EUROPEAN
COMMISSION

Brussels, 17.8.2021
C(2021) 6022 final

REPORT FROM THE COMMISSION

2020 Annual Report on CO_2 Emissions from Maritime Transport

{SWD(2021) 228 final}

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1. Introduction

Maritime transport plays an essential role in the EU economy, and it will continue playing a key role in a European climate-neutral economy. As part of the package to deliver the European Green Deal[1], the Commission proposed in July 2021 a series of measures to ensure that the maritime transport sector contributes to the EU's climate ambitions. These measures include extending the European emissions trading to maritime transport, a dedicated initiative to boost demand for sustainable alternative fuels (the FuelEU Maritime initiative), and revision of existing directives on energy taxation, alternative fuel infrastructures and renewable energy. In addition, the Commission is committed to support the implementation of the initial IMO Strategy for GHG emission reductions, which needs to lead to effective and timely action.

The first step towards action to cut emissions is understanding what is being emitted and where. In this context, monitoring CO_2 emissions from maritime transport is a necessary first step to enable the deployment of future policies as part of the European Green Deal. Transparency brings accountability and incentives for emission reductions. This is the purpose of the EU Regulation on the monitoring, reporting and verification of emissions from maritime transport adopted in 2015[2] ('the EU MRV Regulation'). Through this legislation, a large amount of CO_2 emission data and other relevant information is published every year and an annual report is prepared that provides a comprehensive and granular understanding of CO_2 emissions from ships travelling to and from ports located in the European Economic Area (EEA). It also provides valuable analysis on the characteristics and energy efficiency of ships, helping identify the various factors influencing CO_2 emissions.

This is the second annual MRV report on CO_2 emissions from maritime transport. It follows the first report that was published in May 2020[3]. It builds on all the information and experience gained from the completion of two full compliance cycles of the EU MRV Regulation. The objective of this report is also to inform the public about the maritime transport's overall impact on the global climate[4].

2. Maritime transport remains a substantial CO_2 emitter

The new 2019 MRV data confirms that maritime transport is a substantial CO_2 emitter, representing 3-4% of total EU CO_2 emissions. The monitored journeys emitted in 2019 over 144.6 million tonnes of CO_2 into the atmosphere, slightly higher than the 138[5] million tonnes emitted in 2018. These emissions originated from 12,117 ships in 2019 compared to 12,154 ships in 2018. Taken together, these ships represent around 38% of the world merchant fleet above 5,000 gross tonnage, and over 80% of them are either bulk carriers, oil tankers, container ships, chemical tankers or general cargo ships. While slightly fewer ships reported

[1] Communication COM(2021) 550 final

[2] Regulation (EU) 2015/757

[3] Communication C(2020) 3184 final

[4] In a complementary manner to the 4th Greenhouse Gas Study of the International Maritime Organisation

[5] 138 million tonnes refers to the emissions extracted on 23 September 2019 and used in the previous MRV report. However, the comparisons of this report refer to 144.6 mill tonnes in 2019 and 144.2 in 2018, as they are the most updated figures at the time of writing this report

emissions in 2019 compared to the previous year, yet emissions increased; it does not mean that ships became less efficient. It could be due to several reasons: e.g. the same ships called at the European Economic Area (EEA) ports more often in 2019, different fleet calling at EEA ports, different trading demands, etc.

The distribution of CO_2 emissions per type of voyage follows similar trends in 2019 to 2018. Around 60% of the CO_2 emissions in both reporting periods stem from voyages between an EEA port and a port located outside the EEA, incoming or outgoing. There are slightly more CO_2 emissions from the incoming extra-EEA voyages than from the outgoing ones, which is in line with the pattern of the movement of goods in EU ports. Voyages between two ports in the EEA are responsible for around one third of the reported CO_2 emissions (32%), while emissions at berth represented 7% of all reported CO_2 emissions in 2019, comparable to 2018. New analysis also shows that, in general, smaller ships tend to have a larger proportion of their CO_2 emissions coming from intra-EEA voyages, while most CO_2 emissions coming from large international deep-sea ships are related to extra-EEA voyages. In addition, ro-ro (roll-on/roll-off) and ro-pax (roll-on/roll-off passenger) ships emit predominately in intra-EEA scope, independently from their size, due to their regional-base (i.e. short-sea coastal trading patterns).

Expressed in terms of fuel consumption, the overall CO_2 emissions correspond to 46 million tonnes of fuel, the same amount as 2018 (when comparing with the updated 2018 data). 44 million tonnes of fuel were consumed during navigation and 2 million tonnes at berth. The distribution of fuel types used has not significantly changed between 2018 and 2019. 69% of the fuel consumed by the monitored fleet in 2019 was heavy fuel oil, compared to 71% in 2018. The use of Liquefied Natural Gas (LNG) increased from 4% to 5% of the total amount of fuel consumed.

3. Container ships remains the ship category that emitted the most CO_2 emissions in absolute terms

The distribution of CO_2 emissions across the different types of ships in 2019 was very similar to the one observed in 2018. Container ships represented the largest share of total emissions, with 30% in 2019, compared to 31% in 2018. In absolute terms, these ships reported around 44 million tonnes of CO_2 in 2019, one million tonnes less than in 2018. This pollution originated from 1,801 ships that together reported over 6 million hours of time spent at sea. In 2019, bulk carriers represented almost 30% of the monitored fleet (in terms of numbers of ships) and emitted approximately 12% of the CO_2 emissions (17 million tonnes). Ro-ro (roll-on/roll-off) and ro-pax (roll-on/roll-off passenger) ships together reported 21 million tonnes of CO_2 emissions in both reporting years.

4. Technical and operational energy efficiency of ships under the EU MRV system

The analysis of the 2019 MRV data shows that there is little change observed in the reported technical energy efficiency of containerships, bulk carriers, oil and gas tankers compared to 2018 (both in terms of attained Energy Efficiency Design Index values - EEDI and Estimated Index Values - EIV).

In terms of operational energy efficiency, the analysis based on regression curves shows that the operational energy efficiency, measured in Annual Efficiency Ratio (AER), has not changed for any ship type between 2018 and 2019. In addition, the analysis showed that there is a high correlation between the AER and the carrying capacity of ships (deadweight tonnage

or gross tonnage as applicable) seen in both years for bulk carriers, oil tankers, container ships, gas carriers, general cargo carriers, chemical tankers, ro-pax and ro-ro ships, cruise liners, and vehicle carriers. However, for LNG carriers, no such correlation could be detected as this category includes ships with very different propulsion systems that have a strong influence on the reported operational energy efficiency. When measured in terms of Energy Efficiency Operational Indicator (EEOI), the analysis shows that an acceptable correlation between the EEOI and the carrying capacity, can only be noted on container ships, gas carriers, and cruise liners.

5. Maritime transport sector's overall significance for the global climate and the environment

The 4th Greenhouse gas (GHG) study from the International Maritime Organisation shows that GHG emissions (including carbon dioxide, methane and nitrous oxide) from shipping have increased from 977 million tonnes in 2012 to 1,076 million tonnes in 2018, representing a 9.6% increase. The share of shipping emissions in global anthropogenic GHG emissions has increased from 2.76% in 2012 to 2.89% in 2018[6].

The study also highlights that methane emissions increased by 150% over the period 2012-2018, far greater than the use of LNG as a marine fuel. Regarding the contribution of international shipping to air pollution during the period 2012-18, nitrogen oxides (NOx) emissions increased from 16.9 to 17.1 million tonnes, sulphur oxides (SOx) emissions from 9.1 to 9.6 million tonnes and, fine particulate matters (PM2.5) from 1.304 million tonnes to 1.351 million tonnes. Black Carbon emissions, acting at the same time as air pollutant and climate forcer and with high relevance for Arctic shipping, increased from 59 kilo tonnes to 62 kilo tonnes.

The overall carbon intensity, as an average across international shipping, was 21% and 29% better than in 2008, measured in AER and EEOI, respectively. Increasing average ship size has had a dominant role in carbon intensity reductions. Operating speeds also remain a key driver for trends in emissions. However, under certain market conditions, operating speeds could increase again in the future, leading to increased GHG emissions.

According to the 4th IMO GHG study, CO_2 emissions are projected to increase from about 90% of 2008 emissions in 2018 to 90-130% of 2008 emissions by 2050 for a range of plausible long-term economic and energy scenarios.

[6] 4th IMO GHG Study
In 2018, the contribution from each of the GHG emissions (CO_2, CH_4, N_2O) to overall CO_2-equivalent emissions is 98.03, 0.52, 1.45% respectively when considering voyage-based international emissions, where the vessel-based proportions differ marginally (98.12, 0.44 and 1.44%). If Black Carbon emissions are also included in the calculation of CO_2-equivalents, using a 100-year GWP of 900, these shares become 91.32, 0.48, 1.35% (for CO_2, CH_4 and N_2O), with BC representing the second most significant contribution at 6.84%, for voyage-based international emissions (where shares are 91.17, 0.41, 1.34 and 7.08%, respectively, for vessel-based international emissions)