INTERNATIONAL MARITIME ORGANIZATION

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MARINE ENVIRONMENT PROTECTION COMMITTEE
76th session
Agenda item 7

MEPC 76/7/22
7 April 2021
Original: ENGLISH
Pre-session public release: ☒

REDUCTION OF GHG EMISSIONS FROM SHIPS

NOx compliance for engines using biofuels

Submitted by Denmark, France, Greece, Japan, Singapore and ICS

SUMMARY

Executive summary:	This document draws the attention of the Committee to the conditions for maintaining the NO_X certification of engines in the context of the use of biofuels which could be used by ships to comply with the short-term measures NOx
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 24
Related documents:	Resolution MEPC.304(72) and MEPC 75/18

Introduction

1 This document is presented in the context of the implementation of the *Initial IMO Strategy on reduction of GHG emissions from ships* (hereafter referred to as the Initial Strategy) was adopted by the Organization in 2018 (resolution MEPC.304(72)). The Initial Strategy establishes targets, in particular "to reduce CO_2 emissions per transport work, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008".

2 MEPC 75 approved draft amendments to MARPOL Annex VI concerning mandatory goal-based technical and operational measures to reduce carbon intensity of international shipping (document MEPC 75/18, paragraph 7.28), expected to be adopted at MEPC 76 for entry into force on 1 January 2023.

3 These technical and operational measures may require ships to implement technologically innovative solutions.

4 In this regard, the Organization should ensure that existing relevant instruments do not represent a barrier to the development of these new solutions. At the same time, it will be necessary to ensure that these solutions comply with the requirements of the relevant international conventions, in particular with regards to safety and environmental protection.

5 This document only addresses the specific issue of NOx compliance related to biofuels, without precluding the consideration of other issues related to the development of alternative fuels in general, such as their lifecycle GHG emissions, sustainability criteria, their emissions of other air pollutants, safety considerations, etc.

Biofuel potential

6 One of the most obvious solutions to decarbonize maritime transport is to use low/zero-carbon or carbon-neutral alternative fuels. Among such alternative fuels, biofuels – i.e. fuels produced from biomass – have the great advantage that they can generally be used rapidly by existing ships, without requiring major changes in ships' fuel systems and land-based infrastructures, and either blended with conventional fossil fuels or pure.

7 According to some analysts, biofuels could play a significant role in the transition to zero-carbon shipping, in particular in the mid-term. For example, among the three different possible pathways identified by Lloyd's Register and the University Maritime Advisory Services (UMAS) in their 2019[1] report *Zero-Emission Vessels: Transition Pathways*, bio-energy fuels (i.e. bio-gas oil, bio-methanol and biogas) could represent up to 60% of the fuel mix in 2050 in the "Bio-energy dominates" pathway, as shown in figure 1 below.

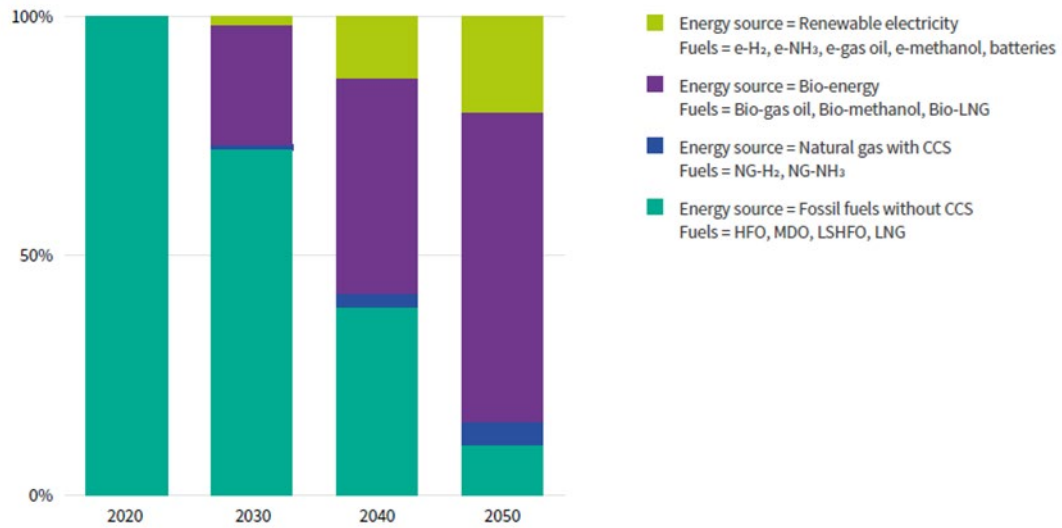

Figure 1: Energy source and marine fuels mix assumed in the "Bio-energy dominates pathway" in *Zero-Emission Vessels: Transition Pathways*, LR, UMAS, 2019

8 While also recognizing the limits of biofuels and the uncertainty regarding their market share in the future energy mix of shipping, the co-sponsors assume that some sustainable biofuels could soon be available on the market and therefore enhance shipowners' capacity to reach their carbon intensity reduction targets in the years and decades to come.

[1] For more information, see https://www.lr.org/en/latest-news/lr-and-umas-release-new-zero-emission-vessels-transition-pathways-study/

Identification of the issue

9 NOx emissions depend on the type of engine and different characteristics of the combustion process, including in particular temperature, but these parameters may also be influenced by the type of fuel used. As pointed out by a paper by Gilbert et al. entitled *Assessment of full life-cycle air emissions of alternative shipping fuels* (2017),[2] it seems that the "bio-derived fuels assessed face broadly the same issues for NOx emissions as the conventional fossil fuels", while they emit much less SOx and particulate matter.

10 The use of biofuel is not a justification for exemption or exception under regulation 3 of MARPOL Annex VI, nor is it considered to be an equivalent under regulation 4.

11 Regulation 18.3.2 states that the requirements of regulation 13 on NOx certification of the engine still applies to "fuel oil for combustion purposes derived by methods other than petroleum refining", which "shall not cause an engine to exceed the applicable NOx emission limit set forth in paragraphs 3, 4, 5.1.1 and 7.4 of regulation 13".

12 Therefore, an existing engine that would use a biofuel must demonstrate that it maintains its certification under regulation 13 and the NOx Technical Code (NTC) when using such fuel.

13 A great advantage of biofuels is that they can generally be used in existing ships and engines with no major change. However, demonstrating their NOx compliance may, depending on the biofuel used, require onboard emissions testing where the results should be presented in g/kWh. This can be challenging as experiments conducted at sea show considerable difficulties in obtaining reliable and sufficiently precise results to assess this conformity.

14 Recent field trials at sea performed on board ships have highlighted the following challenges:

.1 Due to external environment factors (sea state, temperature, humidity, vessel loading condition, etc.), it is not possible to reproduce bench conditions in the field. Emissions shall be evaluated on a comparative test between a known reference fuel and the candidate.

.2 To perform this comparison, the selected ship should be able to segregate three fuels: the usual fuel, the fuel used in Emission Control Areas for sulphur oxides emission control (used as reference fuel) and the tested biofuel. The number of possible ships for a trial is then limited.

.3 As the changeover from the reference fuel to the tested biofuels requires a minimum of one full day in its best condition, external conditions will have changed over this period compromising the accuracy and the comparability of the results.

.4 The total duration of such trials, including the selection of the ship, the biofuels, the trial protocol, the necessary agreements and technical support, require more than six months to try one fuel.

15 As a consequence, and considering the duration of such trials, only a very limited number of molecules could be evaluated per year with a questionable value of the results.

[2] https://www.sciencedirect.com/science/article/pii/S0959652617324721

16 Therefore, for existing ships, the only reliable solution is to conduct a test-bed trial on an identical engine. However, from a practical point of view, it is not realistic to re-test a large number of engines in service, on engine test beds, and with several types of biofuels between now and 2023.

Analysis

17 The logic of regulation 13 of MARPOL Annex VI is to consider a very limited number of fuels from oil refining and a large number of very different engines. The logic is therefore based on the certification of the engine. The simplified measurement method (NTC chapter 6.3) and the direct measurement and monitoring method (NTC chapter 6.4) gives a tolerance of up to 15% for compliance with the NOx limit (10% for uncertainties on board, 10% for use of RM grade fuel). But in no case can the limit exceed more than 15%.

18 In the case of the use of biofuels, there might be a need to reverse this logic. In fact, there will probably be a large variety of products on the market, especially at the beginning, with a number of combinations and almost infinite blending rates, whereas the number of engine types is likely to be almost constant.

19 The NOx Technical Code has integrated a specific cycle for sea trials, however this is the last resort, as the logic of the NOx Technical Code is based on trials on engine test beds. NTC 2008 also provides a direct measurement and an onboard monitoring.

20 Furthermore, in order to carry out trials with biofuels, ships could be able to benefit from a temporary exemption from their Administration under regulation 3.2 of MARPOL Annex VI on "Trials for ship emission reduction and control technology research". However, these ships may face restrictions from certain ports due to national or local regulations.

21 Therefore, there is now a risk that experimentation and development of low-carbon or carbon neutral biofuels be hindered because of the requirements related to NOx emissions of MARPOL Annex VI and the NOx Technical Code.

Proposal

22 The co-sponsors recommend that a regulatory framework for NOx compliance of sustainable marine biofuels soon be clarified to encourage research and development of such new fuels, while ensuring preservation of air quality and of human health.

23 The co-sponsors therefore invite the Committee to:

.1 encourage all industry stakeholders to carry out research, development and trials in the use of sustainable marine biofuels, to collect data;

.2 invite Administrations of Parties to MARPOL Annex VI to issue temporary exemptions for ships conducting biofuel trials for GHG reduction purposes;

.3 include this issue in the work programme of the Intersessional Working Group on Reduction of GHG Emissions from Ships at its next session or any other relevant body of the Organization; and

.4 invite Member States and international organizations to submit concrete proposals on a way forward to address this issue.

Action requested of the Committee

24 The Committee is invited to consider the proposals set out in paragraphs 22 and 23 and to take action as appropriate.