INTERNATIONAL MARITIME ORGANIZATION

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FURTHER CONSIDERATION OF CONCRETE PROPOSALS TO IMPROVE THE OPERATIONAL ENERGY EFFICIENCY OF EXISTING SHIPS, WITH A VIEW TO DEVELOPING DRAFT AMENDMENTS TO CHAPTER 4 OF MARPOL ANNEX VI AND ASSOCIATED GUIDELINES, AS APPROPRIATE

Initial impact assessment of the goal-based short-term measure proposed in document MEPC 74/7/4

Submitted by Denmark

SUMMARY

Executive summary:	This document provides an updated initial impact assessment of the goal-based short-term measure based on the legal framework of SEEMP applied to existing ships, as submitted by Denmark, Germany and Spain in document MEPC 74/7/4. The initial impact assessment is undertaken in accordance with the procedure set out in MEPC.1/Circ.885, concluding that the proposed measure has positive impacts on reduction of GHG emissions and energy efficiency of existing ships.
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 10
Related documents:	MEPC 74/7/4; ISWG-GHG 1/2/4, ISWG-GHG 1/2/14; MEPC 72/INF.12 and MEPC.1/Circ.885

Introduction

1 The Marine Environment Protection Committee, at its seventy-fourth session (13 to 17 May 2019), approved the procedure for assessing impacts on States of candidate measures as described in MEPC.1/Circ.885.

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2 MEPC.1/Circ.885 sets out, in paragraphs 5 and 6, that a proponent of a measure should submit an initial impact assessment at a minimum and submit it as part of the initial proposal.

3 Document MEPC 74/7/4 was submitted before the finalization of MEPC.1/Circ.885 but included a preliminary impact assessment. The proponents of document MEPC 74/7/4 acknowledge that the preliminary impact assessment set out in document MEPC 74/7/4 does not cover all elements of an initial impact assessment as set out in MEPC.1/Circ.885.

4 Document MEPC 74/7/4 proposes a short-term measure for all ships consisting in a goal-based approach based on the legal framework of SEEMP with a reduction target derived from the second level of ambition of the Initial Strategy.

5 According to paragraph 8 of the annex to MEPC.1/Circ.885, an initial impact assessment should pay particular attention to the needs of developing countries, especially SIDS and LDCs. Denmark fully recognizes this and notes that, according to several international studies, climate change affects developing countries, especially SIDS and LDCs, the most (IPCC 2018; UNEP 2018; WMO 2019). Early and effective climate action, as envisaged by the Initial Strategy, is of paramount importance, especially to developing countries.

6 The IPCC 1.5 Special Report states: "Global economic damages of climate change are projected to be smaller under warming of 1.5°C than 2°C in 2100" (Warren et al., 2018). The mean net present value of the costs of damages from warming in 2100 for 1.5°C and 2°C (including costs associated with climate change-induced market and non-market impacts, impacts due to sea level rise, and impacts associated with large-scale discontinuities) are $54 and $69 trillion, respectively, relative to 1961–1990." (IPCC 2018, Box 3.6, p. 264).

7 Denmark notes that the costs of inaction outweigh the costs of climate action. The economic benefits of climate action are greater. As concluded in The Climate Economy Report (2018), "bold action could yield a direct economic gain of $26 trillion through to 2030 compared with business-as-usual. And this is likely to be a conservative estimate."

Initial Impact Assessment of the goal-based short-term measure proposed in document MEPC 74/7/4

8 The full initial impact assessment of document MEPC 74/7/4 is presented in the annex to this document.

9 In summary, the initial impact assessment assesses all impacts listed in MEPC.1/Circ.885, indicates both positive and negative impacts, and analyses the extent of impacts. It finds that the goal-based short-term measure proposed in document MEPC 74/7/4 has several positive impacts on reduction of GHG emissions and the improvement of energy efficiency of existing ships. The measure will not result in disproportionally negative impacts. On the contrary, by helping to achieve the second level of ambition of the Initial Strategy at low or no costs, the measure benefits especially developing countries.

Action requested of the Working Group

10 The Group is invited to include this initial impact assessment in its further consideration of document MEPC 74/7/4 and take action as appropriate.

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ANNEX

INITIAL IMPACT ASSESSMENT OF THE GOAL-BASED SHORT-TERM MEASURE PROPOSED IN DOCUMENT MEPC 74/7/4

1 Initial assessment of impacts on ships and emissions

1.1 Document MEPC 74/7/4 provides a description of impacts on ships and emissions. Changes to ships and emissions are in line with the Initial Strategy. As a measure regulating ships and emissions by setting goals, the changes to ships depend on what the shipowners decide. The Initial Strategy sets given levels of ambition, which will not be cost-free to reach. A goal-based short-term measure will ensure that shipowners can decide on and implement the most cost-effective means to reach the levels of ambition.

1.2 The goal-based measure will require individual ships to reduce their CO_2 emissions per deadweight-mile (dwt-mile) by at least 40% on average in 2030, relative to the relevant EEDI reference line. The reduction measure could be introduced stepwise or in phases. For instance: X% in 2023, Y% in 2026 and Z% in 2029.

1.3 According to the *Third IMO GHG Study 2014*, most ships sailed at less than 75% of MCR in 2012. Since then, speed seems to have decreased further on average (Clarksons Research, 2019). Hence, it is to be expected that ships are still further below the EEDI reference lines than in 2012.

1.4 The Annual Efficiency Ratio (AER) has improved by 12% between 2008 and 2012 (ISWG-GHG 1/2/4 (Japan)). Hence, an additional reduction will be required.

1.5 In order to reduce the emissions per dwt-mile, changes to ships to increase energy efficiency and reduce emissions can be achieved in four not mutually exclusive ways:

.1 introduce ship construction innovations (new-builds or retrofitting), e.g. bulbous bows, ship design improvements, propulsion efficiency, drag reducing paint, etc.;

.2 introduce technical innovations, e.g. energy saving devices, batteries, digitalization, etc.;

.3 introduce operational change, e.g. just-in-time voyage planning, improved network and route design, cargo loading to optimize trim and drag, onboard energy management, fuel-efficient operations like speed reduction and optimization, etc.; and

.4 develop and introduce low-carbon or zero-carbon fuels.

1.6 In 2030, most ships will be able to reach the second level of ambition of the Initial Strategy by one or more of the above options. Different situations and circumstances should leave choices open. Some options, however, are more compatible with the targets beyond 2030 pursuing efforts towards 70% reduction in carbon intensity and at least 50% reduction of total annual GHG emissions by 2050.

1.7 By using a goal-based approach for all ships, shipowners who have invested in energy efficient ships, and accordingly have "over performing" ships, will have the merit of these investments. On the other hand, old pre-EEDI ships would probably need to improve their efficiency and might have to use more operational measures to meet the SEEMP requirement.

It will be up to the shipowner to decide on how to achieve the requirement by either retrofitting the ships to be more energy efficient, or adopting fuel-efficient operations, innovative solutions or by speed reduction, for example by shaft power limitation. Finally, another benefit of such an approach is that it promotes the benefits of better designs, which the EEDI brings, being realized in practice and not countered by inefficient operations.[1]

1.8 This goal-based approach would give shipowners the ability to choose the most cost- and energy efficient measures for each ship.[2]

1.9 Denmark assumes that shipowners will only invest in construction, technical, and/or operational innovations when they are cost-effective, i.e. when the initial investment is lower than present value of future operational savings. What is most cost-effective is different from ship to ship, and a goal-based approach does not prejudge one option over the other.

1.10 Regarding the impacts on emissions, by reducing the emissions of CO_2 per dwt-mile faster than the dwt-miles are projected to increase (i.e. an increase in operational energy efficiency), emissions from individual ships will decrease. By setting a goal with specific yearly or three-yearly targets of CO_2 emissions reduction per dwt-mile, we ensure being in line with the Initial Strategy's objectives to reach actual reductions.

2 Initial identification of impacts to be assessed

2.1 According to MEPC.1/Circ.885, the Initial Impact Assessment should identify which impacts should be assessed, taking into account, as appropriate, inter alia (1) geographic remoteness of and connectivity to main markets; (2) cargo value and type; (3) transport dependency; (4) transport costs; (5) food security; (6) disaster response; (7) cost-effectiveness; and (8) socio-economic progress and development. Denmark finds that all these impacts should be assessed. However, in order to build a logical argument, this section begins with transport costs and cost-effectiveness, before assessing how impacts vary with regards to geographic remoteness of and connectivity to main markets; cargo value and type; and transport dependency. The impacts on food security; disaster response; and socio-economic progress and development are assessed at the end of the section.

2.2 Document MEPC 74/7/4 already contained an assessment of the impacts on transport costs (cf. paragraphs 34, 36, 37 and 40), and cost-effectiveness (cf. paragraphs 39 and 40). The following paragraphs build on this submission.

2.3 Document ISWG-GHG 1/2/14 (Belgium et al.) discusses the possible impact of GHG reduction measures on transport costs. The submission refers to Stopford (2009) where the main components of transport are broken down in five major components. On that basis it could generally be expected that measures to reduce shipping's GHG emissions could affect either or both a ship's voyage costs (e.g. change in fuel use, fuel costs or a carbon price) and capital costs (associated with additional fuel-efficient technology). The impacts could be positive and/or negative.[3]

2.4 Document ISWG-GHG 1/2/14 emphasizes that current work shows mostly a relatively small impact on transport costs associated with some of the measures because measures to reduce GHG emissions influence only a subset of the components of transport cost. However, some important variations in impact exist, depending on the specifics of the commodity and State.[4]

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1 Document MEPC 74/7/4, paragraph 15.

2 Document MEPC 74/7/4, paragraph 16.

3 Document MEPC 74/7/4, paragraph 34.

4 Document MEPC 74/7/4, paragraph 36.

2.5 Document ISWG-GHG 1/2/14 also points to the fact that a number of studies have looked at the issue of transport costs in relation to SIDS and LDCs. For example, Moon (2014) finds that over the period 2004-2013, SIDS have on average paid 2% higher freight costs for their imports than the world average of 8.1%, with the highest values being estimated for the Comoros (20.2%), Seychelles (17.9%), Solomon Islands (17.4%) and Grenada (17%). These are imports that SIDS often heavily rely on because of limited agricultural or mineral production or manufactures. Their higher transport costs are often due to a combination of low volumes of trade, trade deficits, geographical remoteness and distance from maritime belts or corridors, as well as relatively inefficient port facilities.[5]

2.6 Moreover, a goal-based reduction measure can be expected to lead to cost-efficient investments, with reasonable payback times for the shipowners. For instance, Denmark has examples of investments in energy efficiency initiatives such as waste heat recovery and power take-in/power take-out with payback time of around three to four years. Also, there are examples of investments in efficiency improvement of main engine auxiliary systems, such as engine room ventilation system, cooling water system, fuel oil system and lubrication cooling oil. Such investments can, in combination with other measures, increase the overall efficiency of the ship and have a payback time of around just one year. Finally, there are examples of improvements, regarding frequency control, where the payback time is only three to four months.[6]

2.7 As such, improving the energy efficiency of ships can be cost-efficient and, in many cases, can be expected to not increase transport costs, in turn leading to benefits to SIDS and LDCs in some cases. There are also examples in annex 4 to document MEPC 72/INF.12 (Japan) of a number of improvements, where some require significant costs while others require low or negligible cost.[7]

2.8 Speed optimization and reduction is another example of energy efficiency in relation to operational change that would be preferred in cases, where lower speed would not lead to significant higher in-transit inventory costs and costs of perishable goods loosing value, or lead to a shift in mode of transportation to e.g. land or air. It is estimated that the costs per dwt-mile are:

.1 overall lower fuel costs, if the ship moves closer to the optimal speed, with lower fuel costs for propulsion, but higher fuel costs for non-propulsion due to longer time at sea[8]; and

5 Document MEPC 74/7/4, paragraph 37. Further described in document ISWG 1/2/14.

6 Document MEPC 74/7/4, paragraph 39. Further described in document MEPC 72/INF.12, annex 4, pages 26-28.

7 Document MEPC 74/7/4 paragraph 40.

8 A simplified model calculation shows that if fuel costs are 50% of total costs, a speed reduction of 40% would not change the costs per dwt-mile; a larger speed reduction would result in an increase, a lower speed reduction in a decrease of costs. This calculation assumes that the fuel used for a voyage is proportional to the square of the speed at which the ship sails. A 40% speed reduction would reduce fuel costs by $1-(0.6)^2 = 64\%$. Many other costs are proportional to the time it takes to complete a voyage (e.g. crew costs, mortgage service costs), so, with a 40% speed reduction they would increase by 1/0.6 = 66%. If both costs are of the same order of magnitude, the savings on fuel costs are cancelled out by the increase in other costs, and the total voyage costs remain equal. Using the same rule of thumb, a speed reduction of 23% would improve the carbon intensity by 40%. Following from above calculation, if fuel costs are 40% of total costs, the break-even point is around 20% speed reduction.

.2 some non-fuel operational cost items will increase, because crew are longer at sea, insurance costs per dwt-mile go up, etc. Other non-fuel operational cost items will stay the same because they are linked to the voyage (e.g. port dues). See also footnote 8.

2.9 Since shipowners can use all types of measures to comply with this policy, they can select the least-cost mix of options available to reduce their carbon intensity. Hence, the cost-effectiveness of the options used to comply is better than the cost-effectiveness of measures that allow to use just a subset of all available options for compliance.

2.10 The administrative costs of the measure are low. It uses data that is already collected, reported, and verified under the IMO ship fuel oil consumption Data Collection System. The additional costs result from calculating a limit value for the ship and managing it. Denmark expects these costs to be small.

2.11 Many investments are theoretically cost-effective, however, the empirical evidence of lack of investments and implementation in the shipping sector (IEA, 2018) indicate that shipowners face different barriers, e.g. lack of access to finance, lack of information, or short-term over long-term thinking. This situation further warrants international regulation.

2.12 Hence, Denmark considers the cost-effectiveness of this measure to be good. The impacts on transport costs is likely to be negligible or positive (i.e. a decrease in transport costs). Note that the analysis does not make assumptions on the length of the voyage, so the conclusions are valid for voyages over all distances.

3 Geographic remoteness, cargo value and connectivity to main markets

3.1 Document MEPC 74/7/4 only partially assessed: (1) geographic remoteness of and connectivity to main markets; (2) cargo value and type; and (3) transport dependency.

3.2 States with a low connectivity in general have higher costs of trade (Wilmsmeier, 2014). Better connected States are served by more different liners, as a result of which there is more competition and freight costs are lower. Less well-connected States see less competition, as a result of which shipping companies can make oligopoly profits on routes to and from those States. In these circumstances, profit-maximizing firms often absorb some of the cost increase in their profit margins because they set their capacity to meet marginal demand and this will not change. Hence, Denmark does not envisage that less connected States can be disproportionately impacted.

3.3 Based on lower or unchanged transport costs and cost-effectiveness, for most cargoes and most routes, the impact of the goal-based measure on trade will be either positive or neutral.

3.4 High-value cargo may be more impacted from the policy as the insurance premiums and in-transit inventory costs can go up when ships slow down. If containerships slow down below a certain speed, perishable goods will likely be transported by other modes like air and rail, if available. Denmark expects that high-value cargoes and perishable goods will be transported predominantly by ships that will comply by making technical and operational improvements, rather than slowing down. Thus, the impact on States of changes in transport costs for high-value cargoes and perishable goods will be positive or neutral.

3.5 Because transport costs will either decrease or stay the same, the impact on States with high transport dependency will not differ from States with a lower transport dependency.

4 Food security, disaster response, and socio-economic progress and development

4.1 Document MEPC 74/7/4 did not identify whether or not to assess the following impacts: food security; disaster response; and socio-economic progress and development.

4.2 Denmark follows FAO"s definition of food security.[9] Further, food security is severely threatened by climate change and acidification of the oceans because of CO_2 emissions (FAO, 2019). Because transport costs will either decrease or stay the same, Denmark expects that States that are dependent on food imports for their food security will not be negatively affected. On the contrary, not implementing the Initial Strategy poses a bigger threat to food security.

4.3 Denmark understands disaster response as ships' ability to respond to disasters onboard the ship, onboard other ships, or other disasters where ships are called upon for assistance. Disaster response may require ships to go as fast as possible (thereby decreasing energy efficiency) and exemptions should be granted in such cases.

4.4 Denmark understands socio-economic progress and development to cover two dimensions of Sustainable Development's three dimensions (economic, social and environment). As such, socio-economic progress and development have to be based on activities not in conflict with the environment. Denmark argues that the goal-based approach is a means to achieve sustainable development, because it spurs innovation and support of developing countries' plans to decarbonize shipping. Because transport costs will either decrease or stay the same, Denmark expects that States will be able to better exploit comparative advantages and that the measure will foster socio-economic progress and development.

4.5 The goal-based approach also delivers on the Initial Strategy with co-benefits of e.g. better health and livelihoods.

5 Positive and negative potential impacts

5.1 The following positive impacts can be expected, inter alia:

.1 securing a level playing field and reducing emissions across the fleet by targeting the existing fleet and not just new ships;

.2 possibly lower transport cost (see above);

.3 cost-effective energy efficiency gains (see above);

.4 incentivizing development and integration of better ship designs, technological innovations, and efficient operation of ships because the regulation can be met by operational and technical measures and the means for reducing emissions is open. Hence, the measure is also compatible with pursuing efforts of towards 70% reduction by 2050 as well as the third level of ambition of the Initial Strategy;

.5 incentivizing the shift towards sustainable alternative fuels, since the means for reducing emissions is open. Hence, the measure is also compatible with pursuing efforts of towards 70% reduction by 2050 as well as the third level of ambition of the Initial Strategy; and

[9] "A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Based on this definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability over time." (FAO, 2017).

.6 climate action will reduce costs associated with climate change to many States and shipping (cf. paragraphs 5 to 7 of main document).

5.2 The following negative impacts could be expected, inter alia:

.1 possibly higher costs on States that export or import large amounts of high-value goods; and

.2 a few ships could be laid-up or scrapped earlier than expected at time of purchase possibly leading to extra costs for the shipowner (depending on efficiency gains and lower fuel costs).

6 Extent of impacts

6.1 Paragraph 8.4 of MEPC.1/Circ.885 calls for analysis of the extent of the impacts (e.g. by quantifying them and relating them to normal variations in transport costs, trade or GDP). This is already done in document MEPC 74/7/4 and the above paragraphs in this document.

7 Likelihood of disproportionally negative impacts

7.1 The proposed measure would apply to all ships on all flags. Given it is aimed at energy efficiency and leaves shipowners with the choice of how to reach the measure, it is difficult to see how small island developing States (SIDS) and least developed countries (LDCs) would be disproportionally impacted. This would also depend on the current distribution of more efficient ships.[10]

8 Methodological tools and data sources

8.1 This initial impact assessment is based on a desk study research approach with use of state-of-the-art academic and grey literature as well as IMO documents.

8.2 The initial impact assessment does not apply its own methodological tools as such but relies on the validity and reliability of those applied in the referenced sources. When own calculations and assumptions are made, these are explicitly mentioned.

8.3 The desk study research approach has the advantage of being time efficient, and the disadvantage of being able to only include data and findings already available. There are naturally holes in the literature as not all sectors, ship types, ship classes, routes, and cargo, etc. are equally analysed. The existing literature does not adequately reflect the very latest developments. Despite these limitations, Denmark argues that this initial impact assessment is valid and reliable.

[10] Document MEPC 74/7/4, paragraph 35.

9 References

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