considered as one of the biggest challenges that humanity must face. Different human activities contribute to climate change, including shipping industry among them. The topic has raised great controversy globally. On June 1, 2017, United States' President Donald Trump announced that the U.S. would withdraw[2] from the Paris agreement. Even though the withdrawal has not yet taken effect, such a decision from the US can create great uncertainty for future actions. However, the global community remains focused on the common effort of tackling the effects of the upcoming climate change. The recent devastating fires in Australia which burned in total, more than 7.3 million hectares (17.9 million acres), an area larger than the countries of Belgium and Denmark combined, affected about half a billion animals and cost the life at 28 people[3]. It worth to be noted that an increase of approximately 1°C[4] has been occurred in Australia since 1900 due to human-caused greenhouse gas emissions. Increasing temperatures can influence fire danger in various ways, including through their effect on humidity and the moisture content of vegetation. Undoubtedly, this should 'ring the bells' to the global community that our planet's ecological balance is in danger and crucial actions need to be initiated.

Over the last years, international, regional, national regulations and laws have been developed since the problem was first detected. As a result, a complicated system of legal and political agreements, for the reduction of GHGs emissions has been formed[5]. The most significant legal regime can be detected in the *United Nations Framework Convention on Climate Change* (1992)[6] (hereby: UNFCCC), which created the legitimate ground for the *Kyoto Protocol* (1997) and the *Paris Agreement* (2016). A deep analysis of the interaction between the aforesaid conventions will follow in

[1]Handbook on the *United Nations Framework Convention on Climate Change* (UNFCCC) p.17
[2]Article by Hai-Bin Zhang, Han-Cheng Dai, Hua-Xia Lai, Wen-Tao Wang, Sep. 2017, Available online at www.sciencedirect.com: *'U.S. withdrawal from the Paris Agreement: Reasons, impacts, and China's response'*
[3]Article by Jessie Yeung for CNN on 14.01.2020: *'Australia's deadly wildfires are showing no signs of stopping. Here's what you need to know'*
[4]National Environmental Science programme by Dr Andrew Dowdy, Earth Systems and Climate Change HUB October 2019: *'Bushfires and climate change in Australia'*
[5]Cinnamon P. Carlarne, Kevin R. Gray, Richard Tarasofsky, Mar 2016: *'The Oxford Handbook of International Climate Change Law'*. P 4
[6]United Nations Framework Convention on Climate Change, originally adopted on 9 May 1992

chapter IV. The main objective of this framework, which can be identified as the backbone of the international climate change legislation is:

'to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.' [7]

Further reference will be made to EU's initiatives to follow the international regime and the efforts of the Union to tackle climate change. A comparative approach between EU's policy for shipping and aviation industry will be conducted also.

The below dissertation is shaped under the scope of maritime law and the need for special regulations in shipping industry. To present a solid approach of the issue, it is considered necessary to conduct an overview of the global GHG emissions impact and point out the necessity for international rules. The evolution and the 'maturation' of the International climate change regime will be explored, starting from the UNFCCC back in the 90s, until the extremely innovating International Maritime Organization[8] (IMO) 2020 regulation. It is to be noted that IMO 2020 Regulation addresses $SO_x$ emissions[9], which are not greenhouse gases, therefore, it is not directly relevant to climate change. However, this innovative new rule consists a landmark for shipping industry and it should be considered as part of the common effort of the international community to protect environment and human health in general.

But how did we reach to IMO 2020 regulation? What is the role of IMO and why is there a need for IMO to implement rules on behalf of the international community? To have the aforesaid questions answered, it is considered necessary to understand the complexity of shipping industry and its vital significance for the modern global economy. A brief analysis of the historical and functional approach of IMO will be made. Furthermore, the International Convention for the Prevention of Pollution from Ships (1973) as modified by the Protocol of 1978 (here after: MARPOL convention)

[7] *United Nations Framework Convention on Climate Change* (UNFCCC), Article 2
[8] IMO is a specialized agency of the United Nations, responsible for regulating shipping
[9] Source: http://www.imo.org/en/mediacentre/hottopics/pages/sulphur-2020.aspx

and its annex VI (1997) will be explored in depth and a comparative overview between maritime legal instruments and international climate change regime will be conducted.

Further reference to MARPOL convention will be made under the scope of tackling GHG emission from shipping by the guidance of IMO's regulations. The concept of Energy Efficiency Design Index, the Ship Energy Efficiency Management Plan, and the emission control areas (ECA) will be discussed extensively also, before approaching the 2020 regulation. An extended analysis of the regulation will follow. It is extremely important to provide a solid understanding of the issue, both from a legal and especially from commercial approach. Challenges that market is facing, but also the reaction of the industry to the new era after the enforcement of the compliance rules will be explored. The side effects of the new rules will be illustrated, and suggested solutions will be discussed.

## II. TECHNICAL INFORMATION AND DEFINITIONS

**Climate change**[10]**:** is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time. The factors can be either "internal" or "external". Internal factors are natural processes within the climate system itself (e.g., the thermohaline circulation). External factors can be either anthropogenic—caused by humans—(e.g. increased emissions of greenhouse gases and dust) or natural (e.g., changes in solar output, the earth's orbit, and volcano eruptions).

**Legal definition of climate change**[11]: "Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

For the purposes of this essay, the term *climate change* refers to the law definition.

**Emissions**[12]**:** 'means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period.'

[10]Climate change is a comparatively broad concept than the more popular term 'global warming'
[11]As defined by UNFCCC article 1.2
[12]As defined by UNFCCC article 1.4

**GHGs**: compound gases that have the property of absorbing infrared radiation emitted from Earth's surface and reradiating it back to Earth's surface, contributing to the greenhouse effect,

**Source**[13]**:** 'means any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.'

**Carbon dioxide ($CO_2$)**[14]: organic molecule composed of a carbon atom and two oxygen atoms. Fossil fuel use is the primary source of $CO_2$. $CO_2$ can also be emitted from direct human-induced impacts on forestry and other land use, such as through deforestation, land clearing for agriculture, and degradation of soils. Likewise, land can also remove $CO_2$ from the atmosphere through reforestation, improvement of soils, and other activities. It is one of the main GHGs.

**Carbon footprint**[15]: 'the total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO2).'

## III. THE IMPACT OF CLIMATE CHANGE AND THE CARBON FOOTPRINT OF SHIPPING INDUSTRY

### A. Global production Of GHG emission

According to the Intergovernmental Panel on Climate Change (IPCC)[16] findings the production of GHG globally can be attributed to different sectors of economy as follows. Electricity and Heat Production rate to 25%, as the burning of fossil fuels dominates in the production of power, even though the renewable energy sources are getting more and more ground. The agriculture, forestry, and other land use cover 24% of the total contribution of GHG emissions. Industry follows with 21%, while the transportation sector covers 14%. This sector[17] primarily involves fossil fuels burned for road, rail, air, and marine transportation. At this end, buildings cover 10% and other

[13]As defined by UNFCCC article 1.9
[14]See U.S Environmental Protection Agency (EPA) https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data
[15]Article available at https://www.britannica.com/science/carbon-footprint by Noelle Eckley Selin for Britannica ACADEMIC, May 25, 2010: *'Carbon footprint ecology and conservation'*
[16]See IPCC, Climate Change 2014: *'Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change'*
[17]Almost all (95%) of the world's transportation energy comes from petroleum-based fuels, largely gasoline and diesel.

energy[18] an amount equal to 6%.[19] Even though the global production of GHG emissions can be affected and restricted in periods of economical regression, the trend is that the total amount of $CO_2$ emissions is being increasing rapidly. According to the same report, the total amount of $CO_2$ emissions has developed from 19.9Gt$CO_2$eq per year (giga tones of $CO_2$ equivalent) in 1970 to 33.61 Gt$CO_2$eq per year in 2010.

According to statistics from the Carbon Dioxide information analysis center (CDIAC)[20] for 2014, China 'leads' the global production of GHG with a figure[21] of 2806634 mt of carbon per year, which is equivalent to 30% of the worldwide production. Followed by the U.S.A., which contributes 15%, a figure which is approximately at the same level with the worldwide transport sector. The list is completed by EU (9%), India (7%), Russia (5%) and Japan (4%). It worth mentioning that the rest of the world is producing the same amount with China, which is 30% of the Global Co2 emissions annually.

### B. Brief overview of the impact of Climate change

A significant volume of the energy radiated by the sun to earth, is reflected back by our planet's atmosphere into the space. It is the clouds, aerosols, and atmosphere, which form a thick blanket around the Earth, reradiate some energy back. This process is identified as natural greenhouse effect[22]. The result of this mechanism is keeping the ideal conditions for maintaining life on our planet. However, since the industrial revolution commenced, the extended release of GHG emissions have significantly modified the global energy balance. As GHG emissions are concentrated in a larger extend around the planet, the loss of energy to space is gradually reduced, resulting into the increase of the earth's surface temperature.

The aforesaid phenomenon has led to some substantial changes which have been noticed over the last years. Chronic droughts, which lead to soil erosion and plenty of other devastating side effects have been reported in many regions. Receding of glaciers

[18]This source of greenhouse gas emissions refers to all emissions from the Energy sector which are not directly associated with electricity or heat production, such as fuel extraction, refining, processing, and transportation.
[19]See IPCC, Climate Change 2014: *'Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change'*, p. 9.
[20]Source: U.S. Environmental Protection Agency (EPA), Global Greenhouse Gas Emissions Data https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data
[21]Emissions (CO2_TOT) are expressed in thousand metric tons of carbon (not CO2).
[22]Asheem Srivastav, Springer Nature Singapore Pte Ltd. 2019: *'The Science and Impact of Climate Change'*,p. 40

has been noticed also. It worth mentioning that on 2014, Okjökull[23], a small[24] glacier in West-central Iceland, was the first officially glacier to be declared 'dead'. Furthermore, acidification[25] of oceans is being noticed as a reflect consequence of the increased $CO_2$ in the atmosphere as the oceans take up much of the $CO_2$ through their surface. The most significant impacts of these changes can be listed as follows: habitats are destroyed, and species driven to extinction, cultivable land is depleting, and global mean sea level (GMSL) will have raised significantly by 2100 relative to 1986–2005[26]. Further to that, beyond 2100, GMSL will continue to rise for centuries due to continuing deep ocean heat uptake, putting the whole balance of our planet into a great danger.

### C. Overview of the GHG emission from shipping

Shipping industry's GHG emissions are 'credited' to the transportation sector (14% of global GHG). The GHG emissions of total shipping (international, domestic, and fishing) have increased from 977 million tonnes in 2012 to 1,076 million tonnes in 2018 (9.6% increase). This figure includes carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O), expressed in CO2. The amount of CO2 which is released from the industry has been steadily increasing during the last years. In 2012, 962 million tonnes were CO2 emissions, while in 2018 this amount grew 9.3% to 1,056 million tonnes of CO2 emissions. Shipping accounts for approximately 3.1% of global CO2 and approximately 2.8% of GHGs on a CO2e basis[27]. From a more comparative point of view, shipping should be included among the biggest 'producers' of GHG globally and ranked as the 7th biggest pollutant after Japan. International shipping specifically accounts for approximately 2.6% and 2.4% of CO2 and GHGs on a CO2e basis, respectively. These CO2 and CO2e comparisons are almost equivalent, but slightly smaller than, the 3.3% and 2.7% of global CO2 emissions reported by the Second[28] IMO GHG Study in 2009 for total shipping and international shipping, respectively. This depletion, however, can be attributed to the recession of the shipping market

[23]See Nasa Earth Observatory, https://earthobservatory.nasa.gov/images/145439/okjokull-remembered
[24]Okjökull spanned an area of about 38 square kilometers in 1901, 3 square kilometers in 1978 and less than 1 square kilometer remains today.
[25]For more information on the effects of acidification of oceans to the climate see Asheem Srivastav, Springer Nature Singapore Pte Ltd. 2019: *'The Science and Impact of Climate Change'*, p. 11
[26]IPCC September 2019, special report for: *'The Ocean and Cryosphere in a Changing Climate'*, p. 324
[27]Fourth IMO GHG Study 2020: '*Final report for reduction of GHG emissions from ships*', 29 July 2020, MEPC 75/7/15, p.10
[28]Second IMO GHG Study 2009, International Maritime Organization (IMO) London, UK, April 2009; Buhaug, Ø., Corbett, J.J., Endresen, Ø., Eyring, V., Faber, J., Hanayama, S., Lee, D.S., Lee, D., Lindstad, H., Markowska, A.Z., Mjelde, A., Nelissen, D., Nilsen, J., Pålsson, C., Winebrake, J.J., Wu, W., Yoshida, p. 24

during the upcoming years after the financial crisis of 2009[29]. For the needs of this dissertation, any future reference to shipping is meant for International shipping.

It can be said that shipping is responsible for a significant amount of GHG emissions which can be compared with those of many industrialized countries. It is of great interests mentioning the allocation of $CO_2$ emissions per different types of ships. Between the years 2013-2015, container ships accounted the lion's share, which was approximately 23% of CO2 emissions from shipping in total. Bulk carrier trade is causing the 19% while the oil tanker 13%. The aforesaid three different types together accounted for over half (55%) of the CO2 emitted in 2013, 2014, and 2015. Rest 45% of the share is allocated between general cargo vessels, chemical tankers, liquefied gas tankers, roll on/roll off vessels, pure vehicle carrier and other liquids tankers[30]. Undoubtedly, no one can argue that shipping industry should not adapt in the new era and mitigate its environmental carbon footprint. However, and before reaching to any conclusions it is significant to follow a more comparative approach to the issue.

### D. Comparative analysis of total shipping transport supply to aviation in regard of GHG emission

As it was analyzed in previous chapters, shipping has a significant contribution to the deterioration of the ecological balance of the planet. However, interpreting the figures from a different point of view can lead to different conclusions. According to IMO, maritime transport is vital for modern global economy, as over 90% of the world's trade and manufacturing supply chain is carried by sea, while the total production of GHG emission by shipping is estimated around 3% of the global figures. Therefore, it could be said that maritime trade is not only, by far, the most cost-effective but also 'eco effective' way to move massive amounts of goods and raw materials around the world.

In 2018, containerized volume of transported cargo counted approximately 793.26 million twenty-foot equivalent unit (TEUs)[31], while tanker trade is calculated at 3.194 million tones loaded. Main bulks 3.210 million tones loaded, and other dry cargo 4.601 million tones loaded. In general, world maritime trade was calculated in a total volume

[29] Article by Ozan Sahiner, 2016: *'The reason for financial distress in shipping industry'*

[30]Naya Olmer, Bryan Comer, Biswajoy Roy, Xiaoli Mao, and Dan Rutherford, International Council on Clean Transportation Oct.2017: *'Greenhouse gas emissions from global shipping, 2013–2015'*, P.14

[31]The twenty-foot equivalent unit is based on the volume of a 20-foot-long (6.1 m) intermodal container

of 11 billion tons in 2018.[32] From a more comparative approach, it can be said that container ships, bulk carriers and oil tankers can be credited for 84% of total shipping transport supply, while they are causing around 55% of the CO2 emitted by shipping, as was analyzed in previous chapter (III C).

To designate further the issue, it is considered appropriate to follow a brief approach to aviation, as another important transport sector. The international scheduled air transport industry is more than 100 times larger than it was in 1945. Few industries can match the dynamism of that growth. However, according to IATA[33], global transport of goods by air are estimated around 52 million metric tons of goods a year, representing less than 1%[34] of world trade by volume.

In 2018, the carbon footprint of international aviation industry was equal to 2.4%, a total of 918 million metric tons (MMT), of global CO2 emissions from fossil fuel use. 43% out of the 918 million metric tons derived from passenger movement in narrow body aircraft, followed by widebody jets in a 33%, while regional aircraft contribute 5%. The remaining 19%, which is equivalent to around 175 million metric tons was produced by pure transport freight operations[35]. In addition to this, emissions from international aviation that affect the global climate and local air quality are expected to increase[36] until 2050, from approximately 2 to 4 times compared to 2015 levels.

To sum up this brief comparison of total GHG emissions between international shipping and aviation industry, it could be easily concluded that the two different transport methods have approximately the same carbon footprint. However, the volume of cargo transported by sea is incomparably larger than cargo transported by air. The aforesaid, conclusion, could not be used against the aviation industry, which has some special features which make this type of transport vital for the modern economy. Furthermore, it could never consist a solid argument, against the responsibilities and the actions that should be initiated from shipping industry to adapt to the new era. On

[32]United Nations Publications, by UNCTAD under the overall guidance of Shamika N. Sirimanne: *'The Review of Maritime Transport 2019'*, p. 21
[33]IATA is the International Air Transport Association is a trade association of the world's airlines. Consisting of 290 airlines, primarily major carriers, representing 117 countries,, source: https://www.iata.org/en/about/history/
[34] However, this percentage is accounting for approximately 35% of world trade by value.
[35]ICCT, Brandon Graver, Kevin Zhang, and Dan Rutherford: *'CO2 emissions from commercial aviation in 2018'*,p. 4
[36]Gregg G. Fleming (US DOT Volpe) and Ivan de Lépinay (EASA), 2019, ICAO: '*Environmental Trends in Aviation to 2050'*, p. 23

the contrary and proven of the significance of shipping in modern economy, the industry is in debt to society for securing a viable future for the planet. Further comparison between aviation and shipping will follow in the last session of chapter IV, under the scope of European Law.

## IV. THE INTERNATIONAL CLIMATE CHANGE REGIME

### A. Overview of the evolution and the necessity for international regime

The global climate has changed significantly during the last 150 years. The most concrete and direct change is the increase of global mean surface temperature (GMST), which reached 0.87°C[37] in 2006–2015 relative to pre-industrial period. During the G-8 in 2009 a maximum limit of increase by 2 degrees Celsius[38] goal was put forward for first time as a target of the international community and later agreed in the Copenhagen Accord. Even though this increase might seem minor, it is the spark for various and threatening changes in the climate system. In 2010 this goal was formally incorporated into the *UNFCCC* process, while the *Paris Agreement*[39] not only extended this goal, but also pursues efforts to limit the temperature increase to 1.5 degrees Celsius. The deduction of the emissions as source of pollution. Carbon dioxides have not been pointed out as an essential ecological threat to the marine environment during the negotiation period between the 70s and 80s. Therefore, UNCLOS will not be examined further in this dissertation. Later, in 1987, the UN General Assembly initiated a panel, based on a report entitled 'Our Common Future'[40], attracting worldwide attention to the global issues related to environment and development. That was the exact moment when climate change was officially declared as a fast-growing global threat. The evolutions were rapid and one year later, in 1988, the Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and the United Nations Environment program (UNEP) in order to evaluate climate change based on the latest science[41]. In 1992, the 'backbone' of international regime, the United Nations Framework Convention on Climate Change (UNFCCC)

[37]IPCC, 2018, Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.): *'Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty'*, p.177

[38]Yubing Shi, 2017: *'Climate Change and International Shipping-The Regulatory Framework for the reduction of Greenhouse Gas Emissions'*, p. 28

[39]See Article 2

[40]Yubing Shi, p.118

[41]Source: https://www.ipcc.ch/about/history/

was adopted at the Rio United Nations Conference on Environment and Development (UNCED), while its Kyoto Protocol and Paris Agreement were adopted in 1997 and 2016 respectively. Furthermore, EU has set its own initiatives and targets which follow its obligations as party of the aforesaid conventions. It is clear, that a universal threat like climate change can only be tackled by the common effort of the international community. However, the greatest challenge for creating a viable future for next generations is to be secured that '*pacta sunt servanda*' and the agreements reached will be implemented by the international community.initial goal is vital as the difference of 0.5 degrees Celsius could reduce substantially the probability of extreme drought, precipitation deficits, and risks associated with water reserves[42]. Furthermore, the sea level rise (GMSLR) could be restrained and the volume of melting of Artic ice could also be reduced. But how did the international community managed to set these goals?

One of the first legally binding conventions, the United Nations Convention for the Law of the Sea (UNCLOS), was adopted in 1982, but only came into force in 1994 after almost a decade of negotiation[43]. However, this very first effort for international cooperation to protect environment does not refer particularly to greenhouse gas

## B. The United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC was adopted in 1992 at the Rio UN Conference on Environment and Development and entered to force on March 1994. It could be said that UNFCCC is the 'constitution'[44] of the International climate change regime. With 197 parties, including EU, the acceptance of the convention has succeeded great consensus among the international community. The primary objective set by the treaty is:

'the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt

[42]For more details see: IPCC, 2018, Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.): *'Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty'*, p.178

[43]E. Roukounas, third edition 2019: *'Public International law'*, p.235

[44]Yubing Shi, p. 152

naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner'.[45]

From the wording of the article though, it is obvious that the convention does not set legally binding or specified limits and obligations for the parties. On the contrary, it shapes general declarations, which do not regulate climate change but simply encourage the initiatives of the parties for negotiating multilateral solutions among them[46].

As it was mentioned above, the convention does not specify the way that the primary targets of article 2 will be reached but outlines some important guidance principles, which should guide any future actions. The principle of common but differentiated responsibilities and respective capabilities (hereinafter: CBDR-RC principle)[47] is to be considered as one of the most important and innovative spots of the convention. According to that principle, developed country Parties should take the lead in combating climate change. The specific needs and special circumstances of developing country Parties should be given full consideration. In other words, this is a recognition that developed countries are more responsible for the impacts of climate change and they must tolerate a bigger portion of responsibility. It does worth mentioning that member states have been categorized into three different groups with different responsibilities and certain exceptions, according to their economic status[48]. Parties are classified as per Annex I parties, Annex II parties and Non-Annex parties. However, the least developed states are not included into the above categories and are given a special status under the treaty because of their limited capacity to adapt to the effects of climate change.

**'**Broadly speaking, the UNFCCC can be divided into four parts: (1) the introductory provisions, setting forth the basic definitions, principles, and objectives of the regime (Articles 1–3); (2) the commitments relating to mitigation of, and adaptation to, climate change, including commitments relating to finance and technology transfer (Articles 4–6); (3) institutional and procedural mechanisms to implement the convention (Articles

[45]Article 2 UNFCCC
[46]Cinnamon P. Carlarne, Kevin R. Gray, Richard Tarasofsky, Mar 2016: '*The Oxford Handbook of International Climate Change Law'*, p. 28
[47] See UNFCCC article 3.2
[48]Yubing Shi, p.155

7–14); and (4) final clauses dealing with such matters as protocols, annexes, amendment, ratification, and entry into force (Articles 15–26).' [49]

However, the biggest criticism against UNFCCC is that the set targets cannot be turned into action and climate change policy cannot be implemented through the convention. The greatest obstacle is that the convention does not include any enforcement or monitoring mechanism and do not set a system of legally binding obligations for the parties, while does not even include the issue of GHG from shipping and leaves the sector entirely unregulated. As a result, its implementation stands on the discretion of the parties-states. That said, it worth mentioning that the negotiations for forming the UNFCCC have been characterized as:

'the politics of international 'blame' and that the UNFCCC approach reflects countries' own interests or their own group interests. Consequently, the UNFCCC negotiations have moved away from their original objective of stabilizing greenhouse gas (GHG) concentrations in the atmosphere based on the principles of precaution and equity'[50].

### C. The Kyoto Protocol

As it was noted on the previous chapter, UNFCCC by itself would be inefficient in terms of implementation and enforcement of the mutual agreed goals of international community. Therefore, it was considered necessary for the existing regime to be supported with future conventions. As a result, the Kyoto Protocol was adopted in Kyoto, Japan on 11 December 1997 and entered into force on 16 February 2005[51]. The Kyoto Protocol 'reconfirms' the targets set by UNFCCC to stabilize atmospheric concentrations of GHGs at a level that will prevent dangerous interference with the climate system. It can be said that UNFCCC is extended by the protocol, as article 3 sets specific goals that parties should reach. The greatest innovation launched by the protocol is undoubtedly the Flexibility mechanisms[52]. A market-based mechanism created to contribute the parties to reach the aforesaid goals. This mechanism[53] includes

[49]Daniel Bodansky, Jutta Brunnée, Lavanya Rajamani, May 2017: *'International Climate Change Law'*, p. 118
[50]Takashi Sagara, Climatico Special Features - November 2009: *'Are there realistic ways to improve the UNFCCC? An interview with Aubrey Meyer'*
[51]Katia Simeonova, November 2008: *'Kyoto Protocol reference manual on accounting of emissions and assigned amount'*, p. 12
[52]Yubing Shi, p.158
[53]For detailed information about the function of the mechanism, see: *'Kyoto Protocol Reference Manual on Accounting of Emissions and Assigned Amount'*, p. 15-18

some 'tools' which include the Emissions trading system[54], the Clean Development Mechanism[55] and the Joint Implementation.[56]

The Kyoto Protocol is differentiated by the UNFCCC as it divides the parties into two[57] groups only. Annex I and non-Annex I, and this allocation is broadly based on the concept of developed and developing States. Furthermore, the legally binding targets on the reduction of anthropogenic GHG emissions set by the protocol are divided in two commitment periods.

The first period including parties in Annex I sets that:

'The Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012'[58].

The second commitment period was agreed to last from 2013 to 2020 at the Climate Change Conference in Doha, Qatar[59]. The Kyoto protocol was extended until 2020, while a total of 18% target for reduction of GHGs compared to 1990 was agreed for Parties of both Annexes. The European Union committed to a 20% reduction.

The Kyoto protocol initiated some substantial changes and made decisive steps for changing the approach of the international community against the climate change. For the first time, the parties undertook specific commitments as exact targets for reducing GHGs were agreed. Furthermore, the protocol initiated the '*landmark*' for aviation and shipping sector, as the responsibility and the authority to regulate issues regarding GHGs were surrogated[60] to the International Civil Aviation Organization and the

[54]See Kyoto Protocol art.17
[55]See Kyoto Protocol art.12
[56]See Kyoto Protocol art.6
[57]Yubing Shi, p.158
[58]Kyoto Protocol, art. 3.1
[59]International Institute for Sustainable Development (IISD), 2012: *'Summary of The Doha Climate Change Conference'* p. 14
[60]Kyoto Protocol art. 2.2: *'The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively.'*

International Maritime Organization respectively. Further analysis for the contribution of IMO will follow in next chapters.

However, it needs to be said that the Protocol has been criticized for various reasons. As a starting point, the wording which has been used consists one of its greatest deficiencies. Under the convention, the parties are 'committed' to implement their obligations to actions. It is easily concluded that this neither create legally binding obligations, nor make the provisions of the protocol enforceable to the states. This view is supported by the lack of monitoring mechanism or any sanctions system related to the breach of the obligations. Furthermore, the Flexibility mechanisms allows the trade of the GHGs between the states. As a result, even though it can been considered as a useful 'tool' in order to succeed 'logistical' compliance with the rules, it involves the risk that wealthy states might abuse this mechanism by investing in and pay for emissions reduction projects in other countries where the cost of cutting greenhouse gas emissions might be cheaper than attempting to slash their own emissions. Last, but not least, criticism deriving from the other side of the Atlantic is pointing out that the alignment of West (prosperous) Europe with the countries from the Eastern part might create misleading conclusions, which would give disproportionately smaller responsibility to some states[61]. Furthermore, excluding great emitters like China and India, as developing countries, which though are significant pollutants, consisted a great deficiency of the treaty.

### D. The Paris Agreement

The Paris Agreement, is an extension of the UNFCCC, dealing with greenhouse-gas-emissions mitigation, adaptation, and finance, which adopted in 2016. It got into force on 4 November 2016 and it can be considered as 'the first multilateral environmental agreement referring to human rights, climate justice and the right to health'[62]. Until 2020, 189 parties[63] have ratified the Convention. The Paris Agreement's long-term goal is to keep the increase in global average temperature to well below 2 °C above pre-

[61]Article by Robert O. Mendelsohn, published on NPR on February 18, 2005: *'An Economist's View of the Kyoto Climate Treaty'*
[62]Yubing Shi, p. 166
[63]Source UN: https://unfccc.int/process/the-paris-agreement/status-of-ratification

industrial levels; and to limit the increase to 1.5 °C[64], since this would substantially reduce the risks and effects of climate change, as it was analyzed at chapter IV(A).

The convention recognized the deficiencies of its 'ancestors' and replaced the strict binary interpretation of CBDR-RC between Annex I and non-Annex I parties[65]. Even though this innovation tried to allay the significant criticism raised by the US, it was not enough to prevent the withdrawal of the States from the agreement. The new approach derives from the recognition that everyone, including both developed and developing countries, needs to act according to their respective capabilities and resources to tackle climate change. In addition to that, financial support is to be provided to developing countries per year[66]. The most significant mechanism initiated by the Agreement is the concept of the Nationally Determined Contributions (NDCs)[67] which reflects each party's domestic target for reducing its emissions. Three essential provisions derive from that concept. Firstly, the obligation for each party is to *prepare, communicate and maintain successive that it intends to achieve*. Secondly, successive NDCs are to be communicated every five years and lastly the parties to *pursue domestic mitigation measures, with the aim of achieving the objectives of such contribution.*

The Paris agreement was characterized as 'a pivotal moment for the future of countries, people and our common home*'* by the Secretary-General of the United Nations Ban Ki-moon[68]. Undoubtedly, the convention reflects the increasing maturation of the global community against climate change. However, criticism has been raised, as the Agreement follows the same pattern with Kyoto Protocol and no enforcement mechanism is established. Furthermore, even though the communication of NDCs, which consists the 'backbone' of the Agreement for tackling climate change, is mandatory, their contents and targets are not[69]. The Paris Agreement maintains the basic concept of the Kyoto protocol which is based on the ambitious efforts of the

[64]Paris agreement article 2(a): '*Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change'*
[65]Michele Stua, 2017: *'From the Paris Agreement to a Low-Carbon Bretton Woods- Rationale for the Establishment of a Mitigation Alliance*', p. 23
[66]Paris agreement article 9
[67]Paris agreement article 4.2
[68]Secretary-General's speech to COP21 Leaders' Summit, Paris, 30 November 2015
[69]Mayer, B, 2018: *'International Law Obligations Arising in relation to Nationally Determined Contributions'*, p. 252

parties. Besides this, emissions from international shipping fall outside the scope of the agreement.

### E. General overview of the EU legislation against climate change

The Treaty of Maastricht (1993) introduced the environmental protection as an official EU policy area[70], while the Treaty of Amsterdam (1999) established the duty to integrate environmental protection into all EU sectoral policies with a view to promoting sustainable development. In 2000, the European Climate Change program (ECCP) was established and created the guidance for the implementation of the Kyoto Protocol. The second European Climate Change program (ECCP II) followed in 2005, while the EU Emissions Trading System (the EU ETS) was also introduced the same year. The EU ETS is first and biggest carbon market globally, while is referred as the cornerstone of Europe's climate change policies[71]. However, GHGs from shipping have not yet been included into the EU ETS, as no consensus has been succeeded for their allocation between the several states. It was only on September 2020, when the European parliament voted for including CO2 emissions from shipping into the EU ETS. However, the implementation of the decision requires time. Further analysis of the problematic will follow on section V. At this end, 'Combating climate change' became a specific goal with the Treaty of Lisbon (2009) [72].

It worth mentioning that EU environmental policy rests on the principle of precaution[73]. The precautionary principle is a risk management tool, which permits the decision-makers to implement measures to prevent a potential risk to human health or to the environment even though there are no sufficient evidence for the alleged risk. To this assignment the view that emissions from shipping are harming the environment and contribute to climate change are considered as a scientifically defined fact, therefore there will be no further analysis of the principle.

[70]Emanuela Orlando**,** 2013: ***'****The evolution of EU policy and Law in the environmental Field: achievements and Current Challenges****',*** p.6
[71]Article by Oztig, Lacin Idil, 2017: *'Europe's climate change policies: The Paris Agreement and beyond'*
[72]A. Pliakos, 2018: *'The European Union Law'*, p.31
[73]Article 191 of the Treaty on the Functioning of the European Union

### i. The ’20-20-20’ Policy

The most significant agreement was set by the Union in 2009 and is broadly known as the ’20-20-20’ targets[74]. The ’20-20-20’ policy represents the goal of the Union, compared to levels of 1990, for 20% reduction of the GHG, the increase of renewable energy by 20% and the improvement of energy efficiency by 20% until 2020. In February 2014, the extension of the aforesaid framework was agreed by the Council of the EU until the year 2030[75]. The new agreement maintains the same policy framework but sets significantly more ambitious targets, as it sets a commitment of 40% reduction of GHGs, a renewable energy target of at least 32% and at least 32.5% improvement in energy efficiency. Further to the aforesaid, EU has set the goal of 80% reduction below the levels of 1990 until year 2050.

Furthermore, European Union as party of the Paris agreements has adopted the concept of the Nationally Determined Contributions. Each member state must publish its national plan regarding NDC every five years. The latest climate package adapted in the Climate Change Conference in Katowice in 2018. One of the most important measures is the guidance provided for the second round of Nationally Determined Contributions (NDCs) which need to be submitted by the states by 2025[76]. The guidance describes the contents of and approach to mitigation goals and activities to ensure comparability across NDC.

Undoubtedly, EU and its members have succeeded substantial progress in respect of the short-term goals. However, the ambitious targets set for 2050 require substantially bigger efforts. This could only be succeeded, through a structural change of Union’s production and consumption of energy. Fossil fuels are the main emitters of GHGs as they are used almost by all economic sectors inside EU. As a result, decarbonization can only be a thorny and complicated process. European Union needs to realize, that transformation of this existent energy model can only be succeeded through the technological developments and the undisputable need for fighting climate change. Therefore, the depletion of use fossil fuels can be the first step to this process, but the need for radical changes is imperative[77].

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[74]Jos Delbeke, 2014: ‘*The EU's Climate Policy’*, p. 27
[75]Source: https://ec.europa.eu/clima/policies/strategies/2030_en
[76]Leila Mead, 2019: *‘UNFCCC publishes Overview of Katowice Climate Package’*
[77]Vicente Lopez-Ibor Mayor, 2017: *‘Clean Energy Law and Regulation- Climate Change, Energy Union and International Governance’*, p. 28

### ii. Overview and comparative analysis between the specific initiatives for shipping and aviation

Even though climate change has triggered a lot of initiatives for different sectors of economy, it was only in 2013 when the Commission set out a strategy for reducing GHG emissions specifically from the shipping industry. Until that time, GHGs from shipping were excluded from EU's carbon footprint reduction under the 20-20-20 Policy. It can be assumed that this was the result of the lack of international regime under the Kyoto Protocol, which did not include shipping[78]. Furthermore, the complex nature of shipping and its importance for national economies makes it an extremely sensitive field for regulations. Further reference to that will be made on the next chapter.

The existence EU's strategy is transformed under the below initiatives. All ships over 5.000 GT using EU ports, from 1 January 2018 are obliged to monitor, report, and verify their $CO_2$ emissions (MRV Regulation)[79]. Companies are obliged to monitor $CO_2$ emissions, fuel consumption and other data such as time at sea, distance travelled, and transported cargo for each one of their vessels on a per single voyage basis. These data need to be submitted annually through a report to an accredited MRV shipping verifier. From 2019, by 30 April of each year, this verified emissions report should submitted through *THETIS MRV*, to the Commission and to the flag States that the vessels are registered. This obligation is imposed on each vessel that has performed maritime transport activities in the European Economic Area in the previous reporting period. Further to this obligation, after the 30th June of 2019 vessels should carry on board a document of compliance issued by THETIS MRV. Member States' authorities have the power to inspect and confirm that vessels comply with those rules. [80]

Directive (EU) 2018/410[81] of the European Parliament and the Council, designated the need for further and more drastically measures. According to the Directive, EU has

[78]Heitmann Nadine, 2013: *'including maritime transport in the EU's climate change policy: Country-based allocation and effects'*, p.30

[79]MRV Regulation 2015/757 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC

[80]Source: European Commission https://ec.europa.eu/clima/policies/transport/shipping_en

[81]Paragraph 4: *'In line with the commitment of the co-legislators expressed in Directive 2009/29/EC of the European Parliament and of the Council (1) and Decision No 406/2009/EC of the European Parliament and of the Council (2), all sectors of the economy should contribute to the reduction of greenhouse gas emissions. Under the Paris Agreement, the Union and its Member States have undertaken an economy-wide reduction target. Efforts to limit international maritime emissions through the International Maritime Organization (IMO) are under way and should be encouraged. The IMO has set up a process to adopt in 2018 an initial emission reduction strategy to reduce greenhouse gas emissions from international shipping. The adoption of an ambitious emission reduction objective as part of this initial strategy has become a matter of urgency and is important for ensuring that international shipping contributes its fair share to the efforts needed to achieve the objective of well below 2 °C agreed under the Paris Agreement. The Commission should keep this under regular review, and should report at least once a year to*

no other option rather than including shipping in the ambitious targets for reduction of GHGs, as have been formed by the Union. In support of the aforesaid Directive, on 16 September 2020, the European Parliament voted for including CO2 emissions from vessels above 5,000 gross tonnage in the EU Emissions Trading System (ETS). Furthermore, mandatory goals for vessels for reducing the yearly average CO2 emissions by 40% by 2030 were set. Another suggestion which was included into the vote was the establishment of an "Ocean Fund" from 2023 until 2030. The Environment Committee of the European Parliament proposes that Ocean fund should be supported with means obtained from auctioning allowances under the ETS. This evolution does not create any legal binding obligations at this stage, however it 'flags up' the intension of EU to include Shipping emissions in EU ETS. This decision constitutes the spark for the commencement of negotiations with member states for the final shape of the legislation. However, the decision has raised substantial concerns and received constructive criticism. Further reference will follow in Chapter V regarding the hesitance of various interests, especially from the World Shipping Council[82].

Regarding aviation sector, despite that the Kyoto Protocol had excluded the emissions from the sector, the EU decided in 2008 (implemented from 2012) to incorporate emissions from aviation into the domestic greenhouse gas emission reduction targets[83]. Therefore, aviation is contributing to meeting the Paris Agreement objectives. It worth mentioning GHGs from aviation accounted Apr. 3% of the EU's total emissions[84]. Furthermore, the EU ETS covers all aviation activities between all airports in the European Economic Area (EEA). Until 31 December 2023, flights to and from airports in non-EEA countries have subsequently been excluded from the EU ETS. Furthermore, it is EU's commitment to cooperate narrow through ICAO with Third states for the reduction of GHG from aviation and for the expansion of the ETS to a global system. The objective of stabilizing GHG was reconfirmed by the contracting states of ICAO on October 2016, at the 39th General Assembly. The Resolution A39-3 was adopted, as an effort to introduce a global market-based measure, broadly known as *the Carbon*

*the European Parliament and to the Council on the progress achieved in the IMO towards an ambitious emission reduction objective, and on accompanying measures to ensure that the sector duly contributes to the efforts needed to achieve the objectives agreed under the Paris Agreement. Action from the IMO or the Union should start from 2023, including preparatory work on adoption and implementation and due consideration being given by all stakeholders.'*

[82]Newsletter 14-17 September 2020 Brussels plenary session

[83]Preston Holly, Lee David, Hooper Paul D, 2012: *'The inclusion of the aviation sector within the European Union's Emissions Trading Scheme: What are the prospects for a more sustainable aviation industry?'*, p. 48

[84]Source: European commission https://ec.europa.eu/clima/policies/transport/aviation_en

*Offsetting and Reduction Scheme for International Aviation'* (CORSIA). The program aims to counterbalance international aviation's CO2 emissions above 2020 levels through international credits. The Bratislava Declaration reconfirmed this position on 3 September 2016[85].

Even though, emission from both aviation and shipping were not included in the Kyoto protocol, the need for cooperation with specialist international organizations was recognized. Therefore, the Protocol delegated the authority to IMO and ICAO to regulate GHG emissions from shipping and aviation respectively. As a result, all the initiatives of EU must follow the general directives set by IMO and ICAO. However, as it will be explained below, the European regime followed a substantially different approach for each of the two sectors.

Regarding the commercial aviation, EU included the GHG into the domestic reduction target already from 2008, in accordance with its commitments under the 20-20-20 policy. Even though only the inner flights inside EEA area fall into the scope of this initiative and the international flights will be excluded until 31 December 2023, this consists a massive difference compared to the GHG from shipping. On the contrary, it was only 10 years later, in 2018 when EU decided to regulate GHG from shipping, while the only obligation imposed on the shipping industry was that vessels exceeding 5.000 gross tonnage should monitor, report and verify their related $CO_2$ emissions[86]. In September 2020, the European parliament voted for including the GHGs from shipping into EU ETS system. However, it will need time until a solid, legally binding regime will be formed. While the GHG from commercial aviation are considered as domestic emissions and therefore the industry must comply with the targets set by EU, shipping is in a privileged position. This differentiation has various reasons which are related with the special features and the great importance of shipping industry for the global economy. Further reference to the topic will follow in the next section.

[85]European Aviation Environmental Report 2019
[86]Regulation 2015/757 (as amended by Delegated Regulation 2016/2071)

# V. THE NEED FOR SPECIAL RULES FOR SHIPPING INDUSTRY

## A. The deficiency of the international regime to regulate shipping activities

As it was analyzed in the previous chapter, the existing international climate change regime left unregulated GHG emissions from shipping. Both UNFCCC with its Kyoto Protocol and the Paris agreement did not even 'touch' international shipping, rather than delegating this authority to IMO. One important reason for this was that the aforesaid conventions adapted[87] the broad definition of 'air pollution' from the 1979 Convention on Long –range Transboundary Air Pollution (CLRTAP). Even though the definition of air pollution could include GHG from vessels, the deficiency can be detected in the wording: Long –range Transboundary air pollution which is defined as: 'air pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one State and which has adverse effects in the area under the jurisdiction of another State at such a distance that it is not generally possible to distinguish the contribution of individual emission sources or groups of sources'[88].
As a result, GHG from shipping is excluded as the distance between the vessel emitting and the victim should be long enough so that the ship cannot be identified.

However, the most challenging obstacle that International Community has not succeeded to overcome until today is the lack of political consensus between the states representing different economic interests. The GHG from shipping are produced by the burn of the bunkers and since shipping is one of the most 'international' human activities, it was extremely difficult for the parties to allocate this responsibility. The decision 4/CP.1[89] tried to solve the problem and suggested eight[90] different alternatives.

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[87]Yubing Shi, 2017: *'Climate Change and International Shipping-The Regulatory Framework for the reduction of Greenhouse Gas Emissions'*, p.131
[88]CLRTAP art. 1.b
[89] Source: United Nations https://unfccc.int/topics/mitigation/workstreams/emissions-from-international-transport-bunker-fuels
[90]article 27*:*
*'Option 1 No allocation, as in the current situation.*
*Option 2 Allocation of global bunker sales and associated emissions to Parties in proportion to their national emissions.*
*Option 3 Allocation to Parties according to the country where the bunker fuel is sold.*
*Option 4 Allocation to Parties according to the nationality of the transporting company, or to the country where a ship of aircraft is registered, or to the country of the operator.*
*Option 5 Allocation to Parties according to the country of departure or destination of an aircraft or vessel. Alternatively, the emissions related to the journey of an aircraft or vessel could be shared by the country of departure and the country of arrival.*
*Option 6 Allocation to Parties according to the country of departure or destination of passenger or cargo. Alternatively, the emissions related to the journey of passengers or cargo could be shared by the country of departure and the country of arrival.*
*Option 7 Allocation to Parties according to the country of origin of passengers or owner of cargo.*
*Option 8 Allocation to the Party of all emissions generated in its national space.'*

The issue was extremely sensitive and purely political rather than technical and an agreement could not be reached. Therefore, all international conventions against climate change decided to exclude the issue. It worth mentioning that in the lack of new adopted measures, international shipping's yearly carbon emissions are projected to exceed the 1.090 million tons by 2035. This increase would be equivalent to a 23% growth of emissions by 2035 compared to 2015[91]. From a more utilitarian point of view, this decision might have been beneficial for the evolution of the existence international climate change regime. Should GHG from shipping been incorporated to the international agreements for climate change, they probably would had never been approved by the parties. Further analysis of the special features of shipping which make the political consensus extremely difficult will be analyzed in the next chapter.

### B. The complexity of the nature of shipping

Shipping is a fundamental activity for the global trading and economic system. Furthermore, the special characteristics of the industry pose great challenges in regulating the reduction of GHG emissions. The difficulties can be detected to both financial but also to practical reasons. Financial reasons are related to Parties' unwillingness to regulate activities in the industry. Shipping companies, including their assets, can easily move and relocate to more lenient jurisdictions, which are also known as states of Convenience. Therefore, the states are aware that every effort to regulate shipping bears always the risk of 'losing' these companies which can easily 'escape' from a strict jurisdiction. Furthermore, the economic interests related to shipping are so strong to some states, which rely on the industry for maintaining their wealth and prosperity. It is to be mentioned that in 2015[92], the EU shipping industry directly employed 640,000 people and supported a €57 billion contribution to European GDP, while considering the spillover effects to other sectors, this figure could be much higher.

Besides this, the nature, and the structure of shipping itself makes extremely difficult every possible solution. The below example can be self-explanatory for the complexity of the industry: Greek interest owned one vessel shipping company registered in Cayman Islands uses the Liberian flag for its vessel, while the vessel is operated by a management company in Switzerland. The aforesaid structure is very common in

[91]Organization for Economic Cooperation and Development (OECD)/ International Transport Forum (ITF) 2018: *'Decarbonising Maritime Transport; Pathways to zero-carbon shipping by 2035', p.13*
[92]Oxford Economics, the Economic Value of the EU Shipping Industry, 2017 update: *'A report for the European Community Shipowners Associations (ECSA)'*

shipping industry and it is obvious that it is almost impossible to attribute the GHG emissions to one of these different jurisdictions related to the operation of the vessel. Other important factors are, the mobility of the vessel around the globe, which makes the allocation of the GHG extremely difficult[93]. Further to that, the very complex commercial and operational function of a vessel might create great disputes. It is almost always the case that the vessel of the aforesaid example, will be chartered by one or various charterers which can have the same complex structure and might involve various jurisdictions.

The aforesaid reasons where substantial to leave the GHG from shipping unregulated under the international regime. It can be claimed that this 'immunity' granted to shipping derived from the practical, economic, and political reasons. However, another important factor was that regulating the industry could only be succeeded only through a specialist organization. Even if the states could overcome all the above, still it is under great doubt if they would have the technical know-how in order to regulate the industry without putting in risk the balance in the global economy which is based on the transport of products through the sea. As a result, IMO was authorized by the Kyoto protocol to conduct this role[94].

### C. Criticism of introducing an EU carbon pricing mechanism for shipping

It was already mentioned that on 16 September 2020 the European Parliament voted for including CO2 emissions from vessels in the EU Emissions Trading System (ETS) and for creating a carbon pricing mechanism for shipping. This decision refers to vessels bigger than 5,000 gross tonnage. Of the greatest concerns for the industry is that this initiative will not be restricted into only intra-EU voyages but will be extended to extraterritorial voyages outside of the European Economic Area (EEA). EU ETS consists a "regional" system, restricted only into European areas of jurisdiction, as a result, including international shipping into that system would fall outside the scope of ETS. World Shipping Council's President and CEO *John Butler* stated:

*"This question of the geographic scope of any ETS system for shipping must be addressed before the European Commission can turn to the many technical details that*

[93]Aldo Chircop, Meinhard Doelle and Ryan Gauvin, 2018: *'Shipping and Climate Change International Law and Policy Considerations special report'*, p.27-30

[94]Kyoto protocol article 2.2: *The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively.*

*would be involved in creating such a system. If the current MRV geographic scope is used, a majority of the emissions covered by the system would occur outside EU waters, in many cases from voyages extending thousands of miles across the globe."*[95]

Such a decision would constitute a significant unilateral intervention over global trade and the operation of commercial shipping. As it was already analyzed in previous paragraphs, shipping is probably the most international human activity. Therefore, including international shipping into the system, would lead to the result that the lion's share of the emissions which are regulated and charges imposed by the system would be produced by activities taking place outside EU waters, in many cases thousands of miles distant from the EU. Another concern is that the costs which will be imposed to the industry will be disproportionate. Furthermore, such decision could raise legal and diplomatic disputes as EU would unilaterally impose emission charges and operational regulations in territorial waters where third states' sovereignty applies[96].

Transshipment of cargo through EU ports to destinations outside EU might bear the risk of double charges. Volume of Trans-shipped cargo in EU ports to and from the Least Developed Countries is substantial, as there is bigger variety of alternative commercial choices and different routes from Europe. This could create a situation that charges are imposed first on the inbound voyage as the ship sails to an EU port and then again on the outbound voyage as the same cargo leaves the EU enroute to its further destination. Undoubtedly, this could escalate the economic depression in LDC, but it would also reduce Europe's prominent position in global trade[97]. Another concern raised by the WSC is that if the same practice is followed by other countries, then there would overlapping charges for international shipping, which could significantly affect global trade and supply chain[98]. Finally, EU's flagged fleet, would be substantially reduced in the burden of the external competition.

### D. Measures for the decarbonization of the industry

On April 2018 International Maritime Organization adopted its initial strategy on reduction of GHG from shipping. During this conference, it was agreed that CO2 should be reduced by at least 40% per transport work until 2030 as a first step before pursuing

[95]Article by Jasmina Ovcina, September 11, 2020, 'World Shipping Council denounces EU's ETS plans
[96]World Shipping Council, 2020, 'EU ETS Discussion Paper', p.11
[97]Ibid, p.10
[98]Ibid, p.5

the target of 70% reduction until 2050 compared to 2008 figures. Further to that the goal to reduce the total yearly GHGs by at least 50% until 2050, compared to 2008 levels was expressly agreed[99]. Even though the decarbonization of shipping can turn into a thorny issue, it has become clear that international community has decided to act in that direction. The very recent evolutions in EU, as were described on the previous chapter, confirms this decision. The technological progress which has been achieved and the various strategic measures which can be adopted consist useful tools in the for companies to comply with the targets. Besides the use of alternative fuels such as biofuels, LNG, ammonia, hydrogen etc.[100], the measures for achieving the reduction of shipping's footprint can be divided to technological, operational.

The first category includes technologies which can be applied to vessel targeting to the improvement of the energy efficiency of a ship. The main tool for this purpose is the Energy Efficiency Design Index. EEDI imposes the obligation for ships to comply with a minimum energy efficiency level, which is tightened gradually every five years. The first reduction level was 10% for the first phase (2015-2020), 20% for the second phase (2020-2025) and a 30% reduction mandated from 2025 to 2030. Further analysis of the EEDI will follow in chapter VII.D. It is calculated that the use of lighter material from ship building industry could save up to 10%[101] of fuel consumption by reducing the weight of a vessel. While, modern design and engineering could reduce the fuel consumption up to 25% by implementing new ways to reduce friction of ships. Slender hull designs can reduce the overall propulsion requirements of a ship and succeed a fuel reduction from 10-15% up to 25% when the vessel is operating at lower speeds[102]. Techniques for using thermal energy for the vessel's needs, which is produced by the engine or the exhaust gas and converts it into electrical energy could save another 4% of fuel consumption[103]. It worth also mentioning that on shore power appears to be more and more tempting for reducing the fuel consumption of modern vessels. In the effort to reduce carbon emissions from the shipping industry, wind and solar power has been proposed. Especially for wind power, no complicated technology or a new fuel source

[99]IMO, RESOLUTION MEPC.304(72), 13 April 2018: *'Initial IMO strategy on reduction of GHG emissions from ships'*, annex 11 p.5
[100]Article by Jennifer Brown for the Environmental Defense Fund, 31 Jul 2018: *'Alternative fuels: the future of zero emissions shipping'*
[101]Organization for Economic Cooperation and Development (OECD)/ International Transport Forum (ITF) 2018: *'Decarbonising Maritime Transport; Pathways to zero-carbon shipping by 2035',* Table 2 on p.26
[102]Ibid, p.25 next
[103]Ibid, p.28

is required, but the same power sailors have harnessed for millennia, which gives great prospects of success to this alternative. Most of the technological measures can only be implemented to new build ships or require significant modifications on the old equipment of a vessel.

Contrary to the first category, the operational measures can apply easier to older ships without upgrading their equipment and technology. The first obvious way to cut emissions is by simply slowing ships down. The concept is broadly known as slow steaming and can be proved extremely efficient as it is calculated that just a 10% of speed reduction can lead up to 19% reduction of energy required by the vessel. It is worth mentioning, that during periods that the price of the fuels is higher, ship companies adjust their strategy and reduce speed to save bunkers. Even though, this is a good example of how the needs of the market can contribute to the reduction of GHGs, this is just an opportunistic situation, which cannot maintain a sustainable model for the industry. All the above, flag up the need for a global homogenous regime for speed in maritime transport[104]. This could be achieved either unilaterally as a condition of entry into a port or to navigate in coastal waters, or multilaterally through an international convention or IMO regulations. In the lack of such regime, slow steaming might lead to uncompetitiveness of companies following this measure compared to their competitors which provide faster service, making this option unattractive.

Another major factor of the pollution from ships is given off while they are in port with their engines idling to produce on-board power. Approximately 5% of shipping's CO2 emissions are currently generated in ports. With sufficient infrastructure from the port states, the method of 'cold ironing' could lead to significant reduction of GHG. Onshore power supply (OPS) facilities in ports could provide a vessel with clean electricity while She is berthed and considerably reduce the local smog and soot that choke some port cities. California is among the first states which adopted cold ironing as mandatory. However, an extended implementation of the measure in a bigger scale requires significant amount of funds for the adjustment of port facilities and currently seems that states do not have the political will to implement such measures. A supplementary 'tool' to this direction could be the 'just in time arrival', which would

[104]Ibid, p.29

reduce the waiting time of a vessel until gets access in the port facilities. As the cold ironing, this measure could also have a strong local impact, and the results could benefit in short term the ports implementing such rules. Air pollutants that have huge health impacts for citizens of port-cities are reduced immediately once such measures are implemented. However, these measures cannot be implemented in high traffic ports[105] without being combined with infrastructure improvements and ship-port interfaces, which requires significant investments on the existing facilities.

## VI. THE ROLE OF IMO

### A. Brief historical and functional overview of IMO

'The IMO GHG Strategy's vision can be set out as follows: 'IMO remains committed to reducing GHG emissions from international shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century'[106]

It was on the 6th March 1948 in Geneva during an international conference, when the establishment of the *Inter-Governmental Maritime Consultative Organization* (IMCO) was decided[107]. The convention got into force for first time in 1958 and in 1982 the organization was renamed to *International Maritime Organization* (IMO) by the amendment of the initial convention of 1948.

IMO is a forum of negotiation of international technical standards, concerning international shipping. Its main purposes are described on Article 1 of the *IMO Convention.* As an authorized special agent under the United Nations, IMO advocates draft proposals for maritime affairs which are suggested to the states in International conferences[108]. Another important task of the organization, which consists a big part of its work, is to propose amendments for existing conventions. IMO has also a significant contribution by issuing non-binding guidelines which are often incorporated into international conventions and have a supportive role to the implementation of the conventions.

[105]Organization for Economic Cooperation and Development (OECD)/ International Transport Forum (ITF) 2018: *'Decarbonising Maritime Transport; Pathways to zero-carbon shipping by 2035',* p. 28
[106]The International Journal of Marine and Coastal Law, Aldo Chircop: *'The IMO Initial Strategy for the Reduction of GHGs from International Shipping: A Commentary'*, p. 492
[107]The 1948 Convention on the International Maritime Organization
[108]Yubing Shi, p.180

IMO's structure consists of the Assembly, the Council and various Committees, and sub-committees[109]. The highest Governing Body, is the assembly, consisting of all Member States of the organization. It worth mentioning that currently IMO has 171 member States, three associate members, and 77 international non-governmental organizations (NGOs) which have a consultative status[110]. The members meet regularly once every two years. The assembly is entitled with the administrative responsibilities of the organization. It is therefore responsible to approve the work program, vote the budget and determine the financial arrangements[111]. Among the other duties, its most important function is to a) to elect the Council, which is the functional and governing body of IMO and b) to advocate proposals to Governments of organization's parties on maritime safety and pollution prevention[112]. The second most important body of the organization is the council, which is consisted by representatives of 40 Member States and coordinates the legal and technical work of the Organization. This work is conducted by several technical committees and sub-committees, which specialize on certain shipping matters of international concern.

One of the most critical committees, is the 'Marine Environment Protection Committee' (MEPC), established in 1975 during the 9th Assembly[113]. The spark for this initiative was give on 18 March 1967 when the Torrey Canyon accident occurred and caused the spillage of more than 119,000 tons of oil, affecting hundreds of miles of coastline[114]. This accident led IMO to focus on marine pollution from ships even though initially its main objective was to ensure maritime safety and support and promote international shipping[115]. Nowadays, MEPC is responsible for the reduction of GHG emissions from international shipping. The committee's function is to exercise the IMOs mandate by establishing the highest practical standards to protect the marine environment from pollution from shipping. Some of the major authorities is the control and prevention of ship-source pollution covered by the MARPOL treaty, including oil,

[109]Yubing Shi, 2017: *'Climate Change and International Shipping-The Regulatory Framework for the reduction of Greenhouse Gas Emissions'*, p. 180
[110]Source: IMO http://www.imo.org/en/About/Membership/Pages/Default.aspx
[111]Source IMO Structure: http://www.imo.org/en/About/Pages/Structure.aspx
[112]Article 15(j) of the Convention on the International Maritime Organization
[113]Source IMO: http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/Convention-on-the-International-Maritime-Organization.aspx
[114]Montes De Oca, R Madariaga Dominguez, Ernesto, journal of maritime research: JMR, 2013: *'The Influence of the Induced Maritime Accidents on the Maritime Safety'*, p.69-78
[115]Bodansky, Daniel, Regulating Greenhouse Gas Emissions from Ships, 2016: *'The Role of the International Maritime Organization, Forthcoming in Ocean Law Debates: The 50-Year Legacy and Emerging Issues for the Years Ahead'*, p.8

chemicals carried in bulk, sewage, garbage, and emissions from ships, including air pollutants and greenhouse gas emissions. Ballast water management, anti-fouling systems, ship recycling, pollution preparedness and response, and identification of special areas and particularly sensitive sea areas.[116] In 2016, MEPC69 agreed to approve the first IMO Data Collection System on fuel consumption for monitoring and recording $CO_2$ emissions from shipping activities globally. While, MEPC70 made data collection requirements mandatory and included the new regulation 22.A to MARPOL Annex VI[117]. The new mechanism got into force on 1 January 2019. The most recent committee's actions were conducted on May 2019, where number of measures were decided, aiming on the support of the achievement of the reduction of GHGs[118].

It worth mentioning that the IMO GHG studies, which have been repeatedly referred to this dissertation, is the result of the elaboration of these committees. Other important committees apart from MEPC are the *Maritime Safety Committee* (MSC), the Legal Committee, the *Technical Co-operation Committee*, and the *Facilitation Committee.*

### B. Comparative overview between Maritime Legal instruments and International climate change regime

From a more comparative point of view, it worth exploring the potential overlap of the current regime regarding the GHGs from shipping. Undoubtedly, the key elements of the global governance architecture for tackling GHG emissions from international shipping are the IMO and the UNFCCC[119]. Both instruments, based on their fundamental scope, could establish rules to fight GHG from shipping[120]. Such overlap could create fragmentation and conflict between the different instruments, or it could be the spark for interaction and cooperation. The connection between IMO and UNFCCC appears to be more cooperative than conflictive, as it cannot be detected any distinctive hierarchy between them. Therefore, it cannot be claimed that neither of the institutions is superior or subordinate to the other [121]. The relationship between IMO

[116] Source IMO: http://www.imo.org/en/MediaCentre/MeetingSummaries/MEPC/Pages/Default.aspx
[117]MEPC 70/18/Add.1, Annex 10, page 12, PART II OF THE SEEMP: SHIP FUEL OIL CONSUMPTION DATA COLLECTION PLAN clause 6
[118]MEPC, 17 May 2019: Resolution MEPC.312(74)
[119]Bernd Hackmann, 2011: *'Analysis of the governance architecture to regulate GHG emissions from international shipping'*, p. 88
[120]Ibid, p. 95
[121]Bodansky, Daniel, Regulating Greenhouse Gas Emissions from Ships, 2016: *'The Role of the International Maritime Organization, Forthcoming in Ocean Law Debates: The 50-Year Legacy and Emerging Issues for the Years Ahead*', p. 11

and the UNFCCC is defined by article 2.2 of the Kyoto Protocol, which recognizes the role of IMO[122]. Even though the targets of UNFCCC and IMO are identical, their fundamental principles follow different patterns. The principle of *no more favorable treatment* consists the orientation for IMO's initiatives. Therefore, the implementation of the rules should not differentiate the organization's treatment for vessels coming from different countries and never take into consideration any special circumstances. On the contrary, the UNFCCC climate regime is based on the principles of *common but differentiated responsibilities and respective capabilities*. The specific needs of developing countries are recognized and major responsibilities are imposed on the wealthiest nations[123].

Another distinguish element is that UNFCCC addresses emissions on a national basis, while IMO on the other hand regulates on a sectoral related basis, assigning the emissions to its actual producer. In addition to this, IMO's regulations depend on the implementation of flag states and the enforcement powers of port states. IMO, through technical standards for the general operation of ships, which are defined by MARPOL, targets to reducing emissions irrespective of the area the ship is currently sailing in. This element differentiates the IMO from the UNFCCC, which sets geographical limits regarding tackling GHGs[124].

It can be easily concluded that both institutions follow a different approach to the issue and the different measures taken derive from different principles. Furthermore, the delegation of the authority from the Kyoto Protocol to IMO was decisive for the allocation of responsibilities between those instruments. However, this must not be interpreted as a degradation of the role of UNFCCC and Kyoto Protocol. On the contrary, it consists the evolution and the maturation of the cooperation between the institutions. Therefore, IMO's role can be detected as 'pursuit of the ultimate objective of UNFCCC*'*[125] on the field of shipping industry. Furthermore, IMO as a specialist in the shipping business, is aiming in establishing efficient and viable common rules so that the industry will comply to the International climate change regime. IMO's work

[122]As it was analyzed in chapter IV.C
[123]Bernd Hackmann, 2011: *'Analysis of the governance architecture to regulate GHG emissions from international shipping'*, p. 96
[124]Bodansky, Daniel, Regulating Greenhouse Gas Emissions from Ships, 2016: *'The Role of the International Maritime Organization, Forthcoming in Ocean Law Debates: The 50-Year Legacy and Emerging Issues for the Years Ahead*', p. 14-15
[125]Ibid p.11

should consist the 'channel' through which the industry will succeed full compatibility to the international climate change regime. Among the most important, is the establishment of a global system of monitoring, reporting and verification of shipping emissions, which was succeeded through the IMO Data Collection System on fuel consumption[126].

IMO DCS can be compared to EU Monitoring, Reporting and Verification of $CO_2$ emissions since both systems have as common objective the facilitation of the reduction of GHG from shipping. Furthermore, they consist the first mandatory effort for collection and analysis of emission data produced by the shipping industry. There is no doubt that a robust database which provides information for the energy efficient of ship operations, focusing on CO2 emissions, is the first step for creating a reliable and efficient framework for international shipping. EU MRV got into force earlier than IMO DCS, commencing from 1 January 2018, while IMO's effort sparked on 1 January 2019[127]. Although, it is not yet clear if the two mechanisms overlap or support each other, there is no doubt that they share some common characteristics but at the same time they are differentiated in various ways.

Both systems apply to vessels exceeding 5.000 GT and require a monitoring plan. However, it is worth mentioning that IMO's system is applicable to vessel which are precisely 5,000 gross tonnage. Therefore, if a vessel is 5.000 GT but does not exceed that figure, then it will only need to comply with IMO DCS[128]. EU MRV requires a separate document describing the methodology for data collection and reporting, which is subject to verification by an independent accredited verifier. Deadline for submission of monitoring plan was 31 August 2017. While IMO DCS methodology should be described in the Ship Energy Efficiency Management Plan and is subject to confirmation of compliance by flag state. The deadline for submission of SEEMP was

[126]IMO Marine Environment Protection Committee as submitted by the Clean Shipping Coalition on 26 February 2016, MEPC 69/7/3: *'Reduction of Greenhouse Gas Emissions from Ships – An appropriate response to the Paris Agreement'*, paragraph 7

[127]Article by Abu Hasan Rony, Momoko Kitada, Dimitrios Dalaklis, Aykut I. Ölçer, Fabio Ballini, World Maritime University 2019: *'Exploring the new policy framework of environmental performance management for shipping: a pilot study'* p. 3

[128]Article by Felicity Deane, Anna Huggins, Md Saiful Karim, review of European, comparative & international environmental law, 2019, Vol.28 (3), p.258-267: *'Measuring, monitoring, reporting and verification of shipping emissions: Evaluating transparency and answerability'*, p265

31 December 2018. Detailed reference for SEEMP and its function will follow in chapter VII.

EU MRV system has a narrower geographical scope, which is restricted to, from, and within the EU area, while IMO DCS covers shipping globally. Furthermore, the supervising authority for the first is European Commission, as each Company must report annual emissions to the EMSA's data base (THETIS-MRV). While, for IMO's system annual emission reports need to be verified by Flag State, which notify the findings to IMO. It worth mentioning that the data gathered by European Commission are publicly available, while IMO is bonded by confidentiality. Reports for both systems should contain some mutual data which include fuel consumption, cargo carried, distance covered, time needed for the voyage, transport work and fuel balance report containing bunker delivery notes and remaining on-board reports[129].

The underlying value of the initiative for creating a data collection with crucial findings from shipping industry, can be spotted to the fact that all this information can be utilized for reforming the current environmental regime. However, this objective requires transparency, as data are useless if they are not accessible by the international community[130]. The distinguishing feature between EU MRV and IMO DCS is that the first secures publicity of all information, while the latter is bonded from confidentiality. Even though IMO, as the specialized agent of UN, should 'lead the way' for reducing GHG from shipping, while EU, as party to UN's climate regime, should comply with IMO 'directions', at this particular regard it seems that the different approach adopted by EU appears to be more efficient. The strict disclosure policy in the IMO DCS undermines the potential for answerability and necessitates a more transparent approach.

## VII. IMO'S MEASURE FOR TACKLING GHG AND POLLUTION FROM SHIPPING.

### A. Overview

As it was analyzed in the previous chapter, IMO is the specialized agent under the UNFCCC. Its main objective is to issue legally binding provisions to fight marine

[129]Source DNV GL: https://www.dnvgl.com/maritime/insights/topics/EU-MRV-and-IMO-DCS/index.html
[130]Article by Felicity Deane, Anna Huggins, Md Saiful Karim, review of European, comparative & international environmental law, 2019, Vol.28 (3), p.258-267: *'Measuring, monitoring, reporting and verification of shipping emissions: Evaluating transparency and answerability'*, p. 266

pollution, including emissions from shipping industry. Loyal to its duty, IMO has already advocated a significant volume of initiatives. The 'in house' responsible instrument of the Organization for all environmental and climate related initiatives is the 'Marine Environment Protection Committee' (MEPC). Provisions and rules with the greatest significance can mainly be detected in Annex VI of the 'International Convention for the Prevention of Marine Pollution from Ships' (MARPOL). Further to that, the concept of Emission Control Areas (ECAs) is another tool in the coastal states' 'arsenal' for reducing the Sulphur content of fuels in their areas of jurisdiction. Besides this, the 'Energy Efficiency Design Index' and the 'Ship Energy Efficiency Management Plan' and their great significance for modern shipping will be explained in this chapter. At this end, the latest evolvement in the fight against climate change can be detected in the recently implemented IMO 2020 regulation. It is noteworthy that the regulation had already created great controversy in the market well before its implementation and that its efficiency has not been evaluated yet. Nevertheless, it marks a new era in the shipping industry. The necessity for the successful implementation of these measures is concluded in the latest IMO's report, as it is estimated that according to different business-as-usual (BAU) scenarios, the emissions of shipping industry are projected to increase from 1,000 Mt CO2 in 2018 to 1,000 to 1,500 Mt CO2 in 2050. This represents an increase of 0 to 50% over 2018 levels and is equal to 90-130% of 2008 levels[131].

### B. Evolution of MARPOL convention and Annex VI

The International Convention for the Prevention of Marine Pollution from Ships (MARPOL) was signed in 2 November 1973. The main objective[132] of the Convention was to prevent and minimize accidental and routine operation's pollution from ships. However, it was only at 2 October 1983 when came into force[133]. Given the significance of MARPOL for the protection of the marine environment, it is remarkable that the process from the first sign of the convention until its implementation lasted ten years[134]. By the time that the Convention finally got into force, the 1978 Protocol had been

[131]Fourth IMO GHG Study 2020 – Final report for reduction of GHG emissions from ships, 29 July 2020, MEPC 75/7/15, p. 9
[132]International Convention for the Prevention of Pollution from ships, (MARPOL 73/78): 'P*ractical guide 2015*', p.3
[133]Source IMO list of conventions-MARPOL: http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx
[134]Article by Brian Glover, December 2007: *'Marpol compliance-a management solution'*

already added. This initiative was international community's response to a spate of tanker accidents between 1976-1977[135]. The protocol technically absorbed the parent Convention and therefore, there was no need for a separate instrument for ratification of the initial convention of 1973. As a result, the 1973 MARPOL Convention and the 1978 Protocol should be considered as one instrument, commonly known as MARPOL 73/78[136]. Until 2005, in total 136 countries, which were equivalent to 98% of the global shipping tonnage, had ratified the Convention and until today the number has increased to 156 states representing more than 99% of the global tonnage[137].

MARPOL consist of six annexes which have been adopted by the Assembly of the IMO. The latest Annex VI, which was adopted in 1997 and came into force in 2005, targets on fighting the prevention of air pollution from ships. MARPOL did not particularly address the arising issue of climate change, even though it was already an emerging global issue in 1997. Annex VI aims in decreasing nitrogen oxides ($NO_x$) emissions from shipping by establishing a cap limit. These substances are categorized as pollutants to the environment and a danger to the world ecosystem because of their proven ability to cause acid rain[138]. The imposed requirements comprise both engine-based and fuel-based standards. Analysis of the different alternative solutions for compliance with these requirements will follow in the last chapter of this assignment. It is noteworthy that Annex VI had been ratified by 89 states until 2018, after Iceland's deposition[139]. It is remarkable that flag states which have ratified Annex VI represent almost the 96% of the world fleet. However, a great paradox is detected, as among parties, only 63 out of the 153 coastal acceded to the Annex[140]. As a result, more than half of the countries which have seacoast have undertaken no official commitment to enforce the rules.

According to the Annex VI, all ships of 400 gross tons and above are obliged to have onboard an International Air Pollution Prevention Certificate (IAPP Certificate). Those

[135]Source IMO: http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx
[136]Elizabeth Mann Borgese and Norton Ginsburg, Ocean Yearbook , 1986, Vol.6(1): *'MARPOL 73/78: The International Convention for the Prevention of Marine Pollution from Ships, 1973 as Modified by Its Protocol of 1978'*, p. 579
[137]Article by Brian Glover, December 2007: *'Marpol compliance-a management solution'*
[138]Bodansky, Daniel, Regulating Greenhouse Gas Emissions from Ships, 2016: *'The Role of the International Maritime Organization, Forthcoming in Ocean Law Debates: The 50-Year Legacy and Emerging Issues for the Years Ahead',* p. 9
[139]Imo Marine Environment Protection Committee (Mepc 72) Report
[140]Article by Unni Einemo on behalf of the International Bunker Industry Association (IBIA), 11 July 2017: *'MEPC 71: Concern about number of states that cannot enforce sulphur limits'*

certificates prove in principle a vessel's compliance with Annex VI regulations. The rule applies to all vessels flying the flag of any state which has ratified the Annex or sailing in such state's territorial waters. This requirement is obligatory for all ships constructed after 19 May 2005. Older ships must be qualified with the IAPP certificate after the first scheduled dry-docking after 19 May 2005, but not later than 19 May 2008[141]. For vessels of less than 400 tons the responsible administration may establish appropriate measures for their compliance with their rules, even though there is no obligation of carrying such certificates. The way to control Sulphur Oxide (SOx) emissions is specified on regulations 14 and 18. Regulation 14 limits the range of permissible fuel oils and the limit varies depending on the geographical area in which the ship is operating at any given moment in time. While regulation 18 defines technical terms and information regarding fuel quality.

On 15 July 2011, the 62nd MEPC meeting adopted the revised Annex VI to MARPOL 73/78. The initiative constitutes the first obligatory GHG reduction legislation for international shipping. The undisputable significance of the amendment can be spotted on the fact that there was for a first time, a concerted effort for establishing a legally binding regime for the sector and included climate change as another crucial effect of air pollution[142]. A package of mandatory technical and operational measures, related to reduction of GHG emissions from the shipping industry, are initiated by the amendment. The reasoning behind amending the existent Annex VI and not adding a new one was related to the way that the parties could approve it. MEPC chose the *tacit acceptance* procedure for the new regime, which meant that member states do not need to explicitly accept the amendment, but its 'silence' is interpreted as approval[143]. This system can only be followed only in amendments and not to new Annexes. Therefore, this solution can be characterized as a wise 'maneuvering' of MEPC to succeed efficiency and speed in the adoption of the new rules. It worth mentioning that the revisions entered into force on 1 January 2013, only two years later[144]. At that point it was clear for the committee that swift actions should be adopted. The tacit acceptance was considered as the most time efficient solution to avoid the extremely long delays of the past. Technical and operational measures, such as the Energy Efficiency Design

[141]Practical Guide for International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), Copyright © TOCPRO 2015, p. 35
[142]Yubing Shi, 2017, p. 190
[143]Ibid, p. 191
[144]Ibid p.191

Index (hereinafter: EEDI) and the Ship Energy Efficiency Management Plan (hereinafter: SEEMP) were added to Annex VI by the new amendment of 2011. Further analysis of the aforesaid concepts will be conducted in next chapter. It worth mentioning though, that these amendments did not differentiate vessels owned, operated, or flagged in developed and developing countries, except from the opportunity for the latter to postpone the introduction for four years.

Regulation 14 of Annex VI sets the significant goal of restricting and controlling the Sulphur content of fuels used by international shipping for vessels 400GT. Even though, Sulphur oxide emissions are not categorized as greenhouse gases, and therefore not directly related to climate change, they have extremely harmful effect to human health and environment and they are included in the boarder concept of marine pollution, which is regulated under Annex VI. The scope of the provision aims to the reduction of air pollution including, but not exclusively, CO2 emissions. Article one of Regulation 14 defines the global limit of permitted Sulphur in marine fuel oil (MFO)[145]. The maximum Sulphur content allowed in MFOs was defined to 4.50% m/m prior to 1 January 2012 and 3.50% m/m on and after 1 January 2012[146]. On 1 January 2020 the notorious IMO 2020 Regulation led to a sharp decrease of the allowed limit and set for a first time the global cap to 0.5%[147]. Further analysis of IMO 2020 will follow in next chapter.

### C. Emission Control Areas (ECA)

Special provisions designated by the IMO in accordance with criteria and procedures set forth in appendix III to Annex VI grand the applicability to the coastal States to declare protected areas called Sulphur Emission Control Areas (SECAs or ECAs), and further tighten the allowed Sulphur limits in designated ECAs. An Emission Control Area can be designated after the proposal of a state Party to Annex VI. Coastal states have the sovereignty to bind marine areas, which belong to its territorial waters, and declare them as ECAs. This discretion was of even greater significance especially before 1 January 2020, as the global allowed limit was substantially higher that the limit in ECAs. Currently it is the Baltic Sea, North Sea, North American ECA, including

[145]Helen Sampson, Michael Bloor, Susan Baker, Katrin Dahlgren, 2016: *'Greener shipping? A consideration of the issues associated with the introduction of emission control areas'*, p. 296
[146]Leo Čampara, Nermin Hasanspahić, and Srđan Vujičić, SHS Web of Conferences 58, 01004 (GLOBMAR 2018): *'Overview of MARPOL ANNEX VI regulations for prevention of air pollution from marine diesel engines'*
[147]Isaac Animah, Augustus Addy-Lamptey, Francis Korsah, John Simon Sackey, 2018: *'Compliance with MARPOL Annex VI regulation 14 by ships in the Gulf of Guinea sub-region: Issues, challenges and opportunities'*, p. 442

most of US and Canadian coast and the US Caribbean ECA, including Puerto Rico and the US Virgin Islands have been declared as ECAs[148]. In terms of port competitiveness, declaring an ECA could create substantial problems in ports located in ECAs. Those ports bear the risk of losing part of their cargo traffic by their non-regulating competitors[149], therefore, vast majority of coastal states were extremely hesitant against ECAs and as a result, did not exercise their discretion.

### D. The Energy Efficiency Design Index and the Ship Energy Efficiency Management Plan

Among the most important IMO's innovations included in Annex VI for tackling GHGs from international shipping are the Energy Efficiency Design Index and the Ship Energy Efficiency Management Plan. In 2011 the amendments adopted to MARPOL Annex VI, made the Energy Efficiency Design Index (EEDI) mandatory for all new constructed vessels above 400 gross tonnages contracted on or after 1 January 2013. The new regulation imposes measures, related to the reduction of emissions of GHGs. Further to that, it provides explanatory notes[150] for the calculation of the required EEDI for different types of ships.

Even though the detailed information regarding EEDI are more on the technical side, broadly it can be said that it consists the most important technical measure and the basic concept behind these rules is the use of more energy efficient (less polluting) equipment and engines on vessels.

'*The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments. The EEDI provides a specific figure for an individual ship design, expressed in grams of carbon dioxide (CO2) per ship's capacity-mile (the smaller the EEDI the more energy efficient ship design) and is calculated by a formula based on the technical design parameters for a given ship. '*[151]

[148]IMO, MEPC.1/Circ.778/Rev.3 2 July 2018: *'list of special areas, emission control areas and particularly sensitive sea areas'*

[149]Young-Tae Chang, Hyosoo Park, Suhyung Kim, Eunsoo, *Transportation Research Part D: 'Transport and Environment Volume 58, January 2018: 'Have Emission Control Areas (ECAs) harmed port efficiency in Europe?'*, p.50

[150]Predrag Čudina, Volume 66 Number 3, 2015: *'Analysis of the Energy Efficiency Design Index with a Proposal for Improvement'*, p.1

[151]Source DNV GL>maritime>energy efficiency: https://www.dnvgl.com/maritime/energy-efficiency/eedi-and-eeoi.html

Therefore, these rules are expected to trigger more and more technical innovation in the ship building industry, regarding the fuel efficiency of a ship from its design phase, as ship building industry has the complete discretion to choose the most cost-efficient solutions for the new build vessels in order to comply with the regulations[152]. This process of innovation and upgrade of new technologies will be constant, as the allowed levels of energy efficiency will be keep reducing every five years from 2015 on until 2030[153].

According to regulation 19 of the amendment[154], there was some flexibility provided to some States, as they could postpone the applying date of the EEDI, longer than the 1 January 2013. As a result, a longer timeline for preparation and adjustment could be granted to the vessel which might had been included in the application of the provision. Practically this choice was used primarily by vessels flying the flags of developing States, however there was no defined distinguish between developed and developing States[155]. Therefore, this provision followed the *no more favorable treatment principle*, as the CBDR principle could not technically apply. The outcome of EEDI regime is that new build vessels complying with the provisions are more cost effective regarding their operational costs and more tempting for the ship owners from a pure commercial point of view. Therefore, the aforesaid waiver was not believed to reduce the outcome of the EEDI provisions[156]. Furthermore, in April 2014, Annex VI to *MARPOL 73/78* was amended and included extra five types of ships and made the auditing mandatory[157].

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[152]Yubing Shi, p. 192

[153]Kati Kulovesi, Kati, Johanna Dafoe, 2016: *'ICAO and IMO: International sectoral approaches to greenhouse gas reductions in transport, in Climate Change Law',* p. 281

[154]Regulation 19:

*1. This chapter shall apply to all ships of 400 gross tonnage and above . . .*
*4. Notwithstanding the provisions of paragraph 1 of this regulation, the Administration may waive the requirement for a ship of 400 gross tonnage and above from complying with regulation 20 and regulation 21.*
*5. The provision of paragraph 4 of this regulation shall not apply to ships of 400 gross tonnage and above:*
*(1) for which the building contract is placed on or after 1 January 2017; or*
*(2) in the absence of a building contract, the keel of which is laid or which is at a similar stage of construction on or after 1 July 2017; or*
*(3) the delivery of which is on or after 1 July 2019; or*
*(4) in cases of a major conversion of a new or existing ship, as defined in regulation 2.24, on or after 1 January 2017, and in which regulation 5.4.2 and regulation 5.4.3 of chapter 2 apply.*

[155]Yubing Shi, p. 192

[156]Yubing Shi, p. 195

[157](MEPC), 66th session, 31 March to 4 April 2014

The Ship Energy Efficiency Management Plan, on the contrary to the EEDI, was made mandatory for all, and not only for new build, vessels of more than 400 gross tonnage (GT) with effect from 1 January 2013. The SEEMP can be described as a goal-based regulation, where the law demands certain results by leaving the method chosen at the complete discretion of the ship owners[158]. SEEMP is a type of internal instructions that every single vessel is obliged to have, for improving its energy efficiency[159]. This plan is ship-specific and must be implemented always taken into consideration various factors as the ship type, cargoes carried, ship routes, and other. Even though IMO has published some guidelines, it is exclusively up to the company to develop its own plan. Weather routing, just-in-time arrival, installing optimal trim and waste heat recovery, optimization of the speed of the vessel, hull cleaning in dry dock are required by the latest edition of the IMO Guidelines[160]for developing an efficient SEEMP.[161] All these methods target in increasing the ship's efficiency and optimizing the ship operation. The SEMP does not require approval from flag State administrations as it was considered as less efficient and more costly for the Shipowners and there was great suspicion against the Flag states of Convenience[162].

### E. Alternatives for compliance with IMO 2020 regulation

From 1 January 2020, Regulation 14 of MARPOL Annex VI reduced the allowed limits of Sulphur cap to 0.5%. The initiative is known as 'IMO 2020 regulation' and led the industry to a new era, which also created a new market of Low-sulfur fuel. Ship operators have various alternatives to comply with the 2020 sulfur cap. However, safe results and conclusions regarding the cost efficiency of each option cannot be extracted in such a short time of implementation of the new regime. Further to that, results might differentiate based on the long-term business plan followed by different companies. Therefore, an analysis of pros and cons of each option will follow.

New low-sulfur fuels (LSF), such as marine gas oil (MGO), marine diesel oil, very low-Sulphur fuel oil (VLSFO, 0.5% m/m Sulphur content), and ultra-low Sulphur fuel oil (ULSFO, 0.1% m/m Sulphur content), have already started substituting the old

[158]Elin Kragesand Hansena, Hanna Barbara Rasmussenb, Marie Lützen, 2020: *'Making shipping more carbon-friendly? Exploring ship energy efficiency management plans in legislation and practice'*, p. 2
[159]Resolution Mepc.282(70), 28 October 2016: *'Guidelines for the Development of a Ship Energy Efficiency Management Plan'*
[160]Resolution MEPC.282(70)
[161]Elin Kragesand Hansena, Hanna Barbara Rasmussenb, Marie Lützen, p. 2
[162]Yubing Shi, p. 205

technology high-sulfur fuels oil (IFO) 180 and 380[163]. New fuels can be described as a 'double-edged sword', as they require minor adjustments to the tanks and the engine of the vessel and as a result the capital cost is maintained in a relatively low rate. However, the operational cost of a vessel is significantly increased, due to higher prices of the new fuels[164]. It is also worth mentioning that significant shipowners' representatives, like the President of Greek shipowner's association, Theodoros Beniamis[165], have expressly raised legitimate concerns, for the capacity of the oil industry to supply global fleet with sufficient quantity of the new compliant fuels.

As an alternative to the new fuels, ship operators can install scrubbers, which remove Sulphur from exhaust gas. Scrubbers are classified into two big categories, the wet and dry scrubbers. Wet scrubbers include open loop, closed loop, and hybrid systems[166]. The specific technical characteristics of different types of scrubbers will not be analyzed in this assignment. However, the distinction is of great significance in regard of compliance with IMO 2020 because some states do not approve certain types of scrubbers. In particular, Open-loop scrubbers have been banned by China, Saudi Arabia, Oman Singapore, Malaysia, Belgium, Ireland and parts of the United States, while many countries have imposed critical restrictions in discharge of washed water which has been used by this type of scrubber[167]. It is of great interest that according to a DNV GL report, in 2018, vast majority of the vessels operating with scrubbers was using open-loop scrubbers[168].

The greatest benefit of use of scrubbers is that cheaper old type fuel can be still used, maintaining the operational costs of a vessel in the same levels as prior the 1 January 2020, while they are fully compatible with new and old ships. However, the age of a vessel can be a critical factor for the cost effectiveness of this option. It is supported that installment of scrubbers cannot be economically viable for vessels with less than

[163]SHELL comprehensive guidelines of IMO 2020: *'IMO 2020 Ready'*
[164]Article by Johan Holmgren, Zoi Nikopoulou, Linda Ramstedt, Johan Woxenius, Transportation research. Part D, Transport and environment, 2014-05, Vol.28, p.62-73: *'Modelling modal choice effects of regulation on low-sulphur marine fuels in Northern Europe'*, p.63
[165]Artcile by Naftemporiki, 10 May 2019, *'Union of Greek Shipowners: IMO's upcoming MEPC74 a 'last opportunity' for viable solutions ahead of 2020 fuel Sulphur cap'*
[166]Article by Zhu, Mo Li, Kevin Lin, Kun-Chin Shi, Wenming Yang, Jialin, Transportation research. Part D, Transport and environment, 2020-02, Vol.79: *'How can shipowners comply with the 2020 global sulphur limit economically?'*, p.2
[167]Source: International Chamber of Shipping
[168]Source: DNV GL (Det Norske Veritas Germanischer Lloyd) *'Scrubbers at glance'*

four years remaining lifetime[169]. However, installment of scrubber requires the retrofit of the Vessels and a significant investment capital. In the drawbacks of this option, should be also included the time required for installation, as vessel must stay of action during the preparatory work. Supporters of this alternative claim that the overall cost effectiveness of using a scrubber generates lower cost than the use of LSFOs[170].

The last option for compliance that could be used by ship operators is the burn of nonpetroleum-based fuels, such as liquefied natural gas (LNG) and methanol. This alternative might be the future 'key' for a cleaner and viable model, however, currently has very limited acceptance by the market. The lack of infrastructure for supply in the ports, the very limited number of vessels that are built to burn this type of fuel and the major cost of installing the appropriate equipment on older vessels does not make this choice very attractive yet[171].

### F. Impact to GHG emissions from compliance to regulation 14 of MARPOL ANNEX VI

As it was explained, MARPOL Annex VI regulation 14 sets the allowed Sulphur cap limits. Companies have two alternatives to comply with the new rules either by installing an exhaust gas cleaning system (EGCS) or start using the new fuel with low Sulphur content. However, the 'price' for desulphurization is the unavoidable increase of CO2 emissions.

New low-Sulphur fuel is produced through a desulphurization process which can be succeeded in the refinery. This procedure requires significant portion of energy, which usually is generated from other fossil fuels, which emit by their turn GHG in the atmosphere. Further to that, desulphurizing fuels requires hydrogen, which is 'generated by steam-reforming methane, a process which also emits CO2'[172]. On the contrary, the desulphurization process on board does not generate additional emissions in the fuel production, as the normal fuels are used. However, the usage of scrubbers

[169]Article by Zhu, Mo Li, Kevin Lin, Kun-Chin Shi, Wenming Yang, Jialin, Transportation research. Part D, Transport and environment, 2020-02, Vol.79: *'How can shipowners comply with the 2020 global sulphur limit economically?'*, p.6

[170]Article by Irina Panasiuk, Liudmila Turkina, Transportation research. Part D, Transport and environment, 2015-10, Vol.40, p.87-96: *'The evaluation of investments efficiency of SOx scrubber installation',* p.95

[171]Report no. 2019-0567 by DNV GL (Det Norske Veritas Germanischer Lloyd): *'Comparison of Alternative Marine Fuels'*, p. 53

[172]Jasper Faber, Anne Kleijn, Diederik Jaspers for CE Delft, August 2020: *'Comparison of CO2 emissions of MARPOL Annex VI compliance options in 2020',* p. 34

does indirectly lead in increase of GHG. These emissions are related to the production, installation, and operation of the scrubber, as also to the release of acidic discharge water, as seawater used for scrubbing is discharged back into the sea[173].

The aforesaid conclusion in regard of the use of low Sulphur fuels, is subject to burning of fossil fuels during the production process. If pure renewable energy was used, the result would be differentiated significantly. On the contrary, the impact from the use of scrubbers would not have major difference even if renewable energy was used to produce the equipment. It has been calculated that more than 90% of the emissions arise are related to the operation phase of life of scrubbers[174]. The amount of the additional GHG related to the use of an EGCS is affected by the type of vessel, while the additional CO2 emissions produced because of using desulphated fuel are related to the manufacturing refinery. Different factors, as energy efficiency, technology, equipment used in various refineries are possible to differentiate the footprint of each production facility and can lead to different conclusions[175]. However, various reports agree that the results between the two different methods are comparable as emissions of ships using an EGCS or low-Sulphur fuels are substantially similar[176].

## VIII. CONCLUSION

‘’Human being in an unpredictable world is about what can happen when nature disrupts our world. We humans try our best to control nature, but nature does not always play by our rules. Nature repeatedly throws us into chaos and forces us to look at the world from a new perspective. People in different ways and different times live between control and chaos. In the distant past we meet Stone Age pioneers who ventured north and made a new life along the coast of Norway after the collapse of the Ice age. We travel east to the Pacific and see how people in Polynesia held chaos at bay with the help of ‘tapu’[177] and ‘mana’[178]’’.[179]

Nowadays, we are facing the consequences of our own activities and as our ancestors did, we have to explore new ways of living and reconsider the perspective that we look

[173]Ibid p. 14
[174]Jasper Faber, Anne Kleijn, Diederik Jaspers for CE Delft, August 2020: *‘Comparison of CO2 emissions of MARPOL Annex VI compliance options in 2020’,* p. 28
[175]Ibid p.13
[176]Ibid p.36
[177]A Polynesian traditional concept denoting something holy or sacred, with "spiritual restriction" or "implied prohibition"; it involves rules and prohibitions
[178]means power, effectiveness, and prestige
[179]Museum of Cultural history, Oslo

at our world, in response to the threat of the upcoming ecological collapse. United Nations gave the spark in 1992 by adopting the UNFCCC, which triggered even greater decisions in the next decades. During the negotiations for the Kyoto Protocol and the Paris Agreement which followed, it was proved that the circumstances were unfavorable for including GHGs from shipping as specific targets. As a result of this, IMO as the specialized agent under the international climate change regime needed to initiate some brave changes and managed to legislate some crucial topics to this direction. Nowadays, IMO can rely to the technological progress that has been succeeded during the past years. However, the most important change is the maturation of conscience of responsibility for tackling the devastating consequences of Climate Change. And even though it is very well known that fighting Climate Change is a constant process, which requires adoptability and alert, the aforesaid have undoubtedly provided the international community with the ability and the ambition to fulfil its targets for securing a viable future for next generations.

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