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REDUCTION OF GHG EMISSIONS FROM SHIPS

Proposal for including carbon capture technologies in the IMO regulatory framework to reduce GHG emissions from ships

Submitted by Liberia and ICS

SUMMARY

Executive summary:	This document proposes to consider the CO_2 reduction obtained from carbon capture technologies and regulate them in the EEDI/EEXI and CII frameworks.
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 15
Related documents:	MEPC 78/17; Resolutions MEPC.304(72), MEPC.308(73), MEPC.328(76) and MEPC.352(78)

Background

1 This document is presented in the context of the implementation of the *Initial IMO Strategy on reduction of GHG emissions from ships* (resolution MEPC.304(72)).

2 MEPC 76 adopted the amendments to MARPOL Annex VI introducing mandatory goal-based technical and operational measures to reduce carbon intensity of international shipping (resolution MEPC.328(76)) and the relevant technical guidelines supporting the EEXI and CII framework.

3 MEPC 78 started discussing, inter alia, proposals related to onboard carbon capture. Following the initial debate where interest for further consideration of the concept of onboard CO_2 capture was expressed, the Committee agreed to invite interested Member States and international organizations to submit further information and concrete proposals to future sessions (MEPC 78/17, paragraph 7.132).

Discussion

4 The imminent entry into force of those MARPOL requirements and the forthcoming measures to meet the future climate targets represent a great challenge for shipping which will get technologically more and more difficult in the future as the 2050 targets are approaching. In fact, while clean energy technologies may be available and able to technically substitute fossil fuels, to become a concrete alternative they should become affordable and globally utilizable.

5 The interdependencies between supply, distribution and demand of fuels and the time it will take for ships and bunkering infrastructure to adapt to pace with new green technologies, once worldwide available, entail an inevitable transition period where different green technologies will coexist. This should be also acceptable in order not to impair the choices of early movers and not to make others waste valuable time in understanding what the right move is.

6 In light of the above-described scenario, the co-sponsors are of the view that technologies able to facilitate the transition period and contribute to the climate target achievement should be assessed and subject to agreement included within the regulatory framework, provided that new requirements are generally applicable without promoting a specific technological choice and hampering the employment of others.

7 Carbon Capture and Storage (CCS) and Carbon Capture, Use and Storage (CCUS) are viable and available technologies which can also be applied in the maritime sectors in order to meet the decarbonization targets, limiting the CO_2 release in the air. In this regard, the amount of captured CO_2, irrespective of the technology used (e.g. mineralization of the carbon in solid form; sequestration of carbon in pure liquid or frozen form (cryogenic and/or pressurized)) should be considered in the regulatory framework.

8 As an example of currently available and technically feasible solution, ships can be fitted with a steam methane reformer, enabling the conversion of LNG into hydrogen and CO_2:

$$CH_4 + 2H_2O \Rightarrow CO_2 + 4H_2$$

With this option, hydrogen becomes the main fuel of a ship but without the need of:

.1 supply (thus resolving all uncertainties about availability of green fuels); and

.2 storage (thus alleviating all technical challenges around the storage of this fuel).

The CO_2 produced from this process can be liquefied from the cryogenic temperature of LNG and stored on board, until it is disposed to dedicated facilities ashore for further storage and/or use, enabling a cyclic economy.

9 Once ashore, the captured CO_2 can be used in many industrial sectors. Globally, some 230 million tonnes (Mt) of carbon dioxide (CO_2) are used every year. The largest consumer is the fertilizer industry, where 130 Mt CO_2 is used in urea manufacturing, followed by oil and gas, with a consumption of 70 to 80 Mt CO_2 for enhanced oil recovery. Other commercial applications include food and beverage production, metal fabrication, cooling, fire suppression and stimulating plant growth in greenhouses. The carbon in CO_2 enables the conversion of hydrogen into a fuel that is easier to handle and use, for example as an aviation fuel, while CO_2-cured concrete can deliver lower costs and improved performance compared to conventionally-produced concrete.

10 Although CCUS systems installed on board ships do not address the entire process, being careless of what happens to the CO_2 after its delivery ashore, it is undeniable that the CO_2 emissions of the ship will not be the ones which correspond to the fuel consumption as documented from the bunker deliver notes, but reduced from the quantities of CO_2 delivered ashore.

11 The CO_2 reduction related to the installation on board of a CCS system (independently from the technology used), should be considered in the calculation of the:

.1 attained EEDI/EEXI (i.e. subtracting the quantity of CO_2 captured per hour of operation taking into account the CO_2 storage capacity); and

.2 attained CII through the reduction of the total mass of CO_2 emitted on the basis of the CO_2 emission in the air.

A "CO_2 receipt note" could be a document certifying the quantity of CO_2 captured and delivered ashore.

Proposal

12 The obtained CO_2 reduction is to be considered in the calculation of CO_2 emissions and included in the regulatory framework, both at the design and operational stage (i.e. EEDI/EEXI and CII).

13 In particular, the co-sponsors propose that the CO_2 reduction related to the use of a CCS/CCUS, independently from the technology applied, is considered in the calculation of the Attained EEDI/EEXI and Attained CII. In this regard, annexes 1 to 3 provide:

.1 a draft MEPC.1 circular on sample format for the information to be included in the CO_2 Receipt Note, providing evidence for the quantity of CO_2 delivered ashore (annex 1);

.2 draft amendments to the *2018 Guidelines on the method of calculation of the Attained Energy Efficiency Design Index (EEDI) for new ships* (annex 2); and

.3 draft amendments to the *2022 Guidelines on operational Carbon Intensity Indicators and the calculation methods (CII Guidelines, G1)* (annex 3).

14 To finalize these proposals, the co-sponsors suggest that the Committee establish a correspondence group with the following terms of reference:

".1 identify all CCS/CCUS technologies that are at an appropriate level of technology readiness to be utilized on board ships;

.2 propose amendments which will enable all such technologies to be accounted for in the existing EEDI/EEXI and CII regulatory frameworks (using annexes 1 to 3 of this document as basis);

.3 propose an acceptable range of CO_2 disposal methodologies;

.4 propose appropriate means of verification and recording of CO_2 disposal; and

.5 submit a written report to MEPC 80."

Action requested of the Committee

15 The Committee is invited to consider this document and especially the proposals set out in paragraphs 12 to 14, together with the draft amendments set out in annexes 1 to 3, and take action as appropriate.

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ANNEX 1

DRAFT MEPC CIRCULAR ON SAMPLE FORMAT FOR THE INFORMATION TO BE INCLUDED IN THE CO_2 RECEIPT NOTE

1 The Marine Environment Protection Committee, at its seventy-ninth session (12 to 16 November 2022), approved a sample format for the information to be included in the CO_2 Receipt Note, as set out in the annex.

2 Member Governments are invited to bring the present circular to the attention of their Administration, industry, relevant shipping organizations, shipping companies and other stakeholders concerned, as appropriate.

ANNEX

INFORMATION TO BE INCLUDED IN THE CO_2 RECEIPT NOTE

1 Name and IMO number of the ship

2 Port of reception

3 Date of reception

4 Name, address and telephone number of the receiver

5 Quantity of CO_2 received ashore in metric tonnes

6 A declaration signed and certified by the ship's master and the receiver

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ANNEX 2

DRAFT AMENDMENTS TO THE *2018 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS* (RESOLUTION MEPC.308(73), AS AMENDED BY RESOLUTIONS MEPC.322(74)) AND MEPC.332(76))

1 Paragraph 2.1 **EEDI Formula** is amended as follows:

$$\frac{\left[\begin{array}{l}\left(\prod_{j=1}^{n} f_j\right) * \left(\sum_{i=1}^{nME} P_{ME(i)} * C_{FME(i)} * SFC_{ME(i)}\right) + \left(P_{AE} * C_{FAE} * SFC_{AE}\right) + \\ \left(\left(\prod_{j=1}^{n} f_j * \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} * P_{AEeff(i)}\right) * C_{FAE} * SCF_{AE}\right) - \\ \left(\sum_{i=1}^{neff} f_{eff(i)} * P_{eff(i)} * C_{FME} * SFC_{ME}\right) - \left(\sum_{i=1}^{nCCS} f_{capture(i)} * Q_{CCS(i)}\right)\end{array}\right]}{f_c * f_i * f_l * Capacity * f_w * f_m * V_{ref}}$$

where:

- Q_{CCS} is the quantity of CO_2 in ton captured and stored on board per hour of operation at the shaft power of the engine as defined in 2.2.5.

$$f_{capture} = \left(\frac{CO_{2capacity}}{\sum_{i=1}^{n} C_{F(i)} * Fuel_{onboard(i)}}\right)$$

where:

- $CO_{2capacity}$ is the total quantity of CO_2 in ton able to be stored on board; and

- $Fuel_{onboard}$ is the 50% of the total quantity of fuel(s) in ton which can be carried in the ship's storage tanks.

However, the Administration can consider higher $f_{capture}$ up to $f_{capture}$=1, taking into account the intended voyages and the possibility to discharge ashore the captured CO_2 more frequently than the intervals corresponding to the ship's range.

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ANNEX 3

DRAFT AMENDMENTS TO THE *2022 GUIDELINES ON OPERATIONAL CARBON INTENSITY INDICATORS AND THE CALCULATION METHODS (CII GUIDELINES, G1)* (RESOLUTION MEPC.352(78))

1 Paragraph 4.1 **Mass of CO_2 emissions (M)** is replaced as follows:

The total mass of CO_2 is the sum of CO_2 emissions (in grams) from all the fuel oil consumed on board a ship in a given calendar year, as follows:

$$M = FC_j \times C_{Fj} - M_{CO2captured} \qquad (2)$$

where:

- j is the fuel oil type;
- FC_j is the total mass (in grams) of consumed fuel oil of type in the calendar year, as reported under IMO DCS;
- C_{Fj} represents the fuel oil mass to CO_2 mass conversion factor for fuel oil type j, in line with those specified in the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships (resolution MEPC.308(73))*, as may be further amended. In case the type of the fuel oil is not covered by the guidelines, the conversion factor should be obtained from the fuel oil supplier supported by documentary evidence; and
- $M_{CO2captured}$ is the total mass of CO_2 delivered ashore whose quantity is certified by the CO_2 Receipt Note.

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