

INTERSESSIONAL MEETING OF THE  
WORKING GROUP ON REDUCTION OF  
GHG EMISSIONS FROM SHIPS  
2nd session  
Agenda items 2 and 3

ISWG-GHG 2/2/12  
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**FURTHER DEVELOPMENT OF THE STRUCTURE AND IDENTIFICATION OF CORE  
ELEMENTS OF THE DRAFT INITIAL IMO STRATEGY ON REDUCTION OF GHG  
EMISSIONS FROM SHIPS**

**DEVELOPMENT OF DRAFT TEXT FOR INCLUSION IN THE  
INITIAL IMO GHG STRATEGY**

**The level of ambition of the comprehensive IMO Strategy on reduction of GHG  
emissions from ships**

**Submitted by Belgium, Denmark, Finland, France, Germany, Kiribati, Luxembourg,  
the Marshall Islands, the Netherlands, Sweden, Tonga, Tuvalu, the United Kingdom,  
IAPH and ICHCA**

**SUMMARY**

*Executive summary:* In order to contribute to the long-term temperature goal of the Paris Agreement, a global emissions pathway is needed for international shipping in which emissions start declining as soon as possible and reduce to zero. This document uses a number of methods to calculate a range of quantifications of the IMO's level of ambition, and proposes as the level of ambition the reduction of GHG emissions from international shipping by at least 70%, and to pursue efforts to achieve 100% reduction, by 2050 compared to 2008. The document also states that to be consistent with the temperature goal of the Paris Agreement, international shipping's GHG emissions should reduce linearly.

*Strategic direction:* 7.3

*High-level action:* 7.3.2

*Output:* 7.3.2.1

*Action to be taken:* Paragraph 32

*Related document:* ISWG-GHG 2/2

## Introduction

1 At ISWG-GHG 1 and MEPC 71, a set of headings for the IMO GHG reduction Strategy was proposed. This included the heading "level of ambition".

2 Consistent with document MEPC 71/7/9, the co-sponsors consider that the Strategy's level of ambition heading can be addressed by agreeing a global level of ambition that defines how the international shipping sector should reduce its greenhouse gas emissions.

3 A global level of ambition has to be set in the context of global climate policy. COP 21 of the UNFCCC approved the Paris Agreement which entered into force on 4 November 2016. Parties to the Paris Agreement have agreed on a long-term temperature goal and an associated emissions pathway to reduce global greenhouse gas emissions.

4 This submission proposes estimates from a number of candidate methods proposed in document MEPC 71/7/7 for setting a level of ambition for the international shipping sector in the initial IMO Strategy that is in line with the Paris Agreement.

## Level of ambition in the Paris Agreement for global emissions

5 Although the shipping emissions pathway does not necessarily have to mimic the global pathway as described in the Paris Agreement, the following two elements of the Paris Agreement emissions pathway should be reflected in order for international shipping to contribute to the global temperature goal:

- .1 emissions have to start declining as soon as possible; and
- .2 in the second half of the century, emissions have to decline to zero.

6 Regarding the first element, documents MEPC 71/7/12 and ISWG-GHG 1/2/4 have both proposed absolute reductions compared to the base year 2008 meaning that peaking of international shipping emissions has already occurred in 2008. The co-sponsors support 2008 as the peak year and base the remainder of this proposal on this assumption.

7 The following sections outline how the second element, i.e. the pathway towards zero ship emissions, could be determined.

## The interaction between the IMO and UNFCCC levels of ambition

8 Several proposals have been made in the literature with regards to the principles based on which the emissions of shipping could be determined in relation to the global emissions pathway, including (Smith et al., 2016; Cames et al., 2015; Bows-Larkin, 2015; ICS, 2016):

- .1 proportionate to international shipping's current share of global emissions and in line with science-based global carbon budgets;
- .2 proportionate to the emission reduction effort of comparable sectors;
- .3 proportionate to the emission reduction effort of all or a set of countries; or
- .4 higher or lower than any of the above based on an analysis that it is easier, cheaper, more costly or harder for the shipping sector to reduce emissions.

9 Methods a), b) and c) have been used below to develop an initial range of levels of ambition. There is currently insufficient data to determine an IMO level of ambition based on method d). It is anticipated that more data relevant to d) will become available through the Roadmap process, so that calculations can be performed that take cost into account prior to the revision of the IMO Strategy.

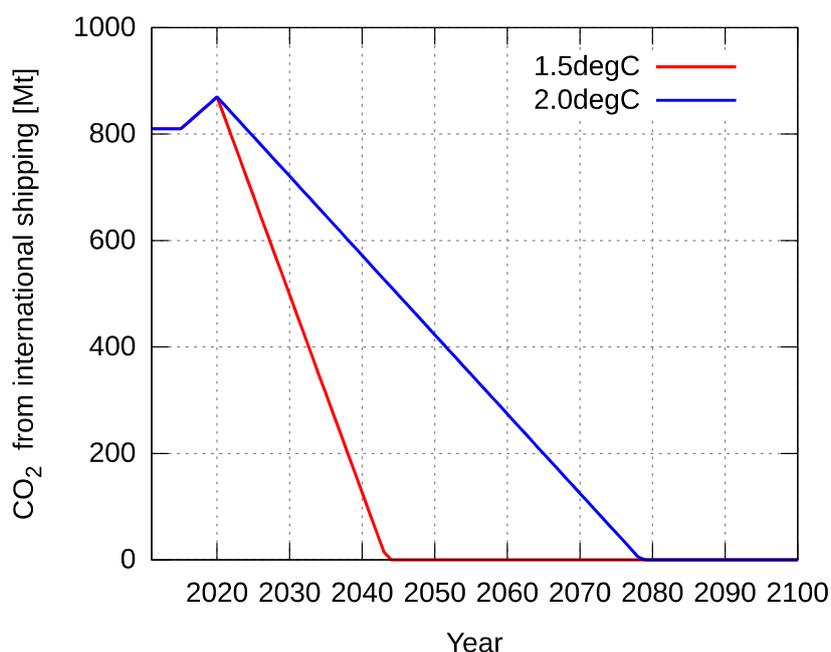
10 The candidate levels of ambition are discussed in terms of cumulative emissions, absolute emissions reduction efforts by 2050, pathways, and relative emissions reduction efforts.

### **Proportionate to the current share of emissions**

11 Following a top-down approach, one method to define international shipping's level of ambition is for the international shipping sector's share of total anthropogenic emissions to be held approximately constant as global CO<sub>2</sub> emissions reduce in line with an overall 1.5°C/2°C carbon budget or pathway. This calculation can be updated as further information becomes available, including during the three-step approach. According to the Third IMO GHG Study 2014, the international shipping sector's share of total anthropogenic CO<sub>2</sub> (and CO<sub>2e</sub>) emissions during the period 2007-2012 is in the range of 2 to 3%. A representative value for this period is 2.3%.

12 The total quantity of GHG emissions that will result in reaching the Paris Agreement temperature goal can only be expressed as a range because of (a) the complexity of the climate system, which is reflected in climate models; (b) the temperature range in the Paris Agreement; and (c) the required level of certainty in reaching the goal.

13 The study presented in documents MEPC 71/7/7 and MEPC 71/INF.35 used one well-recognized climate model (MAGICC) to derive carbon budgets consistent both with 2°C and 1.5°C. This resulted in total cumulative emissions budgets from a start year of 2011 for international shipping of 33Gt and 18Gt respectively. 33Gt can be achieved by reducing absolute emissions of GHG from international shipping by 50% on 2012 emissions by 2050. For the 18Gt budget, full decarbonization of the sector by 2042 will be required, assuming deep reductions of emissions starting in 2020. Figure 1 illustrates these pathways.



**Figure 1: CO<sub>2</sub> emissions trajectories for international shipping consistent with a 2°C temperature rise (blue curve) and a 1.5°C temperature rise (red curve).** The trajectories assume emissions as in the reference scenario from the Third IMO GHG Study 2014 to 2020, followed by constant reductions, with the year-on-year reduction determined by a remaining CO<sub>2</sub> emissions budget of 33Gt and 18Gt, respectively. Source: CO<sub>2</sub> Targets, Trajectories and Trends for International Shipping, Smith, T.W.P., Traut, M., Bows-Larkin, A., Anderson, K., McGlade, C. and Wrobel, P. Shipping in Changing Climates Report.

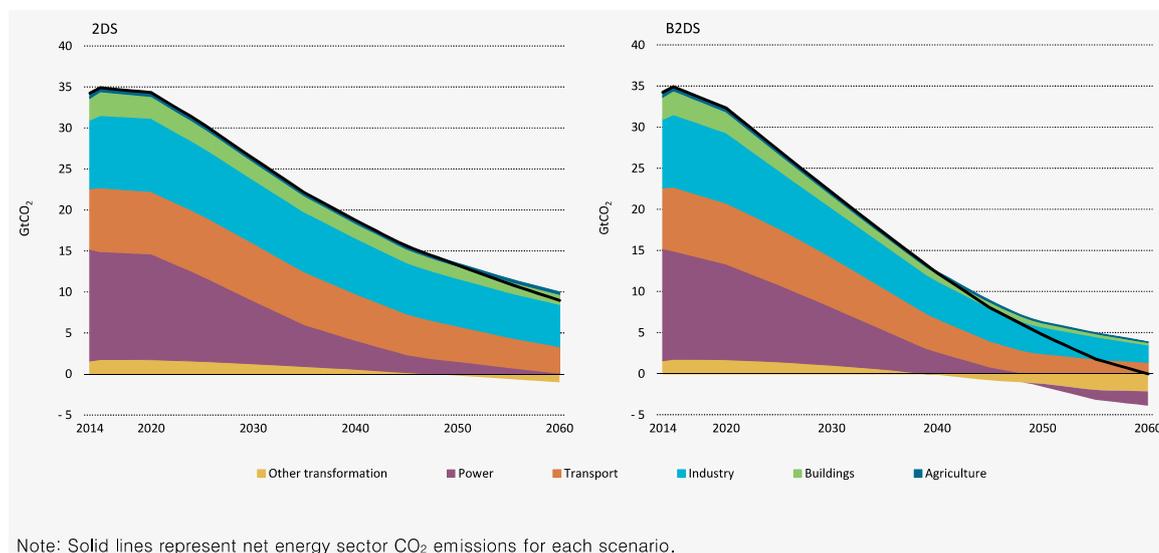
### Proportionate to the emission reduction effort of comparable sectors

14 Another method to determine international shipping's level of ambition is to make it proportional to the emission reduction efforts of comparable sectors. Given that most sectors' emission reduction efforts are defined at a national level and differ depending on a country's circumstances, it is not straightforward to draw comparisons between those reduction efforts. One authoritative source of an all-sector view of emissions reduction efforts is the International Energy Agency's World Energy Outlook and Energy Technology Perspectives. For its low-carbon scenarios, the latter balances carbon reductions for each sector based on an analysis of what is achievable when all technology levers are pulled (reference to document ISWG 2/2/14). ETP also annually tracks progress of relevant technologies and uses this to inform projections of future trends. It is therefore not a description of commitments (by sector or otherwise), but it is an evidenced-based characterization of the different reduction efforts possible based on available technologies, and is regularly used to inform national and international policy objectives.

15 Two scenarios from ETP 2017 are presented in figure 2, the 2°C Scenario (2DS) and the Beyond 2°C Scenario (B2DS). B2DS is broadly consistent with the Paris Agreement temperature goal of "well below 2°C", aiming for a 50% chance of limiting global warming to 1.75°C, and so it is less ambitious than the emissions reduction effort required to aim for 1.5°C temperature stabilization.

16 In the B2DS scenario, different sectors reduce their emissions at different rates – estimated by taking into account the different technologies and their costs by sector. Discounting agriculture and buildings as not being easily comparable to shipping due to their socio-technical specifics, suggested comparators include industry, transport and power. Absolute GHG reductions of these sectors by 2050 are 66%, 63% and 100% respectively, relative to 2014. GHG reduction pathways for all these sectors are approximately linear and

involve an immediate (e.g. before 2020) peaking of emissions. Taking out the power sector and just focusing on the transport and industry sectors, a representative share of emission reduction effort comparative to these aggregate sectors would be 65% relative to 2014. Relative to 2008 emissions, this means that the reduction effort would be 70%.



**Figure 2: 2DS and B2DS emission reduction pathways by sector, source IEA ETP**

### Proportionate to the emission reduction efforts expressed in the NDCs

17 An alternative, bottom-up method to determine international shipping's level of ambition could be to make it proportionate to countries' emission reduction efforts. Countries have outlined their post-2020 climate action in their Nationally Determined Contributions (NDCs) which are at the core of the mitigation provisions of the Paris Agreement.

18 NDC emission reductions are most commonly defined in two ways: absolute emissions reductions relative to a base year, and emissions reductions relative to a BAU trajectory. Analysing all country's commitments enables an average equivalent commitment to be defined. This could then be applied to shipping's historical emissions (where the reductions are relative to a historical base year, this was taken from the Second IMO GHG Study 2009), and shipping's expected BAU trajectory (taken from document MEPC 71/INF.34 "Middle of the Road"). This results in absolute emission reductions of 44% by 2030 and 49% in 2050, relative to 2008 emissions.

19 It should be noted that whilst current NDCs collectively lower GHG emissions compared to where current policies stand, they still imply a median temperature rise of 2.6 to 3.1 °C by 2100<sup>1</sup>. It should also be noted that the Paris Agreement provides for regular upward adjustment of GHG reduction policy and commitments over time. Given that current commitments of reduction measures proposed are insufficient to achieve the Paris Agreement temperature goal, the mitigation commitments will have to become more ambitious in the near to medium future. The first moment where ambition will have to be increased is in 2020 when countries have to communicate new or updated NDCs. Shipping ambition would also need to increase proportionately.

<sup>1</sup> Rogelj, J., Den Elzen, M., Höhne, N., Fransen, T., Fekete, H., Winkler, H., ... & Meinshausen, M. (2016), *Paris Agreement climate proposals need a boost to keep warming well below 2 C*. Nature, 534(7609), 631-639.

## Summary

20 Table 1 summarizes the results from three of the candidate methods described above based on information presented in documents MEPC 71/7/INF.34 and MEPC 71/INF.35 as well as IEA's ETP 2017 report. The levels of ambition are calculated for a base year of 2008, but could equally be calculated for earlier or later base years which could result in small modifications to their quantifications.

21 All sources of information for each of methods a), b) and c) described imminent peaking with linear reduction thereafter. The assumption is therefore made that this is also the shape of the pathway for international shipping, and consistent with document MEPC 71/7/12, a peak of emissions at 2008 levels is applied with significant absolute emission reductions starting from 2020. If the peak emissions rise above 2008 levels, or if significant absolute emission reductions start later than 2020, then the absolute emission reduction objectives in 2050 will need to be increased or brought forwards to achieve an equivalent avoidance of dangerous climate change.

22 Estimates are also presented in table 1 for the implications of these absolute emissions objectives in terms of relative CO<sub>2</sub> intensity of international shipping, and quantified as gCO<sub>2</sub>/tnm (the same percentage is applicable if the alternative gCO<sub>2</sub>/tkm unit is used, as in document MEPC 71/7/12). These use both the upper-bound and lower-bound scenarios from document MEPC 71/INF.34, in order to consider the uncertainty in the future expectation of transport demand.

**Table 1: Summary of results for determining levels of ambition based on methods a), b), c)**

	<b>a) Proportionate to the current share of emissions</b>	<b>b) Proportionate to the share of emissions by industry and transport sectors</b>	<b>c) Proportionate to the emission reduction effort of a set of countries</b>
Zero emissions by year	2042 (1.5°C), 2070 (2°C)	2070	Not achieved
Reduction in absolute emissions by 2050, relative to 2008 emissions	100% by 2042 (1.5°C), 57% (2°C)	70%	49%
Reduction in absolute emissions in 2030, relative to 2008 emissions	45% (1.5°C), 19% (2°C)	23%	44%
Reduction in emissions intensity (gCO <sub>2</sub> /tnm) by 2050 relative to 2008, low trade growth (SSP4)	100% by 2042 (1.5°C), 89% (2°C)	92%	81%
Reduction in emissions intensity (gCO <sub>2</sub> /tnm) by 2050 relative to 2008, high trade growth (SSP1)	100% by 2042 (1.5°C), 92% (2°C)	94%	86%

## Conclusions

23 In order to frame the Roadmap's discussion of GHG reduction measures for international shipping and assess their adequacy in light of the urgency implicit from the threat of dangerous climate change, an initial quantification of international shipping's level of ambition is needed. This will also be important for many reasons including for starting the process of developing evidence on the potential impacts on states and how measures might be used to address potential negative impacts. Furthermore, an initial quantification of international shipping's level of ambition gives the international shipping sector a clear direction in terms of investment, research and development needs which will enable the sector to begin undertaking early and gradual adjustments rather than more costly, sudden and potentially disruptive emission reductions.

24 There are different methods that could be used to calculate a level of ambition consistent with the Paris Agreement temperature goal. These methods provide a range of answers, although it is worth noting that many answers are similar. One strong similarity is that across the range of absolute emissions reductions, the required reduction in emissions intensity is 80-100%. This is because with expectations of significant growth in demand for transport by 2050, even moderate reductions in absolute emissions require very significant reductions in emissions intensity (emissions per tonne-mile).

25 At this point in time method c) is not considered further, because it is known that this is not consistent with the Paris Agreement temperature goal.

26 On the basis of methods a) and b), a range of levels of ambition for consideration of inclusion in the initial IMO Strategy has been calculated both from top-down and bottom-up considerations. In keeping with the framing of the Paris Agreement, we propose that a range of levels of ambition are also adopted in the initial IMO Strategy. These should be to reduce absolute emissions from international shipping by at least 70% in 2050 on 2008 levels, and to pursue efforts to achieve 100% reduction by 2050. Suggested wording for the initial Strategy is provided in the annex to this document.

27 The 100% GHG emission reduction by 2050 is included because this is consistent with the Paris Agreement goal of limiting the temperature increase to 1.5°C above pre-industrial levels. Global warming of 1.5°C must not be exceeded if we are to ensure the best chance of survival of the most vulnerable countries.

28 Proposing a range of levels of ambition is consistent with the three-step approach, and the IMO's GHG reduction Roadmap. We propose that this range can be agreed in the initial Strategy in 2018 and fixed in the revised Strategy in 2023 pending further information from the three-step approach, with periodic reviews every five years thereafter.

29 Further evidence on the challenge/opportunity of shipping's decarbonization relative to other sectors, could justify where shipping's singular level of ambition should lie within this range of quantifications.

30 All methods are based at present on a 2050 target year (absolute or relative emissions), but the pathway to reach 2050 is important for the definition and achievement of a level of ambition. Implicit in this quantification of the level of ambition is the assumption that international shipping's emissions have already peaked (in 2008) and will reduce linearly towards that 2050 (or earlier) objective. IPCC is clear that we need to peak global emissions by 2020, otherwise the relative cost of reductions will be steeper and more expensive.

31 The co-sponsors agree with the suggestion contained in documents MEPC 71/7/12 and ISWG-GHG 1/2/4 that international shipping maintains its CO<sub>2</sub> emissions below 2008 levels. It follows that short-term measures should, as a minimum, ensure that international shipping's GHG emissions do not exceed the 2008 emissions level. If evidence arises that short-term measures will be unable to do so, then the peak would occur later. However, in order to contribute equivalently to emissions reduction efforts, the consequent rate of decarbonization would need to be higher, with greater rates of reduction by 2050 and zero emissions occurring sooner than as listed in table 1.

**Action requested of the Working Group**

32 The Working Group is invited to:

- .1 agree that a quantified global emissions pathway for international shipping will be included as the level of ambition in the initial IMO Strategy and fixed in the revised IMO Strategy; and
- .2 agree on the use of the wording and quantifications proposed in annex to this to express the level of ambition in the initial IMO Strategy.

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## ANNEX

### TEXT PROPOSALS FOR INITIAL STRATEGY BASED ON ISWG 2/2

#### *Levels of ambition*

1 The goals/objectives of the sector need to be evidence-based and revised along the three-step approach agreed by the Committee but take into consideration the urgent need for further action.

2 Consistent with the Paris Agreement, successive refinements should be considered every five years (starting in 2028), and represent progression and maintain a high level of ambition.

3 The identification of the levels of ambition could, inter alia, be based on the following:

- .1 improvement of energy efficiency and other in-sector measures;
- .2 provision of alternative low-carbon fuels to support the achievement of the identified goals/objectives;
- .3 a long-term target and reduction pathway for GHG emissions from international shipping which is based on at least one of the following;
  - .1 proportionate to international shipping's current share of global emissions and in line with science-based global carbon budgets;
  - .2 proportionate to the emission reduction effort of comparable sectors;
  - .3 proportionate to the emission reduction effort of all or a set of countries; or
  - .4 higher or lower than any of the above based on an analysis that it is easier, cheaper, more costly or harder for the shipping sector to reduce emissions; and
- .4 incentive or binding global provisions to motivate the industry to convert to a low or zero carbon technology.

4 The long-term target and reduction pathway (3.3) is specified as:

Objective 1 – to maintain international shipping's annual total CO<sub>2</sub> emissions below 2008 levels.

Objective 2 – to reduce CO<sub>2</sub> emissions per tonne-km, as an average across international shipping, by at least 90% by 2050, compared to 2008.

Objective 3 – to reduce international shipping's total annual CO<sub>2</sub> emissions by at least 70%, pursuing efforts for 100% reduction, by 2050 compared to 2008, as a point on a continuing linear trajectory of CO<sub>2</sub> emissions reduction.

5 The objectives defined in the initial Strategy can be revisited using data available from the three-step approach in the revised IMO Strategy in 2023.

6 The level of ambition should take into account any changes in the international legal framework.

7 The Strategy should be durable, balanced and provide confidence; and the calculated objectives should entail both top-down and bottom-up components.

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