

IMO and Air Emissions from Shipping: A Brief History
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Purpose of this Paper: This background paper has been drafted for participants attending the CIL-MPA International Workshop on Greenhouse Gas Emissions and Shipping that will be held in Singapore on 13-14 November 2018. It is intended to provide participants with an overview of how air pollution from ships has been dealt with by the international community. It explains the provisions on air pollution from ships in the 1982 UN Convention on the Law of the Sea and other multilateral efforts of the international community in the 1980s and early 1990s to address the issue of air pollution. It then provides a history of the efforts of the IMO to address air pollution from ships through Annex VI of MARPOL 73/78, including NO_x and SO_x emissions. It then explains how the UN Framework Convention on Climate Change addressed the issue of GHG under the 1995 Paris Agreement. Finally, it summarizes the work of the IMO on GHG to date. A Table of Abbreviations and Acronyms is appended.

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1. Background and History

The April 2018 meeting of the International Maritime Organization's (IMO) Marine Environment Protection Committee (MEPC 72) adopted its initial strategy for reduction of Greenhouse Gas Emissions (GHG) from commercial shipping in international trade by resolution MEPC.304(72).¹ The strategy sets out a vision to reduce GHG emissions from international shipping and phase them out, as soon as possible in this century.

More specifically, under the identified "levels of ambition", the initial strategy envisages for the first time a reduction in total GHG emissions from international shipping which, it says, should peak as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008, while, at the same time, pursuing efforts towards phasing them out entirely. The strategy includes a specific reference to "a pathway of CO₂ emissions reduction consistent with the Paris Agreement temperature goals".

The initial strategy represents a framework for Member States, setting out the future vision for international shipping, the levels of ambition to reduce GHG emissions and guiding principles; and includes candidate short-, mid- and long-term further measures with possible timelines and their impacts on States. The strategy also identifies barriers and supportive measures including capacity building, technical cooperation and research and development (R&D).²

For more details of the IMO's initial GHG strategy and challenges ahead see section 11 below. GHG reduction efforts by the UNFCCC process are summarized in section 10 below. The results of MEPC 73, 22-26 October 2018, will be summarized in an addendum to this paper.

* * *

Air pollution is not a new phenomenon to receive major international attention.

An early indication of those concerns is evident in articles 194(3)(a), 212 and 222 of the 1982 UN Convention on the Law of Sea dealing with pollution from or through the atmosphere. These three articles are located in Part XII of the Convention dealing with the protection and preservation of the marine environment. The articles originated with proposals at the 1973 session of the Sea-bed Committee.³

Article 194(3)(a) requires States to take measures "designed to minimize to the fullest possible extent the release of toxic, harmful or noxious substances, especially those which are persistent, ... from or through the atmosphere ..."

Article 212, Pollution from or through the atmosphere, provides:

1. States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from or through the atmosphere, applicable to the air space under

¹ The initial strategy is available at

<[https://unfccc.int/sites/default/files/resource/250_IMOsubmission_TalanoaDialogue_April 2018.pdf](https://unfccc.int/sites/default/files/resource/250_IMOsubmission_TalanoaDialogue_April%2018.pdf)>.

² See further "UN body adopts climate change strategy for shipping," IMO press briefing 13 April 2018, <<http://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx>>.

³ The negotiating history of these articles may be found in volume IV of the Virginia Commentary at pages 57-62 (article 194(3)(a)), 209-211 (article 212), and 316-318 (article 222). The issue of air pollution was mentioned at the 1972 UN Conference on the Human Environment and the resulting Stockholm Declaration. However pollution of the marine environment from or through the atmosphere was not specifically mentioned. See Report of the United Nations Conference on the Human Environment, A/CONF.48/14/Rev.1 <www.un-documents.net/aconf48-14r1.pdf>

their sovereignty and to vessels flying their flag or vessels or aircraft of their registry, taking into account internationally agreed rules, standards and recommended practices and procedures and the safety of air navigation.

2. States shall take other measures as may be necessary to prevent, reduce and control such pollution.

3. States, acting especially through competent international organizations or diplomatic conference, shall endeavour to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control such pollution.

Article 222, Enforcement with respect to pollution from or through the atmosphere, provides:

States shall enforce, within the air space under their sovereignty or with regard to vessels flying their flag or vessels or aircraft of their registry, their laws and regulations adopted in accordance with article 212, paragraph 1, and with other provisions of this Convention and shall adopt laws and regulations and take other measures necessary to implement applicable international rules and standards established through competent international organizations or diplomatic conference to prevent, reduce and control pollution of the marine environment from or through the atmosphere, in conformity with all relevant international rules and standards concerning the safety of air navigation.

“Pollution of the marine environment” is defined in article 1(4) of the Convention as:

the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities

* * * *

Other multilateral efforts to reduce air pollution from shipping include the following:

While the 1985 Vienna Convention on the Protection of the Ozone Layer addresses the problem generally, it does not address specific polluting substances.⁴

That gap was filled in the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer which addresses depletion of the stratospheric ozone layer by CFCs and HCFCs.⁵

The UN Conference on Environment and Development, Rio de Janeiro, Brazil, June 1992, adopted Agenda 21 Chapter 17, Protection of the oceans. It provides:

States, acting individually, bilaterally, regionally or multilaterally and within the framework of IMO and other relevant international organizations, whether subregional, regional or global, as appropriate, should assess the need for additional measures to address degradation of the marine environment:

a. From shipping, by:

⁴ The Ozone Convention was adopted 22 March 1985 and entered into force 22 September 1988, 1513 UNTS 292. It is very widely accepted having 197 parties.

⁵ <<http://oone.unep.org/>>. The Montreal Protocol was adopted 16 September 1987 and entered into force 1 January 1989, 1522 UNTS 3. It too has 197 parties.

- xi. Supporting the ongoing activity within IMO regarding development of appropriate measures for reducing air pollution from ships.⁶

The IMO initial strategy is but the latest effort by the IMO to reduce pollution of the atmosphere from shipping. Before addressing GHG emissions from international shipping, the IMO focused on other measures deemed more achievable, embodied in the MARPOL Protocol of 1997 adding MARPOL Annex VI. They are discussed in sections 2-9.

2. MARPOL Annex VI

The IMO has adopted regulations addressing air emissions from ships many times since its initial consideration in the 1980s.⁷ Once the marine engine manufacturers were able to produce marine engines that would meet the initial standards to be set in a new Annex VI of MARPOL 73/78, the Protocol of 1997 was added as Annex VI to MARPOL by diplomatic conference.⁸

Annex VI originally addressed the following types of air emissions from ships:

- Ozone depleting substances (Regulation 12) (CFCs, HCFCs, halon)
- Nitrogen oxides (NO_x) (Regulation 13) (nitric oxide (NO), nitrogen dioxide (NO₂))
- Sulphur oxides (SO_x) (Regulation 14) (Sulphur dioxide (SO₂))
- Volatile organic compounds (VOCs) (Regulation 15) (from transfer of fuel oil)
- Shipboard incineration (Regulation 16)
- Reception facilities (Regulation 17)
- Fuel oil availability and quality (Regulation 18).⁹

The IMO has adopted new and revised regulations further addressing air emissions from ships as amendments to Annex VI by the tacit acceptance procedure a dozen times since its entry into force in 2005, as follows:

- 2005: amended Annex VI (MEPC.132(53)) (Regs. 2, 7-9, 14, App. 1 (IAPPC)) and NO_x Technical Code (EIAPP certificate)
- 2008: adopted revised Annex VI (MEPC.176(58)) and revised NO_x Technical Code 2008 (MEPC.177(58)) (revising inter alia regulations 13 and 14)
- 2010: Amendments to Annex VI (MEPC.190(60)) (Regs. 13, 14, new App. VII) (North American ECA) and MEPC.194(61) (revised form of supplement to IAPPC)

⁶ <<https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>>.

⁷ The IMO's consideration of the issue of air pollution from ship from the 1980s is detailed in Aldo Chircop, Meinhard Doelle and Ryan Gauvin, *Shipping and Climate Change: International Law and Policy Considerations Special Report*, Centre for International Governance Innovation 36-55 (2018) <<https://www.cigionline.org/publications/shipping-and-climate-change-international-law-and-policy-considerations>>.

⁸ The United States 2008 instrument of ratification included the following declaration: "The United States of America notes that at the time of adoption of the Protocol of 1997, the NO_x emission control limits contained in Regulation 13 were those agreed as being achievable by January 1 2000, on new marine diesel engines, and further notes that Regulation 13(3)(b) contemplated that new technology would become available to reduce on-board NO_x emissions below those limits. As such improved technology is now available, the United States expresses its support for an amendment to Annex VI that would, on an urgent basis, revise the agreed NO_x emission control limits contained in Regulation 13 in keeping with new technological developments."

⁹ MARPOL Annex VI was adopted on 26 September 1997 and entered into force 19 May 2005. <<http://www.imo.org>>

- 2011: Amendments to Annex VI (Designation of the US Caribbean Sea Emission Control Area and Exemption of Certain Ships Operating in the North American ECA and the US Caribbean Sea ECA) Amendments to the Annex (Appendix VII) (MEPC.202(62))
- 2011: Amendments to the Annex, Chapter 4 (Inclusion of Regulations on Energy Efficiency for Ships) (MEPC.203(62))
- 2012: Amendments (Regional Arrangements for Port Reception Facilities under MARPOL Annex VI (Reg. 17.1A) and Certification of Marine Diesel Engines Fitted with Selective Catalytic Reduction Systems under the NO_x Technical Code 2008, revised para. 2.2.4, 2.2.5.1) (MEPC.217(63))
- 2014: Amendments to Annex VI (to make the use of the III Code mandatory) (Regs. 2, 24-25) (MEPC.247(66))
- 2014: Amendments to Annex VI (Annex VI Regs. 2 paras 26, 38-43, 5.3, 13 paras 2.2, 5.1, 5.2 (Tier III), 19 paras 2.2, 3.3, 20, 21 (EEDI)) and NO_x Technical Code 2008) (MEPC.251(66))
- 2014: Amendments to Annex VI (Regs. 2 and 13 and the Supplement to the IAPP Certificate) (MEPC.258(67))
- 2016: Amendments to Annex VI (Reg. 13) (MEPC.271(69))
- 2016: Amendments to Annex VI (NO_x Technical Code 2008) (testing of gas-fuelled and dual fuel engines) (MEPC.272(69))
- 2016: Amendments to Annex VI (Data Collection System for Fuel Consumption of Ships) (Regs. 1-3, 5-6, 8-10, 22, new 22A, new Appendices IX-X) (MEPC.278(70))
- 2016: Effective date of implementation of the fuel oil standard in regulation 14.1.3 of MARPOL Annex VI (MEPC.280(70) (confirming 0.50% sulphur limit effective 1 January 2020))
- 2017: Amendments to Annex VI (Designation of the Baltic Sea and the North Sea Emission Control Areas for NO_x Tier III Control, and Information to be included in the Bunker Delivery Note)) (MEPC.286(71))
- 2018: Amendments to Annex VI (ECAs and Required EEDI for Ro-Ro Cargo Ships and Ro-Ro Passenger Ships) (MEPC.301(72)).¹⁰

As of 21 September 2018, Annex VI as amended has 91 parties representing 96.62% of the world's merchant shipping. In Southeast Asia, the following States are party: Indonesia, Malaysia, Philippines, Singapore, and Vietnam, as well as China, Japan and Republic of Korea in East Asia.

3. NO_x and SO_x Emissions

As noted above, in 2008 MEPC adopted a revised MARPOL Annex VI that included revisions to Regulation 13 (NO_x) and 14 (SO_x) significantly reducing permissible emissions over time. Regulation 14.3.1 set a global limit of 0.50% sulphur by 1 January 2020 and 0.10% in sulphur emission control areas (SECAs) by 1 January 2015. (MEPC.176(58), 10 October 2008)

¹⁰ IMO, Status of IMO Treaties (14 June 2018), pages 171-176
<<http://www.imo.org/en/About/Conventions/StatusOfConventions/Documents/Status - 2018.pdf>>

The feasibility of meeting the 2020 global 0.50% limit have been raised for consideration at MEPC 73 in October 2018, including supply/availability, fuel oil quality and safety.¹¹

4. Technical and Operational Measures

In accordance with the MEPC 55 work plan (October 2006), MEPC 59 (July 2009) agreed to develop a package of technical and operational measures to improve energy efficiency and reduce GHG emissions from international shipping: Energy Efficiency Design Index for new ships (EEDI), Ship Energy Efficiency Management Plan (SEEMP) and Energy Efficiency Operational Indicator (EEOI). These measures were adopted as amendments to Annex VI in 2011 by MEPC.203(62), July 2011. They were the first legally binding climate change treaty to be adopted since the Kyoto Protocol. These amendments added Regulations on Energy Efficiency for Ships. These amendments included the EEDI which was made mandatory for new ships, and the SEEMP for all ships both from 1 January 2013. The amendments that introduced a performance-based mechanism for designing more energy efficient (and thus less polluting) equipment and engines are described next.

5. Energy Efficiency Design Index (EEDI)

The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments. From 1 January 2013, following an initial two year phase zero when new ship design will need to meet the reference level for their ship type, the level is to be tightened incrementally every five years, and so the EEDI is expected to stimulate continued innovation and technical development of all the components influencing the fuel efficiency of a ship from its design phase. The EEDI is a non-prescriptive, goal /performance-based mechanism that leaves the choice of technologies to use in a specific ship design to the industry. As long as the required energy efficiency level is attained, ship designers and builders are free to use the most cost-efficient solutions for the ship to comply with the regulations. The EEDI provides a specific figure for an individual ship design, expressed in grams of carbon dioxide (CO₂) per ship's capacity-mile (the smaller the EEDI the more energy efficient ship design) and is calculated by a formula based on the technical design parameters for a given ship.

The CO₂ reduction level (grams of CO₂ per tonne mile) for the first phase is set to 10% and is to be tightened every five years to keep pace with technological developments of new efficiency and reduction measures. Reduction rates have been established until the period 2025 to 2030 when a 30% reduction is mandated for applicable ship types calculated from a reference line representing the average efficiency for ships built between 2000 and 2010. The EEDI is developed for the largest and most energy intensive segments of the world merchant fleet and will embrace 72% of emissions from new ships covering the following ship types: oil tankers, bulk carriers, gas carriers, general cargo, container ships, refrigerated cargo and combination carriers. For ship types not covered by the current formula, table formulas are expected to be developed in the future addressing the largest emitters first.

MEPC 73 considered six submissions on the EEDI under agenda item 5, Air Pollution and Energy Efficiency: MEPC 73/5/2, 5/5, 5/6, 5/7, 5/8, 5/10. (Another eight documents address other issues under this agenda item.) See the addendum for further information on the actions at MEPC 73.

¹¹ See MEPC 73/5, PPR 6/8, MEPC 73/5/14, MEPC 73/5/INF.4. This issue was considered by the IMO as a potential issue at least since MEPC 70 when considering fuel oil quality.

6. 2012 Guidelines on Technical and Operational Measures

MEPC 63 (March 2012) adopted four important guidelines aimed at assisting the implementation of the mandatory regulations on Energy Efficiency for Ships in MARPOL Annex VI:

- 2012 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships, resolution MEPC.212(63);
- 2012 Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP), resolution MEPC.213(63);
- 2012 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI), resolution MEPC.214(63); and
- Guidelines for calculation of reference lines for use with the Energy Efficiency Design Index (EEDI), resolution MEPC.215(63).

Finalization and adoption of the supporting guidelines was a significant achievement which provided sufficient lead time for Administrations and industry to prepare. The guidelines supported Member States in their uniform implementation of the new chapter 4 of MARPOL Annex VI.

An updated work plan for the development of further guidelines and the development of energy efficiency frameworks for those ships not covered by the current EEDI regulations was also agreed at MEPC 63.¹²

7. Data Collection System of Fuel Consumption

To measure the effectiveness of the EEDI and SEEMP, MEPC 70 adopted resolution MEPC.278(70) (October 2016) further amending Annex VI by establishing a data collection system for fuel consumption of ships. At the same session MEPC 70 adopted revised guidelines for the development of SEEMP by resolution MEPC.282(70). The next MEPC adopted guidelines for administration verification of ship fuel oil consumption data by resolution MEPC.292(71) (July 2017).¹³ The mandatory data collection system for fuel oil consumption of ships, which begins in 2019, will provide robust data and information on which future decisions on additional measures, over and above those already adopted, can be made.

The mandatory data collection system is intended to be the first in a three-step approach in which analysis of the data collected will provide the basis for an objective, transparent and inclusive policy debate in the MEPC, under a roadmap (through to 2023) for developing a “Comprehensive IMO strategy on reduction of GHG emissions from ships”. The roadmap was agreed in 2016.

MEPC 73 considered four submissions, under agenda item 6, Further Technical and Operational Measures for Enhancing the Energy Efficiency of International Shipping. The first is a status report from the Secretariat on the IMO Ship Fuel Oil Consumption Database (MEPC 73/6).

The second is a report from Singapore sharing its lessons learnt from a voluntary experience-building phase of the fuel oil consumption data collection system (MEPC 73/6/1).

The third is a proposal by IACS and OCIMF for the Committee to commence its consideration, at least at a preliminary level, of Phase 2 (data analysis) of the three-step approach. In particular, MEPC

¹² MEPC 63/23 (14 March 2012) para 4.62.5 and MEPC 63/23/Add.1 Annex 12.

¹³ The MEPC 70 and 71 resolutions are reproduced in Maritime and Port Authority of Singapore Shipping Circular to Shipowners No. 8 of 2018, The IMO data collection system for fuel oil consumption (DCS), 13 June 2018, available at <<https://www.mpa.gov.sg/web/portal/home/port-of-singapore/circulars-and-notices/shipping-circulars/detail/3db2aa66-5d08-4509-b2fa-185879e36966>>.

73/6/2 discusses how Phase 2 could be conducted, the schedule for undertaking it and who should conduct this Phase.

The fourth document, by India and IACS, discusses implementation of the requirements in chapter 4 of MARPOL Annex VI relating to the data collection system for fuel oil consumption of ships (MEPC 73/6/3).

See the addendum for further information on the actions at MEPC 73.

8. Ship Energy Efficiency Management Plan and Energy Efficiency Operational Indicator

The Ship Energy Efficiency Management Plan (SEEMP) is an operational measure that establishes a mechanism to improve the energy efficiency of a ship in a cost-effective manner. The SEEMP also provides an approach for shipping companies to manage ship and fleet efficiency performance over time using, for example, the Energy Efficiency Operational Indicator (EEOI) as a monitoring tool. The guidance on the development of the SEEMP for new and existing ships incorporates best practices for fuel efficient ship operation, as well as guidelines for voluntary use of the EEOI for new and existing ships (MEPC.1/Circ.684). The EEOI enables operators to measure the fuel efficiency of a ship in operation and to gauge the effect of any changes in operation, e.g. improved voyage planning or more frequent propeller cleaning, or introduction of technical measures such as waste heat recovery systems or a new propeller. The SEEMP urges the ship owner and operator at each stage of the plan to consider new technologies and practices when seeking to optimise the performance of a ship.

9. Model Course for Energy Efficient Operation of Ships

IMO, together with the World Maritime University (WMU), have been developing a model course on SEEMP promoting the energy efficient operation of ships. The first draft of the model course was submitted to MEPC 62. It provides general background on the climate change issue and IMO's related work and aims at building the different operational and technical tools into a manageable course programme, which will promulgate best practice throughout all sectors of the industry. The Course will help create benchmarks against which operators can assess their own performance. The purpose of the IMO model courses is to assist training providers and their teaching staff in organising and introducing new training courses, or in enhancing, updating or supplementing existing training material, so that the quality and effectiveness of the training courses may thereby be improved.

MEPC 62 agreed that the draft model course was an excellent start to providing a structured training course but that it required more work. MEPC 63 recognised that the draft model course had been further developed to include some tutorial examples, but further work was needed to align it with the 2012 guidelines adopted at this session. MEPC 65 instructed the Secretariat to publish an updated version of the model course incorporating changes proposed by a validation group.¹⁴

Since 2016 WMU has offered a specialisation in Maritime Energy Management in the Master of Science in Maritime Affairs program.¹⁵

¹⁴ MEPC 65/22 para 4.128.

¹⁵ <<https://www.wmu.se/academic-programmes>>.

10. UNFCC and GHG

The UN Framework Convention on Climate Change¹⁶ defined GHG as “those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation” (article 1.5)

“Emissions” are defined in article 1.4 as “the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time”.

The ultimate objective of the UNFCCC and any related legal instruments is stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (article 2).

The Paris Agreement was adopted in December 2015 under the UNFCCC and entered into force in 2016.¹⁷ The Paris Agreement’s central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Paris Agreement thus addresses national contributions to GHG reductions. Article 14 calls for a “global stocktake” every five years starting in 2023. This review is to

take stock of the implementation of this Agreement to assess the collective progress towards achieving the purpose of this Agreement and its long-term goals It shall do so in a comprehensive and facilitative manner, considering mitigation, adaptation and the means of implementation and support, and in the light of equity and the best available science.

In anticipation of the first global stocktake the UNFCCC COP23 (2017) established the Talanoa Dialogue as a process designed to help States implement and enhance their Nationally Determined Contributions by 2020. In 2018 the Talanoa Dialog (web-based) Platform was created to facilitate that process.¹⁸

The Paris Agreement does not include international shipping, since IMO, as the regulatory body for the industry, is committed to reducing greenhouse gas emissions from international shipping.

11. IMO and GHG

Until MEPC 61 (2010) the IMO considered air emissions under a single MEPC agenda item: Prevention of air pollution from ships.

Since 2010 MEPC has been considering reducing air emissions under three separate agenda items:

- Air pollution and energy efficiency
- Further technical and operational measures for enhancing the energy efficiency of international shipping (added in 2013 by MEPC 66)
- Reduction of GHG emissions from ships.

Action on first two agenda items since 2011 is summarised above describing the various amendments to MARPOL Annex VI.

¹⁶ UN Framework Convention on Climate Change, New York 9 May 1992, entered into force 21 March 1994, 1771 UNTS 107. It has 197 parties. See further <<https://unfccc.int>>.

¹⁷ See <<https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>>.

¹⁸ <<https://unfccc.int/topics/2018-talanoa-dialogue-platform>>.

MEPC 72 (April 2018) adopted its initial strategy for reduction of GHG emissions from merchant shipping in international trade as resolution MEPC.304(72).¹⁹ A revised strategy is to be adopted in 2023.

The Initial Strategy includes a vision and three levels of ambition:

Vision:

- The IMO remains committed to reducing GHG emissions from international shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century.

Levels of ambition:

- The Initial Strategy identifies three levels of ambition for the international shipping sector, noting that technological innovation and the global introduction of alternative fuels and/or energy sources for international shipping will be integral to achieve the overall ambition. Reviews should take into account updated emission estimates, emissions reduction options for international shipping, and the reports of the Intergovernmental Panel on Climate Change (IPCC), as relevant. Levels of ambition directing the Initial Strategy are as follows:
- Carbon intensity of the ship to decline through implementation of further phases of the energy efficiency design index (EEDI) for new ships--
 - to review with the aim to strengthen the energy efficiency design requirements for ships with the percentage improvement for each phase to be determined for each ship type, as appropriate;
- Carbon intensity of international shipping to decline--
 - to reduce CO₂ 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; and
- GHG emissions from international shipping to peak and decline--
 - to peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out as called for in the Vision as a point on a pathway of CO₂ emissions reduction consistent with the Paris Agreement temperature goals.

12. IMO's Anticipated Results

The IMO estimates that the adoption by the IMO of mandatory reduction measures for all ships from 2013 and onwards is expected to lead to significant emission reductions and also significant cost savings for the shipping industry. By 2020, up to 180 million tonnes of annual CO₂ reductions are estimated from the introduction of the EEDI for new ships and the SEEMP for all ships in operation, a figure that, by 2030, will increase to 390 million tonnes of CO₂ annually. In other words, the reductions will in 2020 be between 9 and 16%, and by 2030 between 17 and 25% compared with business as usual. The reduction measures will also result in a significant saving in fuel costs to the shipping industry, although these savings require deeper investments in more efficient ships and more sophisticated technologies than the business as usual scenario. The annual fuel cost saving

¹⁹ Report of the MEPC on its 72nd session, MEPC 72/17 (3 May 2018), para 7.21 and MEPC 72/17 Add.1 (18 May 2018) Annex 11. See also note 1 above.

estimates states a staggering figure of \$34 to 60 billion by 2020, and even more astonishing \$85 – 150 billion by 2030.

The new chapter 4 also includes regulation 23 on Promotion of technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships, which requires Administrations, in co-operation with the IMO and other international bodies, to promote and provide, as appropriate, support directly or through the IMO to States, especially developing States, that request technical assistance. It also requires the Administration of a Party to co-operate actively with other Parties, subject to its national laws, regulations and policies, to promote the development and transfer of technology and exchange of information to States, which request technical assistance, particularly developing States, in respect of the implementation of measures to fulfil the requirements of chapter 4.

Table of Abbreviations and Acronyms

Annex VI	Annex VI to MARPOL on air pollution from ships added by the Protocol of 1997
CO ₂	Carbon dioxide
COP23	23 rd Conference of the Parties to UNFCCC, 2017
DCS	IMO data collection system for fuel oil consumption
EEDI	Energy Efficiency Design Index
EEOI	Energy Efficiency Operational Indicator
GHG	Greenhouse gases
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997
MEPC	IMO, Marine Environment Protection Committee
NO _x	Nitrogen oxides
Paris Agreement	Supplemental to UNFCCC, 12 December 2015
SEEMP	Ship Energy Efficiency Management Plan
SO _x	Sulphur oxides
UNFCCC	UN Framework Convention on Climate Change, 9 May 1992
WMU	World Maritime University

Addendum: Results of MEPC 73²⁰

NO_x and SO_x Emissions

The feasibility of meeting the 2020 global 0.50% limit were raised and considered at MEPC 73 in October 2018, including supply/availability, fuel oil quality and safety.

Availability of 2020 Compliant Fuel Oils

The Committee considered MEPC 73/5/15 (Liberia) proposing an MEPC resolution to urge Member States to report the availability of compliant fuel oil well in advance of 1 January 2020 to enable shipowners and operators to gain experience on the carriage and use of the new fuel oils on their ships and with proposed ship implementation plans. Based on the discussion the Committee urged Parties to MARPOL Annex VI to inform the Organization of the availability of compliant fuel oils in its ports and terminals via GISIS MARPOL Annex VI module well in advance of 1 January 2020, in accordance with regulation 18.1 of MARPOL Annex VI. Furthermore the Committee agreed to instruct the Secretariat to issue circular MEPC.1/Circ.880 on *Reporting of availability of compliant fuel oils in accordance with regulation 18.1 of MARPOL Annex VI*.²¹

Fuel Oil Quality

The Committee recalled that MEPC 72 had approved MEPC.1/Circ.875 on *Guidance on best practice for fuel oil purchasers/users for assuring the quality of fuel oil used on board ships*.²²

Safety Considerations

Based on the discussion of MEPC 73/5/14 (Bahamas et al.) and MEPC 73/5/17 (ISO et al.), the Committee invited further concrete proposals on how to enhance the implementation of regulation 18 of MARPOL Annex VI, in particular on fuel oil quality and reporting of non-availability of compliant fuel oils, including the enhancement of the GISIS module for data collection and analysis.²³

Guidance on Best Practices for Member States/Coastal States

The Committee recalled that MEPC 72 had approved MEPC.1/Circ.875 on *Guidance on best practice for fuel oil purchasers/users for assuring the quality of fuel oil used on board ships*. The Committee considered the report of the Correspondence Group (MEPC 73/5/3 and MEPC 73/INF.4). The Committee noted the comments made and views expressed on the draft best practice for Member States/coastal States in the report of the Working Group, and re-established the Correspondence Group, under the coordination of the United States, and instructed it to finalize the draft guidance on best practice for Member States/coastal States, using annex to document MEPC 73/5/3 as the basis, taking into account the comments made at MEPC 73 and annex 1 to document MEPC 73/WP.7, discussion at PPR 6 and the Intersessional Meeting on Consistent implementation of regulation 14.1.3 of MARPOL Annex VI (ISWG-AP 1); and to submit a final report to MEPC 74.²⁴

Guidance on Best Practices for Fuel Oil Suppliers

²⁰ This addendum is based on the draft report of MEPC 73, MEPC 73/WP.1, 26 October 2018, as the final report is not yet available.

²¹ MEPC 73/WP.1 paras 5.34-5.36.

²² MEPC 73/WP.1 para 5.37.

²³ MEPC 73/WP.1 paras 5.29-5.33.

²⁴ MEPC 73/WP.1, paras 5.38-5.39 and 5.76.

The Committee considered MEPC 73/5/4 (ICS et al.) providing an updated version of draft best practice for fuel oil suppliers contained in MEPC 72/INF.13. The Committee approved the recommendation of the Working Group to approve MEPC.1/Circ.875/Add.1 on *Guidance on best practice for fuel oil suppliers for assuring the quality of fuel oil delivered to ships*.²⁵

Energy Efficiency Design Index (EEDI)

MEPC 73 considered six submissions on the EEDI under agenda item 5, Air Pollution and Energy Efficiency: MEPC 73/5/2, 5/5, 5/6, 5/7, 5/8, 5/10. (Another eight documents address other issues under this agenda item.)

EEDI Review Beyond Phase 2

The Committee considered document MEPC 73/5/2 (Japan), providing the interim report of the Correspondence Group on EEDI Review Beyond Phase 2 including recommendations for the time period and the reduction rates for EEDI phase 3 requirements. Some delegations expressed disappointment with the interim report which was considered as lacking in ambition to the extent that it did not reflect the levels of ambition adopted by MEPC 72 as part of the Initial IMO Strategy on Reduction of GHG emissions from ships and that amendments should have been proposed recommending a strengthening of the EEDI requirements for all ship types including bringing forward phase 3 and increasing reduction rates to 40% for phase 3, and identifying a phase 4 with reduction rates and timelines.²⁶

EEDI phase 3 requirements for bulk carriers and tankers

With regard to the Correspondence Group's recommendations for EEDI phase 3 requirements for bulk carriers and tankers and comments thereon (MEPC 73/5/8 (Japan) and MEPC 73/5/10 (Liberia et al.) and in plenary, the Committee agreed the starting year for EEDI phase 3 requirements of 2025 should be retained; the required reduction rate for phase 3 of the 30% should be retained; and the parameters for determination of reference values should be retained. INTERTANKO and others expressed serious concerns that the future EEDI for large tankers would have negative impacts on their future design and stated it was their intention to submit a proposal to MEPC 74 with an acceptable alternative solution.²⁷

EEDI phase 3 requirements for containerships

With regard to proposals for EEDI phase 3 requirements for containerships, the Committee agreed that the starting year of EEDI phase 3 requirements for containerships should be 2022; the 40% reduction rate should be applied to all containerships; the parameters for determination of reference values for containerships should be retained; and instructed the Working Group to finalize draft amendments to MARPOL Annex VI for the EEDI phase 3 requirements for containerships, using annex 3 to document MEPC 73/5/2 as a basis, taking into account the decision made at plenary, with a view to approval at this session. The Committee subsequently approved the draft amendments to Annex VI regulation 21 with a view to adoption at MEPC 74.²⁸

EEDI phase 3 requirements for general cargo ships

With regard to EEDI phase 3 requirements for general cargo ships, the Committee agreed that the starting year of EEDI phase 3 requirements for general cargo ships should be 2022 and instructed the Working Group to prepare draft amendments to MARPOL Annex VI for the EEDI phase 3

²⁵ MEPC 73/WP.1, paras 5.40-5.41 and 5.77.

²⁶ MEPC 73/WP.1, paras 5.46-5.47.

²⁷ MEPC 73/WP.1, paras 5.52-5.54.

²⁸ MEPC 73/WP.1, paras 5.55-5.56, 5.73.8, 5.78.3; MEPC 73/WP.7, para 34 and Annex 3.

requirements for general cargo ships. The Committee subsequently approved draft amendments to Annex VI regulation 21 for general cargo ships with a view to adoption at MEPC 74.²⁹

EEDI phase 3 requirements for other ship types

With regard to EEDI phase 3 requirements for other ship types, the Committee instructed the Working Group to consider whether there was sufficient data for the start date of phase 3 for other ships types, excluding ro-ro cargo ships and ro-ro passenger ships, to be advanced to 2022. Subsequently the Committee decided that reduction rates and the starting year for phase 3 for gas carriers, refrigerated cargo carriers, combination carriers, LNG carriers and cruise passenger ship having non-conventional propulsion should not be amended at this session and invited concrete proposals to MEPC 74.³⁰

EEDI phase 3 requirements for ice class ships

With regard to EEDI phase 3 requirements for ice class ships, the Committee considered proposals by the Correspondence Group and Working Group, and adopted resolution MEPC.308(73) on the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships*, as set out in annex 6 to its report.³¹

Survey and Certification of EEDI

The Committee considered ITTC-proposed amendments to the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, taking into account the 2017 update of the ITTC Recommended Procedure on the conduct of sea trials including wind speed profile, correction of waves from all directions, iterative method, roughness allowance and, most importantly, shallow water correction (MEPC 73/5/7). Subsequently the Committee adopted resolution MEPC.309(73) on the Amendments to the Guidelines on survey and certification of the EEDI and requested the Secretariat to issue a consolidated text as MEPC.1/Circ.885/rev.2.³²

²⁹ MEPC 73/WP.1, paras 5.57, 5.78.3; MEPC 73/WP.7, para 34 and Annex 3.

³⁰ MEPC 73/WP.1, paras 5.58-5.59, 5.78.2; MEPC 73/WP.7, paras 23-31.

³¹ MEPC 73/WP.1, paras 5.60-5.63, 5.79; MEPC 73/WP.7, paras 36-42.

³² MEPC 73/WP.1, paras 5.71-5.72, 5.82; MEPC 73/WP.7, paras 43-46, Annex 6.

Data Collection System of Fuel Consumption

MEPC 73 considered four submissions, under agenda item 6, Further Technical and Operational Measures for Enhancing the Energy Efficiency of International Shipping.

IMO Ship Fuel Oil Consumption Database

The first was a status report from the Secretariat on the IMO Ship Fuel Oil Consumption Database (MEPC 73/6), subsequently updated.³³ The Committee noted that as of 5 September 2018, 19 Administrations of Parties to Annex VI had assigned a contact person on the Database in order to submit their fuel oil consumption data and 11 recognized organizations out of 30 recognized organizations had contacted the Secretariat to enable their data submissions to the Database. The Committee encouraged Administrations of Parties to MARPOL Annex VI to assign their "contact person"; and requested recognized organization(s) which had been authorized to submit fuel oil consumption data on their behalf to contact the Secretariat for setting up their web accounts for the Database.

In reaction to an IACS intervention that some 19,000 relevant ships still needed to submit their SEEMP part II before 1 January 2019, the Committee urged stakeholders concerned to submit their SEEMP part II to the Administration or its recognized organization as soon as possible.³⁴

Lessons Learnt From a Voluntary Experience-Building Phase of the Fuel Oil Consumption Data Collection System

The second was a report from Singapore sharing its lessons learnt from a voluntary experience-building phase of the fuel oil consumption data collection system (MEPC 73/6/1). The Committee considered this document and instructed the Working Group on Air Pollution and Energy Efficiency to further review document MEPC 73/6/1 and advise the Committee accordingly.³⁵ The Working Group recommended the Committee to note the Group's discussion on this document.³⁶

Phase 2 (data analysis) of the three-step approach

The third was a proposal by IACS and OCIMF for the Committee to commence its consideration, at least at a preliminary level, of Phase 2 (data analysis) of the three-step approach. In particular, MEPC 73/6/2 discusses how Phase 2 could be conducted, the schedule for undertaking it and who should conduct this Phase. Following discussion of this proposal, the Committee agreed, in principle, that a methodology for conducting the data analysis needed to be developed as a priority with a view to its approval by MEPC 75, to be in line with the timeline set out in paragraph 6.2 of the Initial IMO Strategy on Reduction of GHG Emissions from Ships (resolution MEPC.304(72)); and invited interested Member Governments and international organizations to submit concrete proposals on such a methodology to MEPC 74.

Implementation of Requirements in Chapter 4 of MARPOL Annex VI Relating to the Data Collection System for Fuel Oil Consumption of Ships

³³ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Data-Collection-System.aspx>

The fourth document, by India and IACS, discussed implementation of the requirements in chapter 4 of MARPOL Annex VI relating to the data collection system for fuel oil consumption of ships (MEPC 73/6/3). The document proposed unified interpretations for regulations 5.4.5, 22.2, 22.3, 22A.1, 22A.8 and appendix IX of MARPOL Annex VI on the issuance of the confirmation of compliance for new ships, boil-off gas consumed on board ships and access to the disaggregated data. Pursuant to instructions from the Committee, following consideration, the Working Group finalized draft unified interpretations to MARPOL Annex VI, as set out in WP.7/annex 7, for approval by the Committee, for dissemination as MEPC.1/Circ.795/Rev.3, which the Committee subsequently approved.³⁷

Prohibition on Carriage of Non-Compliant Fuel Oil for Combustion Purposes for Propulsion or Operation on Board a Ship

MEPC 72 had considered and approved draft amendments to MARPOL Annex VI concerning the prohibition on the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship.³⁸ At MEPC 73, the Committee had for its consideration three documents commenting on the draft amendments: MEPC 73/3/1 (IMarEST), MEPC 73/3/2 (CLIA) and MEPC 73/3/3 (Bangladesh). Following discussion of these documents and the report of the Drafting Group, the Committee adopted the amendments by resolution MEPC.305(73), with entry into force on 1 March 2020.³⁹

The IMO has noted that this amendment does not change in any way the entry into force date of 0.50% from 1 January 2020. Rather it is intended as an additional measure to support consistent implementation and compliance and provide a means for effective enforcement by States, particularly port State control.⁴⁰

³⁴ MEPC 73/WP.1, paras 6.2-6.4.

³⁵ MEPC 73/WP.1, paras 6.6-6.7.

³⁶ MEPC 73/WP.7, paras 47-53 and 57.16.

³⁷ MEPC 73/WP.7, paras 56, 57.18; MEPC 73/WP.1, para 6.15.

³⁸ MEPC 72.17, paras 5.2-5.7.

³⁹ MEPC 73/WP.1, paras 3.3-3.18 and Annex 1.

⁴⁰ IMO Press Briefing 19 26/10/2018, <<http://www.imo.org/en/MediaCentre/PressBriefings/Pages/19-Implementation-of-sulphur-2020-limit-.aspx>>