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Main events in IMO's work on limitation and reduction of greenhouse gas emissions from international shipping

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SUMMARY

This document provides background information by the IMO Secretariat on development of regulatory measures and associated technical policy and legal considerations related to control of greenhouse gas emissions from international shipping. The annexes provide detailed information on the adopted mandatory technical and operational measures and on IMO's work on Market-Based Measures.

INTRODUCTION

1 International shipping is the most environmentally-friendly and energy efficient mode of mass transport and only a modest contributor to the total volume of atmospheric emissions while moving a considerable part of world trade (90%). Nevertheless, a global approach for further improvements in energy efficiency and emission reduction is needed as sea transport is predicted to continue growing significantly in line with world trade.

2 The International Maritime Organization (IMO), as the UN's Specialized Agency responsible for the global regulation of all facets pertaining to international shipping, has a key role in ensuring that the environment is not polluted by ships'– as summed up in IMO's mission statement: **Safe, Secure and Efficient Shipping on Clean Oceans**.

3 July 2011 was marked by a breakthrough at IMO with the adoption of the first ever global and legally binding climate deal for an industry sector since the Kyoto Protocol. IMO adopted a new chapter to MARPOL Annex VI that includes a package of mandatory technical and operational measures to reduce GHG emissions from international shipping, with the aim of improving the energy efficiency for ships through improved design and propulsion techniques, as well as through improved operational practices. These measures are expected to come into force on 1 January 2013.

4 Work on the prevention of air pollution and control of greenhouse gas (GHG) emissions from ships engaged in international trade started within the IMO in the late 1980s. The first regulatory steps were out-phasing of ozone depleting substances both as refrigerant gases and in fire fighting systems, later prevention of air pollution in form of cargo vapours and exhaust gas were targeted by, *inter alia*, adopting strict limits for nitrogen oxides and

sulphur oxides in ship exhaust gas. In recent years the focus has increasingly shifted to control of GHG emissions from ships.

5 Significant reductions in harmful atmospheric emissions from ships and increases in fuel efficiency have been achieved over the past decades through enhancements in the efficiency of engine and propulsion systems as well as improved hull design. Larger ships and a more rational utilization of individual vessels have also contributed significantly to reducing the amount of energy needed to transport a given unit of cargo. Furthermore, significant emission reductions are expected with the recent adoption of the first-ever global mandatory measures to reduce GHG emissions from an international industry sector.

6 Due to its close connection to global commerce, international shipping plays a vital role in the facilitation of world trade as the most cost and energy effective mode of transport. As shipping is a global industry and ships are competing in a single global market, it must be regulated at the global level to be environmentally effective (avoid carbon leakage) and to maintain a level playing field for all ships, irrespective of flag or ownership. IMO's vision is to eliminate all adverse environmental impact from ships by developing robust and effective regulations that apply universally to all ships.

PREVENTION OF AIR POLLUTION

7 In the late 1980s, IMO started its work on prevention of air pollution from ships. These efforts were based on scientific information on adverse effects of atmospheric emissions from a multitude of sources, ships being one of them, on human health and vulnerable ecosystems. This was something of a departure, as IMO's focus, along with that of national regulators and of the society as a whole, had previously been on more visible sources of ship-sourced pollution – for example, on oil spills resulting from major ship accidents. The harmful long-term effects of exhaust gases on human health and ecosystems were not so immediately visible and had not earlier been fully recognized.

8 The seventeenth session of the IMO Assembly, in November 1991, recognizing the urgent necessity of establishing an international policy on prevention of air pollution from ships, considered and decided, in resolution A.719(17), to develop a new annex to the International Convention for the Prevention of Pollution from Ships (MARPOL Convention). Following development of the regulatory text by the Marine Environment Protection Committee (MEPC), an International Conference of Parties to the MARPOL Convention was held in London in September 1997. The Conference adopted the protocol of 1997 to the MARPOL Convention, which added a new Annex VI, Regulations for the Prevention of Air Pollution from Ships, to the MARPOL Convention (MARPOL Annex VI). MARPOL Annex VI, which sets amongst others NO_x and SO_x emission limits, came into force on 19 May 2005.

9 A revised version of MARPOL Annex VI was adopted at the fifty eight session of MEPC, in October 2008, and entered into force on 1 July 2010. The revised MARPOL Annex VI significantly strengthens the emission limits in light of technological improvements and implementation experience. Moreover, it allows for the designation of Emission Control Areas for sulphur oxides and particulate matter, or nitrogen oxides, or all three types of emissions from ships. The revised Annex provides for progressive reductions in SO_x and NO_x emissions, with the most stringent limits being applicable to Tier III engines within Emission Control Areas.

10 MEPC 62 adopted amendments to MARPOL Annex VI concerning designation of the United States Caribbean Sea Emission Control Area (ECA) and exemption of certain

ships operating in the North American ECA and the United States Caribbean Sea ECA under regulations 13 and 14 and Appendix VII of MARPOL Annex VI (resolution MEPC.202(62)). These amendments to MARPOL Annex VI are expected to enter into force on 1 January 2013 upon their deemed acceptance on 1 July 2012.

11 Issues regarding Black Carbon emission from international shipping have started to gain focus and have been considered by MEPC 62 that agreed to a work plan for the Bulk Liquids and Gases (BLG) Sub-Committee to consider the impact of Black Carbon emissions from international shipping on the Arctic, including development of a definition of Black Carbon emissions and identification of the most appropriate method for measuring and controlling such emissions, with the aim of submitting a final report to MEPC 65 (July 2013) for action.

CONTROL OF GHG EMISSIONS FROM SHIPS

12 Although discussions on GHG emission from ships within IMO started in the late 1980s, it was the 1997 MARPOL Conference Resolution 8 on "CO_2 emissions from ships" that triggered IMO's work on GHG emissions. The 1997 MARPOL Conference Resolution 8 requested IMO to undertake a study on GHG emissions from ships and to consider feasible emissions reduction strategies. The first IMO Study on GHG Emissions from ships was presented to MEPC 45 in October 2000 (document MEPC 45/8) which identified a potential for reduction of GHG emissions through technical and operational measures but that these alone would not be able to prevent a total growth in emissions from ships.

13 IMO's GHG work has been further guided by Assembly resolution A.963(23) on IMO Policies and Practices Related to the Reduction of GHG Emissions from Ships, which was adopted in December 2003. The resolution urges MEPC to identify and develop the mechanisms needed to limit or reduce GHG emissions from international shipping. In doing so, the Committee was urged to give priority to the establishment of a GHG baseline and the development of a methodology to describe the GHG efficiency of a ship in terms of a GHG emission index of that ship. Assembly resolution A.963(23) also calls for MEPC to develop a GHG work plan with timetable to direct the identification and development of the needed mechanisms.

14 MEPC 55 (October 2006) agreed that IMO should continue to take the leading position in developing GHG strategies and mechanisms for international shipping and cooperate closely with other relevant UN bodies so as to avoid unilateral action and approved the work plan requested by Assembly resolution A.963(23). At MEPC 55 it was agreed to update the "IMO Study of Greenhouse Gas Emissions from Ships" from 2000. The "Second IMO GHG Study 2009 was presented at MEPC 59 (July 2009) as document MEPC 59/4/7 and MEPC 59/INF.10.

15 The work plan requested by Assembly resolution A.963(23) culminated at MEPC 59 (July 2009) and called for the consideration of technical, operational and Market-Based Measures (MBMs) for the limitation or reduction of GHG emissions from international shipping as of MEPC 57 (March 2008). MEPC 57 agreed on fundamental principles to serve as reference for any future IMO regulations on GHG emission from international and further debates on GHG emissions from international shipping. Furthermore, MEPC 58 (October 2008) agreed that any regulatory scheme to control GHG emissions from international shipping should be developed and enacted by IMO as the most competent international body.

16 A significant amount of work on technical and operational measures has been carried out in accordance with the work plan and at MEPC 59 (July 2009) the Committee approved to circulate Interim Guidelines on the Method of Calculation of the Energy Efficiency Design Index for New Ships (EEDI), the Interim Guidelines for Voluntary Verification of Energy Efficiency Design Index, the Guidance for the Development of a Ship Energy Efficiency Management Plan (SEEMP) and the Guidelines for Voluntary use of the Energy Efficiency Operational Indicator (EEOI). These were initially intended for trial purposes on a voluntary basis.

17 In September/October 2010, MEPC 61 considered amendments to MARPOL Annex VI as a potential manner for introducing non-mandatory technical and operational measures into IMO's regulatory regime. Nine members (all parties to MARPOL Annex VI) subsequently requested the Secretariat General to circulate propose amendments to MARPOL Annex VI to make mandatory, for new ships, the EEDI and the SEEMP. The text of the proposed amendments was circulated as Circular letter No. 3128 and was considered for adoption at MEPC 62 in July 2011.

18 MEPC 62 (July 2011) considered and adopted [draft] amendments to MARPOL Annex VI for inclusion of regulations on energy efficiency for ships (resolution MEPC.203(62)). These amendments to MARPOL Annex VI are expected to enter into force on 1 January 2013 upon their deemed acceptance on 1 July 2012. The amendments to MARPOL Annex VI – Regulations for the prevention of air pollution from ships, add a new chapter 4 to Annex VI on Regulations on energy efficiency for ships making EEDI mandatory for new ships and SEEMP for all ships. The new regulations apply to all merchant ships of 400 gross tonnage and above regardless of the national flag they fly or the nationality of the owner.

19 MEPC 62 also agreed on a work plan to further develop the guidelines related to EEDI and SEEMP and to include development of the remaining EEDI and SEEMP related guidelines and EEDI frameworks for ship types, sizes and propulsion systems not covered by the current EEDI requirements. MECP 62 agreed to hold an Intersessional Meeting of the Working Group on Energy Efficiency Measure for Ships to develop guidelines on the method of calculation of EEDI for new ships, SEEMP, Survey and Certification of the EEDI and for determining minimum propulsion power and speed to enable safe manoeuvring in adverse weather conditions. The Intersessional Meeting will take place in January 2012 and its report be submitted to MEPC 63 (February/March 2012).

20 In-depth debates on MBMs have taken place at every MEPC since MEPC 59. A work plan for the further consideration of MBMs culminating in July 2011 at MEPC 62 was agreed by MEPC 59. MEPC 60 called for an expert group to undertake a feasibility study and impact assessment of the MBMs that had been proposed by governments and observer organizations. The results of the expert group were presented at MEPC 61; which held an extensive debate on how to progress the development of suitable MBMs and agreed to hold an Intersessional Meeting of the Working Group on GHG Emissions from Ships (GHG-WG 3) that was held in March/April 2011.

21 The GHG-WG 3 was tasked with providing opinion on the compelling need and purpose of MBMs as a possible mechanism to reduce GHG emissions from international shipping, reviewing the proposed MBMs, by grouping and evaluating them, analysing their relations to relevant conventions and rules and by evaluating their impacts on, amongst others, international trade, the maritime sector of developing countries and the environment. The report of the GHG-WG 3 was submitted to MEPC 62 as document MEPC 62/5/1.

22 Due to time constraints and the busy agenda of MEPC 62, it was agreed to postpone the consideration of MBMs, UNFCCC related matters and a possible reduction

target for international shipping to the next MEPC session (MEPC 63 in February/March 2012).

LONDON CONVENTION AND PROTOCOL

23 The London Convention (LC) of 1972 and its 1996 Protocol (LP) address marine pollution from the dumping of wastes and other matter at sea. They are administered by IMO and apply to all marine areas, including internal waters, and cover a significant proportion of global shipping. There are currently 87 parties to the LC and 41 parties to the LP representing two thirds and one third of global merchant shipping tonnage, respectively.

24 The Contracting Parties to the LC and LP have recently taken a number of ground-breaking steps to mitigate the impacts of increasing concentrations of CO_2 in the atmosphere and to ensure that new technologies with the potential to cause harm to the marine environment are effectively controlled and regulated. The LC and LP have, so far, been the most advanced international regulatory instruments addressing carbon capture and sequestration in sub-sea geological formations (CCS-SSGF) and marine climate engineering such as ocean fertilization (OF).

Carbon capture and sequestration in sub-sea geological formations under the London Protocol

25 In 2006, the LP Contracting Parties adopted amendments to Annex I of the Protocol to regulate CCS-SSGF, creating a legal basis in international environmental law to regulate carbon capture and storage in sub-seabed geological formations for permanent isolation. This practice typically applies to large point sources of CO_2 emissions, including power plants and cement works, but excludes the use of such CO_2 waste streams for enhanced oil recovery.

26 With the inclusion of CCS-SSGF to the LP, such activities are now subjected to the licensing arrangements contained in the instrument. For ease of the licensing process, Contracting Parties adopted a "Risk Assessment and Management Framework for CO_2 Sequestration in Sub-Seabed Geological Structures" and "Specific Guidelines on Assessment of CO_2 Streams for Disposal into a Sub-Seabed Geological Formations". These Guidelines provide advice on how to capture and sequester CO_2 in-line with the requirements of the LP and in a safe manner for the (marine) environment, both for the short- and long-term.

27 In 2009, Parties amended LP Article 6 regarding the export of wastes for dumping purposes, aimed at enabling Parties to share *transboundary* sub-seabed geological formations for sequestration projects, on the condition that the protection standards of the LP are fully met. The amendment is not yet in force but will be so for those Parties which have deposited instruments of acceptance with IMO.

Marine Climate Engineering - Ocean fertilization

28 Since 2007, LC and LP Contracting Parties have been working on establishing a global, transparent and effective control and regulatory mechanism for ocean fertilization activities and other activities that fall within the scope of the LC and LP and have the potential to cause harm to the marine environment. This work includes a range of marine geo-engineering activities and is expected to be completed in 2012. As a result of this work, in 2010 Parties adopted Resolution LC-LP.2(2010) on the "Assessment Framework for Scientific Research Involving Ocean Fertilization". Resolution LC-LP.2(2010) serves as a guide to Parties on how to assess proposals for ocean fertilization research and provides

detailed steps for completion of an environmental assessment, including risk management and monitoring.

IMO'S INTEGRATED TECHNICAL CO-OPERATION PROGRAMME

29 IMO's Integrated Technical Co-operation Programme (ITCP) has been providing, over the years, technical assistance to developing countries to address shipping-related environmental issues by offering regional or national workshops on awareness building for policy makers and national administrations as well as more elaborated courses for flag and port Sate control officers and the maritime industry. The aim of this programme is to provide support to developing countries in improving their ability to comply with international rules and standards, in establishing permanent self-sustaining legal, policy and institutional arrangements to ensure uniform application of IMO's policies for the reduction of GHG emissions from ships, whilst combating poverty and promoting sustainable development.

30 IMO as been coordinating and managing environmental programmes since the adoption of Assembly resolution A.1006(25) on "The linkage between the Integrated Technical Co-operation Programme and the Millennium Development Goals" in 2007.

31 The technical co-operation activities are conceived and developed through partnerships between recipient countries, resource providers and the Organization. There are currently over 60 partnerships in operation. The activities have a regional scope targeting developing countries which are major flag and port States, as well as those that have a stake in the ownership and management chain surrounding ship operations, ship design and manufacture. Depending on the focus of the countries involved, the following groups of stakeholders could be targeted:

.1 Policy-makers and national maritime and port Administrations (NGO's, industry and labour organizations);

.2 Ship and port operators, including ship managers; and

.3 Ship designers, shipbuilders, personnel from ship repair yards and equipment manufacturers, as well as other relevant groups depending on national circumstances.

32 These activities on GHG emissions also include an IMO Model Course, based on the SEEMP, to promote energy efficient operation of ships and the industry's "best practices", to reduce GHG emissions from ships.

33 In April 2011, IMO and the Korea International Co-operation Agency (KOICA) signed an agreement, for implementation of a project on "Building Capacities in East Asian countries to address GHG emissions from Ships" as part of a climate change initiative by the Republic of Korea. This project expects to provide East Asian countries with capacity to develop and implement appropriate national actions on CO_2 emissions from ships.

34 With this programme IMO seeks to enhance capacity of beneficiary States to implement and enforce IMO GHG regulations primarily through flag State implementation and of Port State control; to raise industry awareness through seminars and workshops based on communication material and training packages developed, and to build national capacity on fuel efficient ship operation and design.

THE 1997 MARPOL CONFERENCE

35 The 1997 International Conference of Parties to the MARPOL Convention convened by IMO was a historic response to the need to minimize emissions from ships and their contribution to global air pollution and environmental problems. The Conference adopted the protocol of 1997 to the MARPOL Convention, which added a new Annex VI – Regulations for the Prevention of Air Pollution from ships.

36 With a view to addressing the issue of GHG emissions from international shipping, the 1997 MARPOL Conference adopted **Resolution 8 on "CO_2 emissions from ships",** inviting:

.1 the IMO Secretary-General to co-operate with the Executive Secretary of UNFCCC in the exchange of information on the issue of GHG emissions;

.2 IMO to undertake a study of GHG emissions from ships for the purpose of establishing the amount and relative percentage of GHG emissions from ships as part of the global inventory of GHG emissions; and

.3 the MEPC to consider feasible GHG emissions reduction strategies.

2000 IMO GHG STUDY

37 As a follow-up to the above resolution and with the objective of undertaking an examination of GHG emission reduction possibilities through different technical, operational, and market-based approaches, the first **IMO Study on GHG Emissions from Ships** was completed and presented to MEPC 45 in June 2000 as document MEPC 45/8. This Study, using data from 1996, estimated that ships emitted about 420 million tonnes of CO_2 and thereby contributed about 1.8% of the world's total anthropogenic CO_2 emissions that year.

38 The 2000 IMO GHG Study was undertaken by a consortium of internationally renowned research institutes and stated that there was no other mode of transport with a better energy efficiency record than sea-transport on a tonne-mile basis. Nevertheless, the Study identified a number of areas with potential for reduction of CO_2 emissions that if combined could lead to a 40% reduction on a tonne mile basis. However, the Study stated that technical and operational measures have a limited potential for contributing to reduced emissions from ships. If the increase in demand for shipping services and market requirement for increased speed and availability continues, technical measures alone would not be able to prevent a total growth in emissions from ships.

ASSEMBLY RESOLUTION A.963(23) FROM DECEMBER 2003 ON GHG POLICY AND PRACTICES

39 In an effort to further address the issue of GHG emissions from ships, the IMO Assembly adopted (December 2003) **Resolution A.963(23) on "IMO Policies and Practices related to the Reduction of GHG Emissions from Ships"**, which:

1. URGES the MEPC to identify and develop the mechanism or mechanisms needed to achieve the limitation or reduction of GHG emissions from international shipping and, in doing so, to give priority to:

(a) the establishment of a GHG emission baseline;

(b) the development of a methodology to describe the GHG efficiency of a ship in terms of a GHG emission index for that ship. In developing the methodology for the GHG emission indexing scheme, the MEPC should recognize that CO_2 is the main GHG emitted by ships;

(c) the development of Guidelines by which the GHG emission indexing scheme may be applied in practice. The Guidelines are to address issues such as verification;

(d) the evaluation of technical, operational and market-based solutions;

2. REQUESTS the MEPC:

(a) to consider the methodological aspects related to the reporting of GHG emissions from ships engaged in international transport;

(b) to develop a work plan with a timetable;

(c) to keep this matter under review and to prepare consolidated statements on the continuing IMO policies and practices related to the limitation or reduction of GHG emissions from international shipping;

3. REQUESTS the IMO Secretariat to continue co-operating with the Secretariat of UNFCCC and the Secretariat of the International Civil Aviation Organization.

VOLUNTARY SHIP CO_2 EMISSION INDEXING

40 Assembly Resolution A.963(23) urged the Committee to develop a methodology to describe the GHG efficiency of a ship in terms of a GHG emission index for that ship, which recognises that CO_2 is the main GHG emitted by ships. In response thereto, MEPC 53 approved **IMO's "Interim Guidelines for Voluntary Ship CO_2 Emission Indexing for use in Trials"** (MEPC/Circ.471) in July 2005.

Purpose

41 The purpose of the Interim Guidelines was to develop a methodology to describe the GHG efficiency of a ship in terms of CO_2 emissions. The Interim Guidelines provide assistance in the process of establishing a mechanism to achieve the limitation or reduction of GHG emissions from shipping by establishing a common approach for trials on voluntary CO_2 emission indexing. The Interim Guidelines will allow ship owners and operators to evaluate the performance of their ship(s)/fleet in operation with regard to CO_2 emissions. As the amount of CO_2 emitted from a ship is directly related to the consumption of bunker fuel oil, the CO_2 indexing also provides useful information on a ship's performance with regard to fuel efficiency. Ultimately, the information derived from the indexing will enable the development of an even more environmental friendly mode of transport.

Trials

42 Already at MEPC 52 the committee invited the maritime administration and the shipping industry to promote the use of the draft interim guidelines in trials and to report the

outcome to the MEPC for consideration. This invitation was reiterated in later MEPCs. Since then outcome of CO_2 indexing trials from hundreds of ships by a high number of delegations have been submitted to IMO for information.

43 The data received from trials has been reviewed primarily by the Working Group on Air Pollution (WG-AP) under the chairmanship of first Mr. Okamura (Japan) and later Mr. Yoshida (Japan). WG-AP was *inter alia* tasked to review the guidelines for the operational index in the light of the experience gained during trials and also to develop a CO_2 design index. Whilst reviewing the trial data, WG-AP observed large differences in CO_2 indexing for almost identical ships on similar voyages. WG-AP assumed that these differences were not due to shortcomings in the scheme and were most probably the result of differences in weather conditions and operational patterns (length of time of ballast voyages or spent waiting in port areas, whether the ship was fully laden, etc) concerning the specific utilization of individual ships involved in the trials.

GHG and Air Pollution module in GISIS

44 MEPC 56 (July 2007) decided to establish a central database for the results of the voluntary Ship CO_2 Emission Indexing to make the data accessible for comparison and further studies as a module in IMO's Global Integrated Ship Information System (GISIS). Member States are able to enter new data since early 2008 and the module is opened for public at www.imo.org/GISIS.

45 Resolution A.1029(26) on the Global Integrated Shipping Information System (GISIS) states that GISIS aims at facilitating, *inter alia*, Member States compliance with reporting requirements; urges Member States specifically to use GISIS reporting facilities to sustain and, even, enhance compliance with mandatory reporting requirements, as contained in those mandatory instruments to which they are Parties, thereby potentially assisting them in the context of the Voluntary IMO Member State Audit Scheme; and requests the Secretary-General to continue developing the system in close cooperation with Member States, the IMO organs, international organizations and all other stakeholders of the global maritime community, as appropriate.

Required Notifications under MARPOL Annex VI

46 Parties to MARPOL Annex VI are required to make notifications to the Organization for dissemination to the Members of the Organization (as per the revised MARPOL Annex VI adopted by resolution MEPC.176(58)). For this purpose, a GISIS module has been developed by the Secretariat as a portal for Parties to MARPOL Annex VI to make mandatory notifications to the Organization and to provide easy access to this information for the shipping industry. This GISIS module also aims at enhancing the rate of notification and potentially reducing the administrative burden for Parties wishing to notify the Organization. Further, if agreed, notification via GISIS would remove the requirement to notify the Organization via post.

47 The draft GISIS module was presented at MEPC 62 as document MEPC 62/4/1 but its detailed consideration will continue at the FSI Sub-Committee in March 2012.

GHG WORK PLAN WITH TIMETABLE

48 As follow-up to resolution A.963(23), MEPC 55 (October 2006) approved the Committee's **"Work plan to identify and develop the mechanisms needed to achieve the limitation or reduction of CO_2 emissions from international shipping"**, inviting Member Governments to participate actively in the work.

49 The work plan which included a timetable that culminated at MEPC 59 in July 2009 required the Committee to consider improving the CO_2 emission indexing method, establishing CO_2 emission baseline(s), and to consider other technical, operational and Market-Based Measures to deal with GHG emissions from ships in international trade.

50 As reflected in the above mentioned work plan, IMO's GHG work contained three distinct components: the technical measures that will mainly be applied to new ships, the operational measures for all ships (new and existing), and the MBMs providing incentives to the shipping industry by setting a price on its emissions.

FUNDAMENTAL PRINCIPLES FOR REGULATION OF GHG EMISSIONS FROM SHIPS

51 MEPC 57 (April 2008) acknowledged the importance of developing fundamental principles as a basis for future regulations and decided, by overwhelming majority, to take the below listed principles as its reference for further debate on GHG emissions from international shipping. A coherent and comprehensive future IMO framework should be:

.1 effective in contributing to the reduction of total GHG emissions;

.2 binding and equally applicable to all flag States in order to avoid evasion;

.3 cost-effective;

.4 able to limit, or at least, effectively minimize competitive distortion;

.5 based on sustainable environmental development without penalizing global trade and growth;

.6 based on a goal-based approach and not prescribe specific methods;

.7 supportive of promoting and facilitating technical innovation and R&D in the entire shipping sector;

.8 accommodating to leading technologies in the field of energy efficiency; and

.9 practical, transparent, fraud free and easy to administer.

52 A number of delegations expressed reservations on the principle of a binding regime applicable to all ships or flag States.

SECOND IMO GHG STUDY 2009

53 MEPC 55 (October 2006) agreed to update the first "IMO Study on GHG Emissions from Ships" that was issued in 2000 to provide a better foundation for future decisions and to assist in the follow-up to resolution A.963(23). The Terms of Reference for the update of the first "IMO Study on GHG Emissions from Ships" were adopted at MEPC 56 (July 2007). The work was, also for this study, undertaken by an international consortium of renowned research institutes with particular expertise within their respective fields. The Study is titled: **Second IMO GHG Study 2009** and was presented to MEPC 59 in July 2009 (MEPC 59/INF.10).

54 The Committee has been notably assisted in its work by the Second IMO GHG Study 2009, which has become the paramount reference for information in developing IMO's

strategy to limit and reduce GHG emissions from international shipping, as well as being the most comprehensive and authoritative assessment of the level of GHG emitted by ships, including its potential for reduction. The Study also evaluates the different policy options for control of GHG emissions from ships currently under consideration within IMO and other organizations. The Second IMO GHG Study 2009 may be found at: http://www5.imo.org/SharePoint/mainframe.asp?topic_id=1823

55 The Committee noted that the Second IMO GHG Study 2009 came to the following main conclusions, as outlined in its executive summary:

- Shipping was estimated to have emitted 1046 million tonnes of CO_2 in 2007, which corresponded to 3.3% of the global emissions during 2007. International shipping was estimated to have emitted 870 million tonnes, or about 2.7% of the global emissions of CO_2 in 2007.

- Exhaust gases were the primary source of emissions from ships. CO_2 was the most important GHG emitted by ships. Both in terms of quantity and of global warming potential, other GHG emissions from ships were less important.

- Mid-range emissions scenarios showed that, by year 2050, in the absence of policies, ship emissions could grow by 200 to 300% (compared to the emissions in 2007) as a result of the growth in world trade.

- A significant potential for reduction of GHG emissions through technical and operational measures had been identified. Together, if implemented, these measures could increase efficiency and reduce the emissions rate by 25% to 75% below the current levels. Many of these measures appeared to be cost-effective, although non-financial barriers may discourage their implementation.

- A number of policies to reduce GHG emissions from ships were conceivable. The report analysed options relevant to the current IMO debate. The report found that MBMs were cost-effective policy instruments with a high environmental effectiveness. Such instruments captured the largest amount of emissions under the scope, allowed both technical and operational measures in the shipping sector to be used, and could offset emissions in other sectors. A mandatory limit on the EEDI for new ships was a cost-effective solution that could provide an incentive to improve the design efficiency of new ships. However, its environmental effect was limited because it only applied to new ships and because it only incentivized design improvements and not improvements in operations.

- Shipping had been shown, in general, to be an energy efficient means of transportation compared to other modes.

- The emissions of CO_2 from shipping lead to positive “radiative forcing” (a metric of climate change) and to long-lasting global warming. In the shorter term, the global mean radiative forcing from shipping was negative and implied cooling; however, regional temperature responses and other manifestations of climate change may nevertheless occur. In the longer term, emissions from shipping would result in a warming response as the long-lasting effect of CO_2 would overwhelm any shorter-term cooling effects.

- If the climate was to be stabilized at no more than 2°C warming over pre-industrial levels by 2100 and emissions from shipping continue as projected in the scenarios that were given in the report, then they would constitute between 12% and 18% of the global total CO_2 emissions in 2050 that would be required to achieve stabilization (by 2100) with a 50% probability of success.

INTERIM TECHNICAL AND OPERATIONAL MEASURES ADOPTED IN 2009

56 A significant amount of work on technical and operational measures has been carried out in accordance with the MEPC 55 work plan. At MEPC 59 (July 2009) the Committee agreed to a package of technical and operational measures to reduce GHG emissions from international shipping aimed at improving the energy efficiency for new ships through improved design and propulsion technologies and for new and existing ships, primarily through enhanced operational practices. The package included the following four measures:

.1 interim guidelines on the method of calculation of the Energy Efficiency Design Index for new ships (EEDI) (MEPC.1/Circ.681);

.2 interim guidelines for voluntary verification of Energy Efficiency Design Index (MEPC.1/Circ.682);

.3 guidance for the development of a Ship Energy Efficiency Management Plan (SEEMP) (MEPC.1/Circ.683); and

.4 guidelines for voluntary use of the Energy Efficiency Operational Indicator (EEOI) (MEPC.1/Circ.684).

Further development of the Technical and Operation Measures

EEDI

57 The EEDI for new ships is the most important technical measure and it aims at promoting the use of more energy efficient (less polluting) equipment and engines. The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments. With the level being tightened incrementally every five years, the EEDI will 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, 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 CO_2 per ship's capacity-mile (the smaller the EEDI the more energy efficient ship design) and is calculated by a complex formula based on the technical design parameters for a given ship.

58 The CO_2 reduction level (grams of CO_2 per tonne mile) for the first phase is set to 10% and will be tightened every five years to keep pace with technological developments of new efficiency and reduction measures. IMO has set reduction rates until the period 2025 to 2030 when a 30% reduction is mandated for most ship types calculated from a baseline 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 70% of emissions from new ships covering the following ship types: oil and

gas tankers, bulk carriers, general cargo and container ships. For ship types not covered by the current formula, suitable formulas will be developed in the future addressing the largest emitters first. Annex 1 and 2 of this document provides more detailed information on the development and assessment of the EEDI.

SEEMP and EEOI

59 The SEEMP is an operational measure that establishes a mechanism to assist a shipping company and/or a ship to improve the energy efficiency of its ship operations in a cost-effective manner. The SEEMP provides an approach for monitoring ship and fleet efficiency performance over time using the EEOI as a monitoring tool and serves as a benchmark 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. The indicator 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. Annex 1 of this document provides more detailed information on SEEMP and EEOI.

Model Course for energy efficient operation ships

60 At MEPC 60 the Committee noted that to assist in achieving the visions and goals set out in resolution A.947(23) on the “Human Element Vision, Principles and Goals for the Organization”, and the principles and aims of resolution A.998(25) on the “Need for capacity-building for development and implementation of new and amendments to existing, instruments”, the Secretariat had engaged the World Maritime University (WMU) to develop a draft model course on energy efficient operation of ships (MEPC 60/INF.23).

61 At MEPC 61 the Committee noted the information provided in document MEPC 61/16/3 on the status report of the Organization's planned development of an IMO Model Course on Ship Energy Efficiency Management Plan in promoting the energy efficient operation of ships through a MoU with the World Maritime University (WMU).

62 The draft Model Course was submitted to MEPC 62 as document MEPC 62/INF.39. It was developed on the elements comprising the SEEMP as agreed at MEPC 59 (MEPC 59/24, annex 19) as well as on the Guidance for the development of a SEEMP as agreed and contained in MEPC.1/Circ.683. This draft model course 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.

63 The Committee agreed that the draft model course was an excellent start to providing a structured training course but that it required additional work to identify the relevant parts and information, such as key practical operational efficiency measures, which are pertinent to the ship’s deck and engineering officers. The Committee also considered important that consideration be given to integration of the SEEMP into the on board safety management system. In light of the improvements necessary to the Model Course, the Committee invited interested delegations to provide practical information and examples on the efficient operation of ships to the Secretariat by 31 August 2011 for inclusion in the IMO Model Course. The draft Model Course will be published in November 2011.

64 The purpose of the IMO model courses is to assist training providers and their teaching staff in organizing 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.

Mandatory Regulation on Energy Efficiency for Ships

65 MEPC 60 agreed by majority that MARPOL Annex VI was the appropriate vehicle to make the technical and operational measures mandatory. Subsequently, at MEPC 61 (September/October 2010), nine members (all parties to MARPOL Annex VI) requested the Secretary-General to circulate proposed amendments to MARPOL Annex VI to make mandatory, the EEDI for new ships and the SEEMP for all ships in operation, both of which have previously been disseminated for voluntary use.

66 The proposed amendments to MARPOL Annex VI were adopted by Parties to MARPOL Annex VI during MEPC 62 in July 2011 (resolution MEPC.203(62)), adding a new chapter 4 to Annex VI on *Regulations on energy efficiency for ships* to make mandatory the EEDI for new ships, and the SEEMP for all ships. The regulations apply to all ships of 400 gross tonnage and above and are expected to enter into force on 1 January 2013. However, under regulation 19, an Administration may waive the requirement for new ships of 400 gross tonnage and above from complying with the EEDI requirements. This waiver may not be applied to ships above 400 gross tonnage for which the building contract is placed four years after the entry into force date of chapter 4. The amendments to MARPOL Annex VI represent the first ever mandatory global GHG regime for an international industry sector or transport mode.

67 The adoption by IMO of mandatory reduction measures for all ships from 2013 and onwards will lead to significant emission reductions and also a cost saving for the shipping industry. By 2020, between 100 and 200 million tonnes of annual CO_2 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 between 230 and 420 million tonnes of CO_2 annually. In other words, the reductions will in 2020 be approximately between 10 and 17% and by 2030 between 19 and 26% below 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 estimate gives an average figure of US$50 billion by 2020 and of US$200 billion by 2030.

68 The new chapter also includes a regulation 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 IMO and other international bodies, to promote and provide, as appropriate, support directly or through 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.

69 MEPC 62 also agreed on a work plan and schedule for further development of the remaining EEDI and SEEMP related guidelines, EEDI framework for ship types and sizes and propulsion systems not covered by the current EEDI requirements. For this purpose, MEPC 62 agreed to terms of reference for an intersessional working group meeting on energy efficiency measures for ships that will take place in January 2012. The intersessional working group meeting should report to MEPC 63 in February/March 2012 and is tasked with:

.1 further improving, with a view to finalization at MEPC 63, draft Guidelines on the method of calculation of the EEDI for new ships; draft Guidelines for the development of a SEEMP; draft Guidelines on Survey and Certification of the EEDI; and draft interim Guidelines for determining minimum propulsion power and speed to enable safe manoeuvring in adverse weather conditions;

.2 considering the development of EEDI frameworks for other ship types and propulsion systems not covered by the draft Guidelines on the method of calculation of the EEDI for new ships;

.3 identifying the necessity of other guidelines or supporting documents for technical and operational measures;

.4 considering the EEDI reduction rates for larger tankers and bulk carriers; and

.5 considering the improvement of the guidelines on the Ship Energy Efficiency Operational Indicator (EEOI) (MEPC.1/Circ.684).

MARKET-BASED MEASURES

70 In line with the work plan adopted at MEPC 55 (October 2006), potential MBMs have been considered in-depth by every single MEPC since MEPC 56 (July 2006). The MEPC 55 work plan ceased at MEPC 59 (July 2009), where the Committee recognized that technical and operational measures would not be sufficient to satisfactorily reduce the amount of GHG emissions from international shipping in view of the growth projections of world trade. It was therefore agreed by overwhelming majority that a Market-Based Measure (MBM) was needed as part of a comprehensive package of measure for the effective regulation of GHG emissions from international shipping. The Committee therefore agreed upon a new work plan for the further consideration of MBMs. The new work plan guides the future discussions on MBMs as follows:

.1 Member States, Associate Members and observer organizations should endeavour to submit further detailed outlines of possible MBMs to MEPC 60 (March 2010);

.2 MEPC 60 would further consider the methodology and criteria for feasibility studies and impact assessments in relation to international shipping, giving priority to the overall impact on the maritime sectors of developing countries;

.3 taking into account the outcome and conclusions of the studies mentioned in paragraph 2 above and any other contribution made, the Committee would be able, preferably by MEPC 61 (September/October 2010), to clearly indicate which MBM it wishes to evaluate further and identify the elements that could be included in such a measure; and

.4 based on the outcome mentioned in paragraph 3, MEPC 62 (July 2011) could be in a position to report progress on the issue to the twenty-seventh regular session of the Assembly, to identify possible future steps.

71 MBMs place a price on GHG emissions and serve two main purposes:

.1 providing an economic incentive for the maritime industry to reduce its fuel consumption by investing in more fuel efficient ships and technologies and to operate ships in a more energy efficient-manner (in-sector reductions); and

.2 offsetting in other sectors of growing ship emissions (out-of-sector reductions).

In addition, MBMs can generate funds that could be used for different purposes such as adaptation and transfer of technology.

72 The MBMs proposals, from governments and observer organisations, that have been considered by the Committee in recent sessions range from contribution schemes for CO_2 emissions from international shipping (to be collected and transferred to a fund), via emission trading systems, to schemes based on the actual ship's efficiency both by design and operation.

Proposed Market Based Measures

73 To date, Governments and observer organizations proposed the following MBMs:

.1 **International Fund for GHG emissions from ships (GHG Fund) (Cyprus, Denmark, the Marshall Islands, Nigeria and IPTA (MEPC 60/4/8)):** Establishes a global reduction target for international shipping, set by either UNFCCC or IMO. Emissions above the target line would be offset largely by purchasing approved emission reduction credits. The offsetting activities would be financed by a contribution paid by ships on every tonne of bunker fuel purchased.

.2 **Leveraged Incentive Scheme (LIS) (Japan (MEPC 60/4/37)):** GHG Fund contributions are collected on marine bunker. Part thereof is refunded to ships meeting or exceeding agreed efficiency benchmarks and labelled as “good performance ships”.

.3 **Port State Levy (Jamaica (MEPC 60/4/40)):** Levies a uniform emissions charge on all vessels calling at their respective ports based on the amount of fuel consumed by the respective vessel on its voyage to that port (not bunker suppliers).

.4 **Ship Efficiency and Credit Trading (SECT) (United Sates (MEPC 60/4/12))**: Subjects all ships to mandatory energy efficiency standards. As one means of complying with the standard, an efficiency-credit trading programme would be established. These standards would become more stringent over time,

.5 **Vessel Efficiency System (VES) (World Shipping Council (MEPC 60/4/39)):** Establishes mandatory efficiency standards for new and existing ships. Each vessel would be judged against a requirement to improve its efficiency by X% below the average efficiency (baseline) for the specific vessel class and size. Standards would be tiered over time with increasing stringency. Existing ships failing to meet the required standard through technical modifications would be subject to a fee applied to each tonne of fuel consumed.

.6 **Global Emission Trading System (ETS) for international shipping (Norway (MEPC 61/4/22)):** Sets a sector-wide cap on net emissions from international shipping. A number of allowances (Ship Emission Units) corresponding to the cap would be released into the market each year via a global auctioning process. The units could then be traded.

.7 **Global Emissions Trading System (ETS) for international shipping (United Kingdom (MEPC 60/4/26)):** Differs from the Norwegian ETS proposal in two aspects: the method of allocating emissions allowances (national instead of global auctioning) and the approach for setting the emissions cap (set with a long term declining trajectory).

.8 **Emissions Trading System (ETS) for International Shipping (France (MEPC 60/4/41)):** Sets out additional details on auction design under a shipping ETS. In all other aspects the proposal is similar to the Norwegian ETS proposal.

.9 **Market-Based Instruments: a penalty on trade and development (Bahamas (MEPC 60/4/10)):** Insists that the imposition of any costs should be proportionate to the contribution by international shipping to global CO_2 emissions.

.10 **Rebate Mechanism (RM) for a market-based instrument for international shipping (IUCN (MEPC 60/4/55))**: Compensate developing countries for the financial impact of a MBM. It could be applied to any maritime MBM which generates revenue.

Feasibility Study and Impact Assessment

74 In line with the new work plan, MEPC 60 called for an Expert Group (EG) to undertake a feasibility study and impact assessment on the proposed measures. The EG was made up of experts nominated by Member Governments and organizations, but served in their own personal capacity. Consistent with the terms of reference given by the Committee, the EG was to evaluate the various proposals with the aim to assess the extent to which each proposed measure could assist in reducing GHG emissions from international shipping. The EG were requested to consider the following criteria in its analysis:

.1 environmental effectiveness;

.2 cost-effectiveness;

.3 potential to provide incentives to technological change and innovation and to accommodate existing emission reduction and energy efficiency technologies;

.4 practical feasibility of implementation;

.5 need for technology transfer to, and capacity building within, developing countries, in particular the least developed countries (LDCs) and the small island development states (SIDS);

.6 relation with other relevant conventions and compatibility with customary international law, as depicted in UNCLOS;

.7 potential additional administrative burden for the national administration;

.8 potential additional workload, economic burden, and operational impact for individual ships, the shipping industry and the maritime sector as a whole; and

.9 compatibility with the existing provisions under the IMO legal framework.

75 To manage the work load in a tight time scale, the EG established four task-groups: Environment, Shipping and Maritime, Administrative and Legal, and Trade and Development and Developing Countries.

Outcome of the Feasibility Study and Impact Assessment

76 EG noted that the evaluations of the measures had been complicated by the different levels of maturity of the proposals and that all proposals required further elaboration and development to enable a full assessment of all possible impacts in a comparable analysis. The EG concluded that all proposals addressed reduction of GHG emissions from shipping, although the proposed means of doing so differed with some proposals focusing on in-sector reductions and others also utilising reductions in other sectors. Some of the proposals went beyond mitigation and proposed a mechanism that provided for substantial contribution to address the adverse effects of climate change. Moreover, the EG found that all proposals could be implemented notwithstanding the challenges associated with the introduction of new measures and possible negative impacts such as increases in bunker fuel prices and freight costs. Some countries would be affected more than others by these impacts. Some proposals tried to mitigate such negative impacts.

77 The EG Report was presented at MEPC 61 (September/October 2010). The Committee was to a great extend assisted by the comprehensive EG report (the Executive Summary of the EG report is set up as Annex 3 to this document) and held an extensive debate on how to progress the development of suitable MBMs and recalled that the MEPC 59 work plan intended the outcome and conclusions of the EG to enable the Committee to indicate, preferably at MEPC 61, which MBM should be further evaluated. However, despite the EG Report no majority view prevailed. The Committee, therefore, agreed to hold an Intersessional Meeting of the Working Group on GHG Emissions from Ships (GHG-WG 3) in March 2011 tasking it with providing an opinion on the compelling need and purpose of MBMs as a possible mechanism to reduce GHG emissions from international shipping. The meeting was also tasked to evaluate further the proposed MBMs considered by the EG, including their impact on, among others, international trade, the maritime sector of developing countries, as well as the corresponding environmental benefits. The report from the Intersessional Meeting was to be submitted to MEPC 62 in July 2011 enabling the MEPC to make further progress in accordance with its work plan.

Third Intersessional Working Group on GHG Emissions from Ships

78 The Intersessional Meeting made steady progress in considering the development of suitable MBMs. It reviewed the proposed MBMs by *grouping them* and *evaluating the groups*, analysing the MBMs *relations to relevant conventions and rules* and by evaluating the MBMs *impacts* on, amongst others, international trade, the maritime sector of developing countries and the environment.

79 The Intersessional Meeting agreed to group MBM proposals (on in-sector; and in-sector and out-of-sector) and that no incompatibilities existed between IMO establishing an MBM for international shipping, for the purpose of reducing GHG from the sector, and customary international law as depicted in UNCLOS. However, there were some mixed

opinions on the need and purpose of an MBM and whether an MBM for international shipping under IMO was compatible with WTO Rules and UNFCCC Rules and Principles.

80 Moreover, the Intersessional Meeting also agreed that a further *impact* study was urgently needed, that it should build on the MBM-EG study, and should address both the positive and negative impacts for developing countries, including possible costs if no action was taken by international shipping. It also agreed also that further studies would be more meaningful and comprehensive when proposals are more detailed and matured, and it therefore urged MBM proponents to fully develop their proposals in the shortest possible time, preferably before MEPC 62, so that the necessary impact study could be undertaken, ideally prior to MEPC 63 (February/March 2012).

81 To sum up, the Intersessional Meeting held extensive exchange of views on issues related to the desirability of MBMs providing: certainty in emissions reductions or carbon price; revenues for mitigation, adaptation and capacity building activities in developing countries; incentives for technological and operational improvements in shipping; and offsetting opportunities. Based on such policy considerations, the Intersessional Meeting reported to MEPC 62 in accordance to its Terms of Reference, related to: the grouping of the MBMs; the strengths and weaknesses of the groups; their relation to relevant international conventions; and the aforementioned possible impacts.

82 The report of the Intersessional Meeting was submitted to MEPC 62 (July 2011) with the aim of assisting the Committee on which MBM to bring forward as a possible mandatory IMO instrument, so that the Committee could, in line with the MEPC 59 work plan, report progress to the twenty-seventh session of the Assembly.

83 MEPC 62, due to time constraints, could not consider the working group's advice and agreed to continue its consideration of MBMs at the next session (MEPC 63, February/March 2012).

OUTCOME OF MEPC 62

Historic climate deal in IMO

84 MEPC 62 in July 2011 continued its consideration of making the developed technical and operational measures mandatory by adding a new chapter 4 on energy efficiency to MARPOL Annex VI – *Regulations on the prevention of air pollution from ships*. MEPC 62 was held from 11 to 15 July 2011 at IMO's Headquarters in London. Very good momentum had been generated in the lead up to the session, during which parties involved in informal talks had showed great willingness to work out a compromise that could be accepted by all and be adopted by consensus.

85 A compromise proposal by Singapore (MEPC 62/6/21) included a possible phased-in implementation where administrations with the need for more time could waive the EEDI requirement for ships flying their flag for up to four years. A large number of delegations supported the proposal by Singapore and expressed interest in further consideration of how it could be incorporated in the draft regulatory text. Noting that an informal group convened by the MEPC Chairman was holding consultations with a view to seeking consensus among Member States on the proposed energy efficiency regulations, the Committee agreed that the proposal by Singapore provided scope for a compromise agreement as it contained elements around which a consensus could be built.

86 Assisted by an informal group convened by the Chairman, delegations embarked on negotiations involving capacity building and technical assistance to developing countries.

Being well aware that capacity building and technical assistance to administrations without the needed human and financial resources are essential elements for any new regulations to be effectively implemented and enforced in the world fleet of merchant vessels, the Committee successfully reached a compromise solution. The new chapter includes a regulation on "*Promotion of technical co-operation and technology transfer related to the improvement of energy efficiency of ships*", which requires Administrations, in co-operation with IMO and other international bodies, to promote and provide, as appropriate, support directly or through 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 new energy efficiency requirements.

87 On the challenging issue of application, a number of delegations opposed the possibility of port States to deny port entry for ships issued with an EEDI waiver as this would undermine the phased implementation, making the provision hollow. Other delegations felt the suggested timeline was excessive and should be shortened to one or maximum two years. Extensive informal negotiations were held until the Chairman was able to present to plenary a compromise text on a new chapter 4 on energy efficiency to be added to MARPOL Annex VI. The successful negotiations leading to a compromise text clearly indicated the Parties' willingness to find workable solutions and to respond to the urgent need for all industries to contribute to the combined effort to halt climate change.

88 In the informal negotiations led by the Chairman, development of a draft MEPC resolution on capacity building, technical assistance and transfer of technology also took place to complement the regulatory text in order to strengthen the technical assistance to developing countries. The resolution was intended to be adopted together with the energy efficiency regulations as a package. However, while good progress had been made during the informal negotiations it was not possible to finalize the draft resolution by consensus as there were several issues where divergence could not be overcome. As a result, a number of delegations opposed the adoption of the energy efficiency regulations during MEPC 62. The Chairman stated that he would further develop the draft MEPC resolution on capacity building, technical assistance and transfer of technology with a view to its final adoption at MEPC 63.

89 All delegations that intervened in the ensuing plenary debate expressed their admiration for the Chairman's strenuous efforts to bring all Members together and produce a text on the basis of which consensus might be reached. In this respect, some delegations considered that additional amendments and clarifications were required before adoption of the proposed text could be further considered, while other delegations were of the view that the text presented by the Chairman was the most delicate of compromises and should be considered as the final text for adoption.

90 The Secretary-General congratulated the Chairman and delegations for their hard work and statesmanlike attitude in drafting the compromise text. Recalling his opening remarks appealing to all Members to compromise, and noting that the proposed text had been carefully crafted on the basis of concessions made by all engaged in the consultations, he commended the text to the Committee as it represented a well-balanced outcome that was workable in today's shipping reality and which also preserved the universality of IMO's regulations and the unity of its membership. In turn, the Chairman thanked the Committee for its trust in his leadership on the issue, and commended the text inviting the Committee to adopt it.

91 The majority of delegations that responded to the Chairman's invitation supported adoption. However, the delegation of Saudi Arabia requested that a vote be held on adoption of the aforementioned draft amendments and the delegation of Brazil requested that the vote be undertaken by a roll-call. 59 of the 64 Parties to MARPOL Annex VI were present and eligible to vote. The following outcome of the roll call vote should be noted:

> **Yes: 49 Parties**: Antigua and Barbuda, Australia, Bahamas, Bangladesh, Belgium, Belize, Bulgaria, Canada, Cook Islands, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Ghana, Greece, Ireland, Italy, Japan, Kiribati, Latvia, Liberia, Lithuania, Luxembourg, Malaysia, Malta, Marshall Islands, Netherlands, Norway, Panama, Poland, Portugal, Republic of Korea, Romania, Russian Federation, Saint Kitts and Nevis, Samoa, Serbia, Singapore, Slovenia, Spain, Sweden, Tuvalu, Ukraine, United Kingdom, United States, Vanuatu
>
> **No: 5 Parties**: Brazil, Chile, China, Kuwait, Saudi Arabia
>
> **Abstain: 2 Parties**: Jamaica, Saint Vincent and the Grenadines
>
> **Not present in the room: 3 Parties**: Iran (Islamic Republic of), Kenya, Syrian Arab Republic

92 The roll call vote resulted in the adoption of mandatory measures to reduce GHG emissions from international shipping by Parties to MARPOL Annex VI representing the first ever mandatory global GHG reduction regime for an international industry sector.

93 The yes-voting countries represent roughly 80% of the world's merchant shipping tonnage flagged in developing or developed countries. Moreover, the universality of the regulatory measures now introduced into MARPOL Annex VI is well illustrated by the yes-voting countries as they represent all regions of the world – both exporters and importers, as well as the largest flag States, most of the large ship building nations and many of the countries such as the Pacific Islands States, that are most likely to suffer first from the effects of climate change. Furthermore, the yes-voting countries represent about 75% of CO_2 emissions from international shipping which, augurs well for the environmental effectiveness of the new IMO treaty obligations.

94 The amendments to MARPOL Annex VI Regulations for the prevention of air pollution from ships, add a new chapter 4 to Annex VI on *Regulations on energy efficiency for ships* to make mandatory the EEDI for new ships, and the SEEMP for all ships (resolution MEPC.203(62)). Other amendments add new definitions and requirements for survey and certification, including the format for the new International Energy Efficiency Certificate. The new regulations apply to all merchant ships of 400 gross tonnage and above regardless of the national flag they fly or the nationality of the owner, and are expected to enter into force globally on 1 January 2013. However, an Administration that considers that it on its industry needs more time to comply may waive the requirement for new ships from complying with the EEDI for up to four years.

95 The amendments to MARPOL Annex VI making energy efficiency standards mandatory constitute the first international climate change treaty provisions to be formally adopted since the Kyoto Protocol in 1997 and the first ever globally binding instrument introducing energy efficiency regulations for any international industry sector.

96 Commenting at the close of the session, on the outcome of MEPC, IMO Secretary-General Efthimios E. Mitropoulos expressed satisfaction at the many and various significant achievements with which the session should be credited. "Although not by consensus – which of course would be the ideal outcome – the Committee has now adopted amendments

to MARPOL Annex VI introducing mandatory technical and operational measures for the energy efficiency of ships. Let us hope that the work to follow on these issues will enable all Members to join in, so that the service to the environment the measures aim at will be complete," he said.

97 MEPC 62 agreed a work plan to continue the work on energy efficiency measures for ships, to include the development of EEDI frameworks for ship types and sizes, and propulsion systems, not covered by the current EEDI requirements and the development of EEDI and SEEMP-related guidelines. An intersessional working group meeting on energy efficiency measures for ships is scheduled to take place in January 2012 and will report its progress to MEPC 63 (February/March 2012).

98 Following the session, the IMO's Secretary-General wrote to his counterparts in the UN system stating:

> "I am very pleased to inform you of the decision of Parties to MARPOL Annex VI ... to adopt mandatory requirements introducing energy efficiency standards, which are aimed at the reduction of GHG emissions from ships engaged on international voyages.
>
> The amendments were adopted by an overwhelming majority of the Parties concerned, representing regions from across the globe and 79%, by tonnage, of the world's merchant fleet. The fact the amendments do not differentiate between flag States augurs well for the environment effectiveness of the standards adopted and, indeed, it may be said that the regulatory regime now put in place by IMO, with an expected entry into force date of 1 January 2013, constitutes the first ever global mandatory GHG reduction regime for an international industry sector.
>
> This was an historical landmark in IMO's work, leaving the environment as the sole winner in intensive negotiations that lasted four and a half years. It has come as a testimony to IMO's ability to rise to the circumstances and deliver a substancial contribution to the world's efforts to address climate change. I hope it sets a precedent to follow.
>
> I will be very happy to present the outcome of MEPC 62 to the forthcoming United Nations Climate Change Conference (COP 17) in Durban, where I would expect the world community to reiterate its trust in IMO continuing its perennial efforts to protect and preserve the environment, both marine and atmospheric."

99 In acknowledgement of the decision of the Parties to MARPOL Annex VI to adopt mandatory requirements introducing energy efficiency standards, which are aimed at the reduction of GHG emissions from ships engaged on international voyages, Mr. Ban Kin-moon, UN Secretary-General and Mrs. Christiana Figueres, UNFCCC Executive Director wrote to IMO's Secretary-General:

> ***Mr. Ban Kin-moon, UN Secretary-General:***
>
> "I would like to congratulate you on this significant outcome reached at IMO's MEPC 62. This underscores the fact that IMO is the best positioned to play a leadership role in addressing GHG emission from international shipping. This is indeed very welcome progress.
>
> I am confident that your presentation of the IMO outcome in this regard to the seventeenth session of the Conference of the Parties (COP 17) to the United Nations Framework Convention on Climate Change (UNFCCC) in Durban in

December 2011 could make a positive contribution to the respective discussions within UNFCCC.

I commend you and your colleagues in the IMO Secretariat for achieving this important outcome."

Mrs. Christiana Figueres, UNFCCC Executive Director:

"I would like to congratulate you on this outstanding result, which for the first time in history establishes a global mandatory GHG emission reduction regime for an entire economic sector. The International Maritime Organization (IMO) has certainly proven its strong leadership and commitment in addressing GHG emissions from international shipping. This success is a result of the untiring efforts of the IMO secretariat which, through its continuous work and high level of commitment, laid the foundation for this exceptional decision.

The adoption of mandatory efficiency standards for international shipping is a major step and a substantial contribution of the international shipping sector to global efforts in addressing climate change...

I would very much welcome IMO presenting the outcome of MEPC 62 and its contribution to global climate change actions to the Parties under the UNFCCC at the forthcoming COP 17 ... We encourage you to do so in the context of the Subsidiary Body for Scientific and Technological Advice, where Parties have invited the IMO secretariat to report in its relevant work on climate change...

Let me in this context reiterate the commitment of the UNFCCC secretariat to continuing to support and work collaboratively with IMO, its secretariat and Marine Environment Protection Committee, so as to ensure further progress on limiting and reducing GHG emissions from international shipping.

Thank you once again for your leadership and unfailing work in addressing this issue..."

Market-Based Measures and other matters

100 The adoption of mandatory technical and operational measures is a milestone in ensuring that the global shipping industry has the necessary mechanisms to reduce its GHG emissions. Nevertheless, it has been recognized by the Committee at various sessions that these measures would not be sufficient to reduce the amount of GHG emissions from international shipping in view of the growth projection of world trade. Therefore, MBMs have been considered by the Committee in line with Assembly resolution A.963(23) and its work plan.

101 Further work is needed on MBMs but the foundations have already been developed and will facilitate the finalization of a robust, comprehensive and efficient GHG regime, complementing IMO's regime of 53 international treaties regulating all non-commercial aspects of international shipping.

102 Due to time constraints, MEPC 62 was unable to consider MBMs or reduction targets for international shipping as well as other GHG-related issues which will continue to be addressed when the Committee meets again in February/March 2012 (MEPC 63)

CLIMATE FINANCE

103 Climate financing is one of the most important aspects of the world's efforts to address the climate change challenge. It is critical to catalysing efforts in developing countries to strengthen climate resilience, curb GHG emissions and support sustainable development. Timely climate financing can also strengthen trust among countries and generate progress in the negotiations taking place within UNFCCC.

104 Several of the proposed MBMs, the contributions schemes (levy) inherently and the trading schemes through auctioning; would generate funds the greater part of which is proposed to be used for climate change purposes in developing countries. At MEPC 59 in July 2009, the Committee noted that a general preference prevailed within the Committee that a greater part of the revenues generated by an MBM under the auspices of IMO should be used for climate change purposes in developing countries through existing or new funding mechanisms under the UNFCCC (such as the Adaptation Fund and the new Green Climate Fund) or other international organization.

105 In December 2009, at the United Nations Climate Change Conference in Copenhagen, industrialized countries set a goal of mobilizing $100 billion per year by 2020 to support mitigation and adaptation activities in developing countries. Such resources represent a sound investment in a safer, cleaner, healthier future for us all. But they need to be mobilized. Especially at a time when many Governments are experiencing fiscal and budgetary constraints, the world community need to make extra efforts to identify new, innovative and additional sources for the long-term financing that can make a difference.

High-level Advisory Group of the UN Secretary-General on Climate Change Financing

106 The Secretary-General of the United Nations, Mr. Ban Ki-moon, established, in February 2010, a High-level Advisory Group on Climate Change Financing (AGF). The Group was instructed to study potential sources of revenue to finance climate change actions in developing countries in the long term, following the political commitments made during the United Nations Climate Change Conference in Copenhagen, Denmark in December 2009.

107 MEPC 61 expressed its appreciation to the UN Secretary-General for his initiative to establish the AGF as making financing available to developing countries for mitigation and adaptation purposes was an urgent matter to support action on climate change.

The AGF Report and International Maritime Transport

108 The AGF report was presented to the Cancun Conference by Mr. Ban Ki-moon. The two Co-Chairs; Mr. Meles Zenawi, Prime Minister of the Federal Democratic Republic of Ethiopia and Mr. Jens Stoltenberg, Prime Minister of Norway presented the report and responded to questions.

109 Prime Minister Zenawi emphasized in his introduction that although the AGF had worked independently from the UNFCCC process, it had done the legwork for the UNFCCC Parties who now should decide how best to capitalize on the extensive work done and the balanced report presented. Prime Minister Stoltenberg underlined that the work had showed that raising US$100 billion annually by 2020 is challenging but possible and that international mechanisms are the preferred option over national solutions. Global mechanisms that provide both reduction incentives through carbon pricing and at the same time generate funds were, in his opinion, the best funding solutions. He further argued that no single source can raise the necessary financing but that a combination of several sources will be needed – for example US$10 billion per year from international aviation and maritime transport combined.

Cancún Agreements

110 One of the milestones reached at the Cancun Conference in 2010 relates to long-term financing, with developed countries having committed to the goal of jointly mobilizing US$100 billion per year by 2020 to address the needs of developing countries. A significant share of the new multilateral funding for adaptation is to flow through the Green Climate Fund. Whilst the funding sources are not yet identified, it has been approved that these funds may come from a wide variety of sources, including alternative sources, and note has been taken of the report of the High-level Advisory Group on Climate Change Financing, which considered the option of generating revenue through, *inter alia*, the application of MBMs to international maritime transport.

111 The Agreement reaffirms the pledge from the Copenhagen Accord of mobilizing funds to address the needs for climate change actions in developing countries. The Agreement (paragraph 98) recognizes that developed country Parties commit, in the context of meaningful mitigation actions and transparency on implementation, to a goal of mobilizing jointly US$100 billion per year by 2020 to address the needs of developing countries. The funding sources are not identified in the Agreement but its paragraph 99 indicates that they will come from a wide variety of sources, including alternative sources which may also include international maritime transport. The Agreement notes the AGF report in its paragraph 101.

IMO's work on an MBM for International Shipping and Climate Finance

112 At MEPC 59, the Committee noted that a general preference prevailed within the Committee that a greater part of the revenues generated by a MBM under the auspices of IMO should be used for climate change purposes in developing countries through existing or new funding mechanisms under the UNFCCC or other international organization such as the Green Climate Fund.

113 As is apparent from the table below that was prepared by the MBM-EG and included in its report to MEPC, the majority of the proposed MBMs currently under review have the potential to generate proceeds. These funds could be used to co-finance mitigation and adaptation actions and could, amongst others, be a potential source for Green Climate Fund to address the needs for climate change actions in developing countries.

Table 1: Potential of each MBM proposal under review by IMO to generate funds

	GHG Fund	Leveraged Incentive Scheme (LIS)	Port State Levy (PSL)	Ship Efficiency and Credit Trading (SECT)	Vessels Efficiency System (VES)	Emission Trading Scheme (ETS) (Norway, France)	Emission Trading Scheme (ETS) (UK)	Bahamas	Rebate Mechanism (RM)
Remaining proceeds ($billion)	$4-14	$10-87	$40-118	$0	$5-18	$28-87	$0[5]	0	$17-23[6]

114 IMO, as a United Nations observer organization holds a special position in the UNFCCC process being, together with ICAO, the only United Nations organizations to be specifically referred to in the Kyoto Protocol and the draft negotiation texts under both negotiation tracks. In the light of IMO's special position in the UNFCC process, its well-advanced mitigation work, and in particular, the potential of generating revenues for climate change finance through a market-based measure for international shipping, the IMO Secretariat seek to attend all relevant UNFCCC-negotiations, including the meetings of the Transitional Committee for the design of the Green Climate Fund.

World Bank and IMF work on mobilizing sources of climate finance

115 Responding to a request of the G-20 Finance Ministers in exploring scaled up finance for climate change adaptation and mitigation in developing countries, the World Bank (WB) and International Monetary Fund (IMF) have prepared a report that is due to be considered at the G-20 summit in France in early November 2011. In so doing it builds upon and extends the work of last year's High Level Advisory Group on Climate Finance and its starting point is the commitment made in the Copenhagen Accord and Cancún Agreements on the part of developed countries to provide new and additional resources for climate change activities in developing countries. This commitment approaches US$30 billion for the period 2010-12 and US$100 billion per year by 2020, drawing on a wide range of resources, public and private, bilateral and multilateral, including innovative sources.

116 While there is no precise internationally agreed definition of climate finance at present, the term broadly refers to resources that catalyze low-carbon and climate-resilient development. It covers the costs and risks of climate action, supports an enabling environment and capacity for adaptation and mitigation, and encourages R&D and deployment of new technologies. Climate finance can be mobilized through a range of instruments from a variety of sources, international and domestic, public and private. Consistent with the focus of the Copenhagen and Cancun understandings, the WB/IMF paper concentrates on climate finance flows from developed to developing countries.

117 The paper concludes that both public and private flows are indispensable elements of climate finance and that a starting point should be the removal of subsidies on fossil fuel use. It further states that comprehensive carbon pricing policies such as a carbon charge or emission trading with full auctioning of allowances are widely viewed as a promising option. It finds that policy reforms, institutional development and public outlays can leverage much larger flows of private or multilateral climate finance and that carbon offset markets can play an important role in catalyzing low-carbon investment in developing countries but now face major challenges. The authors conclude that private flows for climate mitigation related investment in developing countries have grown rapidly but remain hampered by market failures and other barriers. It further concludes that is important to determine which options for increased climate financing are most promising for prioritization in the near term and which for development over the medium term.

118 MBMs for international aviation and maritime bunker fuels are proposed as an innovative source of climate finance. The paper states that a globally coordinated carbon charge of US$25 per ton of CO_2 on these fuels could raise around US$40 billion per year by 2020, and would reduce CO_2 emissions from each sector by around 5 to 10 per cent. Charges on fuel used in international aviation and maritime transport would need to be carefully coordinated, and legal obstacles would need to be resolved. The flexibility operators have in the location where they take up fuel can undermine the application of fuel charges when this is less than universal, a risk that is especially great in maritime activities. Treaty obligations and bilateral air service agreements could impede applying fuel charges in international aviation. While implementation of these charges need not be especially difficult in principle, new governance frameworks would be needed to determine how charges (or emission levels) are set, control use of revenues and monitor and implement compensation arrangements. The impact on developing countries of such charges would likely be very modest and could be offset by explicit compensation schemes. While closer analysis of impacts is needed in order to design practicable compensation schemes, enough has been done to provide confidence that solutions can be found. Compensation for developing countries is unlikely to represent more than about 40 per cent of estimated global revenues, leaving US$24 billion or more for climate finance and other purposes.

Table 2: Illustrative Scenarios for Potential Elements of International Climate Finance Flows in 2020 (Source: Mobilizing Climate Finance by WB and IMF, October 2011)

	Revenue base ($ Bn.)	Illustrative climate finance allocation (%)	Climate finance flow ($ Bn.)
Sources of Public Finance			
Carbon Pricing ($25 per ton CO_2) in Annex II countries	250	10[(a)] - 20	25 - 50
MBMs for int'l aviation/maritime fuels ($25 per ton CO_2)	22 [(b)]	33[(a)] - 50	7 - 11
Fossil Fuel Subsidy Reform [(c)]	40 - 60	10 - 20	4 - 12
Instruments to Leverage Private and Multilateral Flows			
Carbon Offset Market Flows (various scenarios) [(d)]			20 - 100
Private flows leveraged by public policies and instruments [(e)]			100 - 200
MDB finance – pooled arrangements and/or capital [(f)]			30 - 40

[(a)] Consistent with AGF assumptions of 10 per cent allocation for carbon pricing and 25 - 50 per cent for MBMs.
[(b)] Revenues accruing to developed countries only.
[(c)] As discussed in Section 2.1.3, not all support mechanisms are necessarily inefficient and in need of reform. Precise revenue potential will depend on demand effects of reforms and interaction among tax expenditures, among other factors.
[(d)] $20 billion consistent with $20 - 25 per ton CO_2 scenario; $100 billion with 2 degree pathway scenario, as per Section 3.1 in main text.
[(e)] Gross foreign private flows to developing countries as per scenario in Table 3 and Section 3.2 in the main text.
[(f)] Reflects assumption discussed in Section 3.3 in the main text that every $10 billion in additional resources could be leveraged 3 - 4 times in additional MDB climate flows.

COMMON BUT DIFFERENTIATED RESPONSIBILITY PRINCIPLE *VERSUS* NON-DISCRIMINATION PRINCIPLE

119 Article 2.2 of the Kyoto Protocol, reads:

> "The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively."

120 A number of delegations have maintained the view that any GHG reduction measures to be adopted by IMO should only be applicable to Annex I parties to the UNFCCC and its Kyoto Protocol in accordance with the principle of CBDR. This principle was adopted by the UNFCCC and should be upheld in all international negotiations regarding climate change. In view of the different contributions to global environmental degradation, States should have common but differentiated responsibilities based on the Rio Declaration from 1992. These delegations have been unable to agree to mandatory emission reductions measures applicable to all flag States (all ships) and reasoned that developing countries (non-Annex I countries) cannot take on emission reduction commitments related to international shipping and that such measures on the part of developing countries should be on a voluntary basis only.

121 Other delegations have expressed the opinion that, given the global mandate of IMO, as regards safety of ships and the protection of the marine and atmospheric environment from all sources of ship pollution, the IMO regulatory framework on GHG emissions should be applicable to all ships, irrespective of the flags they fly. It has been stressed that, as three-quarters of the world's merchant fleet fly the flag of developing countries not listed in Annex I to the UNFCCC, any regulatory regime on the reduction of

GHG from shipping would become ineffective for the purpose of combating climate change, if applicable only to Annex I countries. IMO has its global mandate from the IMO Convention, Resolution 8 itself as well as from UNCLOS, and not from Article 2.2 of the Kyoto Protocol. There is no precedent in any of the more than fifty IMO treaty instruments currently in existence where measures are applied selectively to ships according to their flag. On the other hand, there are several international environmental agreements which have a differentiated approach, such as The Montreal Protocol (on substances that deplete the ozone layer), yet when IMO has dealt with the same issues, the principle of differentiated approach has not been taken on board.

122 At the beginning of MEPC 62 session the Secretary-General requested the Committee not to put political interest above those of the environment as there was an imperative need to think globally, and act globally without jeopardizing the unity of the Organization. The Secretary-General recalled that a divided IMO cannot stand simply because the international character of the industry it serves cannot afford a divided membership that might opt for standards other than global. The Secretary-General urged the Committee that there can be no breakthrough unless those standing for each side of the argument accept that both have a point to make; and that, for a successful outcome, both will have to make concessions.

123 Despite de eloquent speech of the Secretary-General the breakthrough achieved at IMO's MEPC 62 was not by consensus. Nevertheless, the Committee has now adopted amendments to MARPOL Annex VI introducing mandatory technical and operational measures for the energy efficiency of ships.

UNFCCC

Outcomes of COP 15 and COP 16 and way forward to COP 17

124 In 2009 the UN Climate Change Conference (COP 15) in Copenhagen, Denmark was expected to adopt a post-2012 treaty to combat climate change that would also address how GHG emissions from international civil aviation and maritime transported would be regulated in the future. However, those expectations were not met and only a non-legally binding Copenhagen Accord was adopted.

125 The expectations for the UN Climate Change Conference (COP 16) in Cancún, Mexico had been significantly lower but, nevertheless, the conference concluded with the adoption of the "Cancún Agreements".

126 Next to provisions on adaptation, mitigation, technology, deforestation and forest degradation, the Cancun Agreements acknowledges – like the Copenhagen Accord – the need to keep rises of the global average temperature below 2°C. Finance plays a crucial role in both – the Copenhagen Accord and the Cancun Agreement: the Agreement reaffirms the pledge from the Copenhagen Accord of mobilizing funds to address the needs for climate change actions in developing countries. The Agreement (paragraph 98) recognizes that developed country Parties commit, in the context of meaningful mitigation actions and transparency on implementation, to a goal of mobilizing jointly US$100 per year by 2020 to address the needs of developing countries. The funding sources are not identified in the Agreement but its paragraph 99 indicates that they will come from a wide variety of sources, including alternative sources which are generally understood to also include international maritime transport.

127 Although emissions from international maritime transport were discussed in depth during negotiations in Copenhagen and in Cancun, neither the Copenhagen Accord nor the

Cancun Agreements refer to emissions from international maritime transport. The most relevant outcomes for shipping at the conferences were next to the above mentioned provisions on finance, the decisions to extend the mandate of the Ad Hoc Working Group on Long Term Cooperative Action under the Convention (AWG-LCA), which, *inter alia*, is considering policy approaches to control GHG emissions from international maritime transport.

128 Being fully aware of the ultimate objective of the UNFCCC, which is to achieve stabilization of greenhouse gas concentrations at a level that prevents dangerous interference in the global climate system, IMO has sought a solution whereby a GHG control regime for international shipping, once enacted, will deliver real emission reductions and, at the same time, will contribute financially towards the wider efforts in combating climate change in developing countries.

129 With the adoption at IMO of global legally binding measures to reduce GHG emission from international shipping, IMO's COP 17/CMP 7 expectations are that as the Kyoto Conference did fourteen years ago, the global community will continue to place its confidence on the Organization for an effective contribution, from the shipping point of view, to the objectives this Conference pursues. IMO will spare no effort to do its duty in pursuing the mandate of its Assembly and Marine Environment Protection Committee and within any target or timeframe the present Conference may decide.

Cooperation between the Secretariats of IMO and UNFCCC

130 Following an invitation by UNFCCC, and as requested by the MEPC, there has been ongoing co-operation between the Secretariats of IMO and UNFCCC on the work of GHG emissions from international shipping concerning the use of bunker fuel oils since UNFCCC entered into force in 1994.

131 MEPC has repeatedly requested the IMO Secretariat to continue its cooperation with the UNFCCC by attending relevant UNFCCC meetings and bring the outcome of IMO's work to the attention of appropriate UNFCCC bodies and meetings. MEPC has also requested the Secretariat to continue reporting back to the Committee on progress and developments within UNFCCC related to emissions from international maritime transport.

132 The IMO Secretariat has participated in all climate change conferences since 1992 and as far as possible in the relevant preparatory meetings thereof. Moreover, the IMO Secretariat has regularly submitted documents to the relevant UNFCCC bodies and meetings.

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ANNEX 1

TECHNICAL AND OPERATIONAL ENERGY EFFICIENCY MEASURES FOR SHIPS

1 Introduction

1.1 In recent years, discussions at IMO have resulted in the development of an Energy Efficiency Design Index (EEDI) for ships and the Ship Energy Efficiency Management Plan (SEEMP) that have the broad and emphatic support of Governments, industry associations and organizations representing civil society interests. All are united in the same purpose: to ensure that the EEDI and SEEMP delivers environmental effectiveness by generating, through enhanced energy efficiency measures, significant reductions in GHG emissions from international shipping.

1.2 Numerous stakeholders – policy-makers, shipowners, naval architects, class societies, etc. – are contributing to this endeavour, providing technical and other input to the debate, leading to the development of an instrument that is eminently suited for its intended purpose.

2 IMO's Energy Efficiency Design Index

2.1 Shipping is permanently engaged in efforts to optimize fuel consumption, e.g., through the development of more efficient engines and propulsion systems, optimized hull designs and larger ships, and thereby achieved a noteworthy reduction in fuel consumption and resulting CO_2 emissions on a capacity basis (tonne-mile). Although ships are the most fuel efficient mode of mass transport, the Second IMO GHG Study 2009 identified a significant potential for further improvements in energy efficiency mainly by the use of already existing technologies. Additional improvements in hull, engine and propeller designs, together with reduction in operational speed, may lead to considerable reductions as illustrated in Table 1.

Table 1: Potential reductions of CO_2 emissions by using existing technology and practices (Source: Second IMO GHG Study 2009)

<table>
<tr><th>DESIGN (New ships)</th><th>Saving of CO_2/tonne-mile</th><th>Combined</th><th>Combined</th></tr>
<tr><td>Concept, speed and capability</td><td>2% to 50%+</td><td rowspan="6">10% to 50%+</td><td rowspan="9">25% to 75%+</td></tr>
<tr><td>Hull and superstructure</td><td>2% to 20%</td></tr>
<tr><td>Power and propulsion systems</td><td>5% to 15%</td></tr>
<tr><td>Low-carbon fuels</td><td>5% to 15%*</td></tr>
<tr><td>Renewable energy</td><td>1% to 10%</td></tr>
<tr><td>Exhaust gas CO_2 reduction</td><td>0%</td></tr>
<tr><td>OPERATION (All ships)</td><td colspan="2"></td></tr>
<tr><td>Fleet management, logistics and incentives</td><td>5% to 50%+</td><td rowspan="3">10% to 50%+</td></tr>
<tr><td>Voyage optimization</td><td>1% to 10%</td></tr>
<tr><td>Energy management</td><td>1% to 10%</td></tr>
</table>

+ Reductions at this level would require reductions of operational speed.
* CO_2 equivalent, based on the use of Liquefied Natural Gas (LNG).

2.2 The EEDI addresses improvements in energy efficiency by requiring a minimum energy efficiency level for new ships; by stimulating continued technical development of all the components influencing the fuel efficiency of a ship; and by separating the technical and design-based measures from the operational and commercial ones. It is already being used to enable a comparison to be made of the energy efficiency of individual ships with similar

ships of the same size that could have undertaken the same transport work (i.e. moved the same cargo).

Applicability

2.3 The EEDI formula – as presently drafted – is not supposed to be applicable to all ships. Indeed, it is explicitly recognized that it is not suitable for all ship types (particularly those not designed to transport cargo) or for all types of propulsion systems (e.g., ships with diesel-electric, turbine or hybrid propulsion systems will need additional correction factors).

2.4 Indeed, the first iteration of the EEDI has been purposefully developed for the largest and most energy intensive segments of the world merchant fleet, thus embracing 70% of emissions from new ships and covering the following ship types: oil and gas tankers, bulk carriers, general cargo ships, refrigerated cargo carriers and container ships. For ship types not covered by the current formula, suitable formulae will be developed in due course to address the largest emitters first. IMO's Marine Environment Protection Committee (MEPC) is poised to consider the matter in detail at future sessions, with a view to adopting further iterations of the EEDI.

Purpose of the EEDI

2.5 The Energy Efficiency Design Index for new ships creates a strong incentive for further improvements in ships' fuel consumption. The purpose of IMO's EEDI is:

- to require a minimum energy efficiency level for new ships;
- to stimulate continued technical development of all the components influencing the fuel efficiency of a ship;
- to separate the technical and design based measures from the operational and commercial measures (they will/may be addressed in other instruments); and
- to enable a comparison of the energy efficiency of individual ships to similar ships of the same size which could have undertaken the same transport work (moved the same cargo).

2.6 The EEDI establishes a minimum energy efficiency requirement for new ships depending on ship type and size and is a robust mechanism to increase the energy efficiency of ships step-wise for many decades to come. The EEDI is a non-prescriptive, 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 would be free to use the most cost-efficient solutions for the ship to comply with the regulations. The reduction level in the first phase is set to 10% and will be tightened every five years to keep pace with technological developments of new efficiency and reduction measures. IMO has set reduction rates up to 2025 from when a 30% reduction is mandated for most ship types calculated from a reference line representing the average efficiency for ships built between 1999 and 2009.

Implementation

2.7 The following circulars were issued (17 August 2009) following MEPC 59 and may be found on the IMO website: www.imo.org:

.1 the EEDI formula was circulated as MEPC.1/Circ.681, Interim Guidelines on the method of calculation of the Energy Efficiency Design Index for new ships (annex 17 to MEPC 59/24);

.2 the EEDI verification procedure was circulated as MEPC.1/Circ.682, Interim guidelines for voluntary verification of the EEDI (annex 18 to MEPC 59/24);

.3 the SEEMP was circulated as MEPC.1/Circ.683, Guidance for the development of a SEEMP (annex 19 to MEPC 59/24); and

.4 the EEOI was circulated as MEPC.1/Circ.684, Guidelines for voluntary use of the ship EEOI (annex 20 to MEPC 59/24).

EEDI coverage

2.8 The EEDI is developed for the largest and most energy intensive segments of the world merchant fleet and will embrace 70% of emissions from new ships covering the following ship types: oil and gas tankers, bulk carriers, general cargo and container ships. For ship types not covered by the current formula, suitable formulas For ship types not covered by the current EEDI formula, suitable formulas are likely to be developed in the future according to work plan agreed at MEPC 62.

The EEDI formula

2.9 The EEDI provides a specific figure for an individual ship design, expressed in grams of CO_2 per ship's capacity-mile (a smaller EEDI value means a more energy efficient ship design) and calculated by the following formula based on the technical design parameters for a given ship:

$$\frac{\left(\prod_{j=1}^{M} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}*\right) + \left(\left(\prod_{j=1}^{M} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}\right)}{f_i \cdot Capacity \cdot V_{ref} \cdot f_w}$$

That can be illustrated by the following simplified formula:

$$EEDI = \frac{CO_2 \ emission}{transport \ work}$$

2.10 The CO_2 emission represents total CO_2 emission from combustion of fuel, including propulsion and auxiliary engines and boilers, taking into account the carbon content of the fuels in question. If shaft generators or innovative mechanical or electrical energy efficient technologies are incorporated on board a ship, these effects are deducted from the total CO_2 emission. The energy saved by the use of wind or solar energy will also is deducted from the total CO_2 emissions, based on actual efficiency of the systems.

2.11 The transport work is calculated by multiplying the ship's capacity as designed with the ship's design speed measured at the maximum design load condition and at 75% of the rated installed shaft power. Speed is the most essential factor in the formula and may be reduced to achieve the required index.

Status of the EEDI

2.12 The EEDI was circulated in August 2009 for trial purposes to ensure its feasibility and for further improvement of the calculation method. The regulatory text introducing the EEDI as a mandatory measure for all new ships under MARPOL Annex VI was adopted by Parties to MARPOL Annex VI in July 2011. The amendments to MARPOL Annex VI are expected to enter into force on 1 January 2013.

Safe Speed

2.13 The need for a minimum speed to be incorporated into the EEDI formula has been duly acknowledged by the MEPC and, to that end, regulation 21.5 states that "For each ship to which this regulation applies, the installed propulsion power shall not be less than the propulsion power needed to maintain the manoeuvrability of the ship under adverse conditions, as defined in the guidelines to be developed by the Organization."

2.14 It should, therefore, be clear that IMO fully supports the view that a minimum installed power to maintain safe navigation in adverse weather conditions is of critical importance to ensure both the safety and efficiency of international shipping. While the EEDI instrument therefore contains the standard to be achieved on this matter, implementation of that standard will be enabled through guidelines that are also to be adopted. With technical input from all concerned parties, these guidelines will be further developed. A draft set of such guidelines will be considered for adoption by the MEPC in March 2012.

Installed Power

2.15 Although the easiest way to improve a ship's fuel efficiency is, indeed, to reduce speed – hence the move to slow steaming by a significant number of ships – there is a practical minimum at which fuel efficiency will decrease as a ship is slowed down further. There are other ways to improve fuel efficiency, such as waste heat generators, which do not impact on speed (they impact on auxiliary engines). Indeed, improvements in road transport efficiency have been made through advances in technology that have, however, not led to a sacrifice in speed; rather, quite the opposite.

2.16 It has been (wrongly) argued that the EEDI limits installed power and so induces owners to use small-bore high-rpm engines, thereby increasing fuel consumption. However, a reduction of installed power does not require a reduction in engine bore and increasing rpm. The easiest way to reduce power would be to "de-rate" the exact same engine by limiting the "maximum" rpm (remember, horsepower = torque multiplied by rpm). This would have the impact of increasing propeller efficiency (if the exact same propeller is installed), as propeller efficiency will generally improve as rpm decreases. Another practical way to reduce installed horsepower is to install an engine with one cylinder fewer. This would have no impact on specific fuel consumption or rpm. Such engines can be identified by reference to the catalogues of major engine manufacturers.

2.17 Of course, there are "economies of scale" in ships' fuel efficiency. The larger the ship is (at a given speed), the lower the fuel consumption per unit of cargo. However, such economies of scale are limited by trade considerations, physical port limitations (generally, draft) or cargo logistics issues. Therefore, ships tend to be designed to be as large as practical for a given trade.

Future developments

2.18 The EEDI formula is not applicable to all ship types e.g., Ro-Ro ships, or all types of propulsion systems, e.g., ships with diesel-electric, turbine or hybrid propulsion systems will

need additional correction factors, and MEPC will consider the matter in detail at future sessions.

Conclusions EEDI

2.19 The EEDI establishes a minimum energy efficiency requirement for new ships depending on ship type and size and is a robust mechanism that may be used to increase the energy efficiency of ships stepwise to keep pace with technical developments for many decades to come. The EEDI is a non-prescriptive mechanism that leaves the choice of what technologies to use in a ship design to the stakeholders as long as the required energy efficiency level is attained enabling the most cost-efficient solutions to be used.

2.20 Introduction of the EEDI as a mandatory measure for all ships will mean, provided it enters into force as expected on 1 January 2013; that between 31 and 42 million tonnes of CO_2 will be removed from the atmosphere annually by 2020 compared with business as usual depending on the growth in world trade. For 2030, the reduction will be between 155 and 224 million tonnes annually from the introduction of the EEDI. By 2050, the estimated annual reductions are 603 and 995 million tonnes of CO2 respectively.

3 Verification of the EEDI

3.1 Regulation 20 of the regulatory text requires the attained EEDI for a new ship to be verified. Guidelines on verification of the EEDI are to be considered for adoption at MEPC in March 2012 to assist verifiers (ship surveyors) of the EEDI in conducting the verification in a uniform manner. The guidelines will also assist shipowners, shipbuilders as well as engine and equipment manufacturers, and other interested parties, in understanding the procedures of EEDI verification.

Verification in two stages

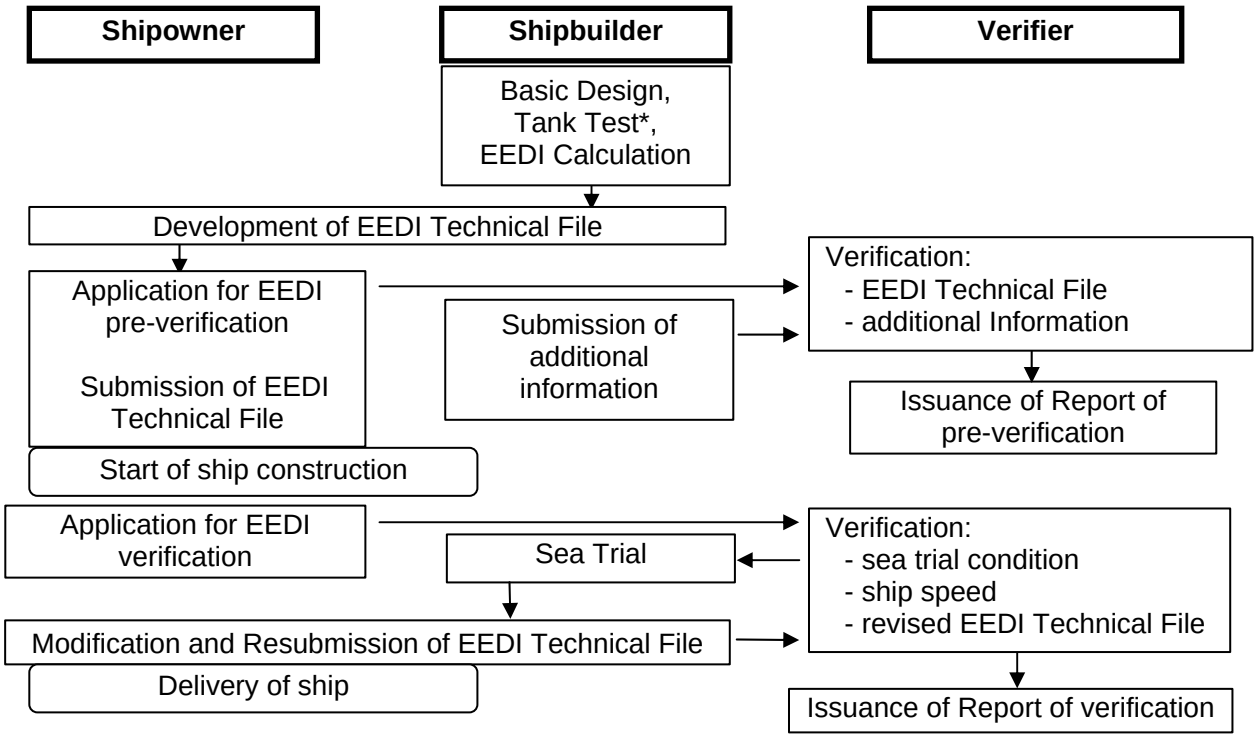
3.2 The attained EEDI should be calculated in accordance with the EEDI calculation Guidelines. EEDI verification should be conducted on two stages: preliminary verification at the design stage, and final verification at the sea trial, before issuance of the final report on the verification of the attained EEDI. The basic flow of the verification process is presented in Figure 1.

Preliminary verification at the design stage

3.3 For the preliminary verification at the design stage, a shipowner should submit to a verifier (e.g., a Maritime Administration or a Classification Society) an application for the verification and an EEDI Technical File containing the necessary information for the verification and other relevant background documents as required by the guidelines.

Final verification of the Attained EEDI at sea trial

3.4 Prior to the sea trial, a shipowner should submit the application for the verification of the EEDI together with the final displacement table and the measured lightweight, as well as other technical information as necessary. The verifier should attend the sea trial and confirm compliance in accordance with the guidelines and the EEDI guidelines.



* to be conducted by a test organization or a shipbuilder itself.

Figure 1: Basic Flow of EEDI Verification Process

Issuance of the EEDI verification report

3.5 The verifier should issue the Report on the Preliminary Verification of EEDI after it verified the Attained EEDI at design stage in accordance with the guidelines. Following the sea trial, the verifier should issue the final report on the verification of the attained EEDI after it verified the Attained EEDI at the sea trial in accordance with the guidelines.

Status of the verification guidelines

3.6 The guidelines are applied to new ships for which an application for EEDI verification has been submitted to a verifier, and form part of the regulatory framework governing the scheme.

4 GUIDANCE FOR THE DEVELOPMENT OF A SEEMP

4.1 The purpose of the Ship Energy Efficiency Management Plan (SEEMP) is to establish a mechanism for a company and/or a ship to improve the energy efficiency of ship operations. Preferably, the ship-specific SEEMP is linked to a broader corporate energy management policy for the company that owns, operates or controls the ship. It should be recognized that the international fleet of merchant vessels comprises a wide range of ship types and sizes that differ significantly in their design and purpose, and that ships operate under a broad variety of different conditions.

4.2 Sea transport has a justifiable image of conducting its operations in an energy efficient way, and in a manner that creates little impact on the global environment. It is nevertheless the case that enhancement in efficiencies can reduce fuel consumption, save money, and decrease the environmental impacts from ships. While the yield of individual measures may be small, the collective effect across the entire fleet will be significant. In

global terms it should be recognized that operational efficiencies delivered by a large number of ships will make a valuable contribution to reducing global carbon emissions.

Practical approach

4.3 Mandatory management plans are used to regulate a range of ship operations where traditional command and control regulations would not work, and is also the chosen option for reduction of GHG emissions from operation of ships engaged in international trade. To regulate ship operations by traditional prescriptive regulations (as is the customary practice for technical regulations) is not feasible, e.g., to determine the most energy efficient speed, optimum ship handling practices or the preferred ballast conditions for all ships in a set of regulations could hardly be done and keeping it updated would not be possible. A management plan is a familiar tool for the shipping industry and provides a flexible mechanism where shipowners and operations can choose the most cost-effective solutions for their ships and their operations.

4.4 The SEEMP provides an approach for monitoring ship and fleet efficiency performance over time and forces the responsible persons and entities to consider new technologies and practices when seeking to optimize the performance of the ship. The Second IMO GHG Study 2009 indicates that a 20% reduction on a tonne-mile basis by mainly operational measures is possible and would be cost-effective even with the current fuel prices, and the SEEMP will assist the shipping industry in achieving this potential.

4.5 The circular provides guidance for the development of a SEEMP that should be adjusted to the characteristics and needs of individual companies and ships. The SEEMP is a management tool to assist a company in managing the ongoing environmental performance of its vessels and, as such, it is recommended that the plan be implemented in a manner which limits any onboard administrative burden to the minimum necessary.

Ship-specific plan

4.6 The SEEMP should be developed as a ship-specific plan by the shipowner, operator or any other party concerned, e.g., the charterer. The SEEMP seeks to improve a ship's energy efficiency through four steps: *planning*, *implementation*, *monitoring*, and *self-evaluation and improvement*. These components play a critical role in the continuous cycle to improve ship energy management.

Status of the SEEMP

4.7 The regulatory text introducing the SEEMP as a mandatory measure for all ships under MARPOL Annex VI was adopted by Parties to MARPOL Annex VI in July 2011. The amendments to MARPOL Annex VI are expected to enter into force on 1 January 2013.

Guidance on best practices for fuel-efficient operation of ships

4.8 The circular contains guidance on best practices related to voyage performance, optimized ship handling, hull and propulsion system maintenance, the use of waste heat recovery systems, improved fleet management, improved cargo handling and energy management. It also covers areas such as fuel types, compatibility of measures, age and operational service life of a ship as well as trade and sailing area.

A sample form of a SEEMP is presented below for illustrative purposes

Name of Vessel:		GT:	
Vessel Type:		Capacity:	
Date of Development:		Developed by:	
Implementation Period:	From: Until:	Implemented by:	
Planned Date of Next Evaluation:			

1 Measures

Energy Efficiency Measures	**Implementation** (including the starting date)	**Responsible Personnel**
Weather Routeing	<Example> Contracted with [Service providers] to use their weather routeing system and start using on trial basis as of 1 July 2012.	<Example> The master is responsible for selecting the optimum route based on the information provided by [Service providers].
Speed Optimization	While the design speed (85% MCR) is 19.0 kt, the maximum speed is set at 17.0 kt as of 1 July 2012.	The master is responsible for keeping the ship speed. The log-book entry should be checked every day.

2 Monitoring

– Description of monitoring tools (e.g. the EEOI, or another suitable indicator or MRV tool)

3 Goal

– Measurable goals

4 Evaluation

– Procedures of evaluation

5 The Energy Efficiency Operational Indicator (EEOI)

5.1 Improvements in energy efficiency are possible by operational measures, such as fleet management, voyage optimization and energy management, with 10 to 50% reductions of CO_2 emissions (on a capacity mile basis) estimated through the combined use of these measures. Saving energy at the operational stage is presently addressed by the SEEMP and the Energy Efficiency Operational Indicator (EEOI) can be used as a monitoring tool and to establish benchmarks for different ship segments of the world fleet categorized by ship type and size.

Purpose of the EEOI

5.2 Guidelines for voluntary use of the ship Energy Efficiency Operational Indicator have been developed to establish a consistent approach for measuring ships energy efficiency at each voyage or over a certain period of time, which will assist shipowners and ship operators in the evaluation of the operational performance of their fleet. As the amount of CO_2 emitted from ships is directly related to the consumption of bunker fuel oil, the EEOI can also provide useful information on a ship's performance with regard to fuel efficiency.

5.3 The EEOI enables continued monitoring of individual ships in operation and thereby the results of any changes made to the ship or its operation. The effect of retrofitting a new and more efficient propeller would be reflected in the EEOI value and the emissions reduction could be quantified. The effect on emissions by changes in operations, such as introduction of just in time planning or a sophisticated weather routing system, will also be shown in the EEOI value.

EEOI coverage

5.4 The EEOI can be applied to almost all ships (new and existing) including passenger ships, however it cannot be applied to ships that are not engaged in transport work, such as service and research vessels, tug boats or FPSOs, as it is the transport work that is the input value together with emissions (fuel consumed x CO_2 factors for different fuel types).

The EEOI formula

5.5 The EEOI provides a specific figure for each voyage. The unit of EEOI depends on the measurement of cargo carried or the transport work done, e.g., tonnes CO_2/(tonnes·nautical miles), tonnes CO_2/(TEU·nautical miles) or tonnes CO_2/(person·nautical miles), etc. The EEOI is calculated by the following formula, in which a smaller EEOI value means a more energy efficient ship:

$$EEOI = \frac{actual\ CO_2\ emission}{performed\ transport\ work}$$

5.6 The actual CO_2 emission represents total CO_2 emission from combustion of fuel on board a ship during each voyage, which is calculated by multiplying total fuel consumption for each type of fuel (distillate fuel, refined fuel or LNG, etc.) with the carbon to CO_2 conversion factor for the fuel(s) in question (fixed value for each type of fuel).

5.7 The performed transport work is calculated by multiplying mass of cargo (tonnes, number of TEU/cars, or number of passengers) with the distance in nautical mile corresponding to the transport work done.

Status of the EEOI

5.8 The EEOI is circulated to encourage shipowners and ship operators to use it on a voluntary basis and to collect information on the outcome and experiences in applying it. The EEOI will be used as a monitoring tool in the SEEMP and to establish benchmarks.

GHG module in GISIS

5.9 To collect EEOI data and make them accessible to Member States and the shipping industry, a GHG module was established in GISIS (IMO's central database) to enable further research work and the establishment of benchmarks for different ship segments (type and size). A sample data in the GHG module is presented below. When fuel consumption data, cargo quantity and voyage distance are completed, the CO_2 emission and the voyage index will be calculated automatically:

HFO (tonnes)	LNG (tonnes)	MDO (tonnes)	Cargo unit	Distance (n.miles)	CO_2 emission	Voyage index
44.46	---	2	475.2	967	145	315
108.78	---	0.8	1051.2	1861	341	174

***

ANNEX 2

EXECUTIVE SUMMARY OF THE STUDY ON ASSESSMENT OF IMO MANDATED ENERGY EFFICIENCY MEASURES FOR INTERNATIONAL SHIPPING

1 This study was commissioned by the International Maritime Organization (IMO) to analyse the potential reduction resulting from the mandated energy efficiency regulations on EEDI and SEEMP as finalised at MEPC 62 in July 2011 and also to estimate the projected reduction in CO_2 emissions from international shipping for every year up to year 2050 resulting from these agreed measures, using a number of scenarios.

2 This Study was undertaken by Lloyd's Register (LR) in partnership with Det Norske Veritas (DNV). Dr. Zabi Bazari (LR) and Mr. Tore Longva (DNV) were the main contributors to the report. They additionally received assistance from colleagues within their organizations.

3 Mandatory measures to reduce greenhouse gas (GHG) emissions from international shipping were adopted by Parties to MARPOL Annex VI represented in the Marine Environment Protection Committee (MEPC) of IMO, when it met for its 62nd session from 11 to 15 July 2011 in London, representing the first ever mandatory global GHG reduction regime for an international industry sector.

4 The amendments to MARPOL Annex VI - *Regulations for the prevention of air pollution from ships,* add a new chapter 4 to Annex VI *on Regulations on energy efficiency for ships* to make mandatory the Energy Efficiency Design Index (EEDI) for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships. Other amendments to Annex VI add new definitions and the requirements for survey and certification, including the format for the International Energy Efficiency Certificate. The regulations apply to all ships of 400 gross tonnage and above, and are expected to enter into force internationally through the tacit acceptance procedure on 1 January 2013.

Reduction factors (in percentage) for the EEDI relative to the reference line for each ship type.

	Size	Phase 0 1 Jan 2013 – 31 Dec 2014	Phase 1 1 Jan 2015 – 31 Dec 2019	Phase 2 1 Jan 2020 – 31 Dec 2024	Phase 3 1 Jan 2025 onwards
Bulk Carriers	>20,000 Dwt	0%	10%	20%	30%
	10-20,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Gas tankers	>10,000 Dwt	0%	10%	20%	30%
	2-10,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Tanker and combination carriers	>20,000 Dwt	0%	10%	20%	30%
	4-20,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Container ships	>15,000 Dwt	0%	10%	20%	30%
	10-15,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
General Cargo ships	>15,000 Dwt	0%	10%	15%	30%
	3-15,000 Dwt	n/a	0-10%*	0-15%*	0-30%*
Refrigerated cargo carriers	>5,000 Dwt	0%	10%	15%	30%
	3-5,000 Dwt	n/a	0-10%*	0-15%*	0-30%*

* The reduction factor is to be linearly interpolated between the two values depending on the vessel size. The lower value of the reduction factor is to be applied to the smaller ship size.

Table i – EEDI reduction factors, cut off limits and implementation phases

5 The EEDI requires a minimum energy efficiency level (CO_2 emissions) per capacity mile (e.g. tonne mile) for different ship type and size segments (Table i). With the level being tightened over time, the EEDI will stimulate continued technical development of all the

components influencing the energy efficiency of a ship. Reduction factors are set until 2025 when a 30% reduction is mandated over the average efficiency for ships built between 1999 and 2009. The EEDI has been developed for the largest and most energy intensive segments of the world merchant fleet and will embrace about 70% of emissions from new oil and gas tankers, bulk carriers, general cargo, refrigerated cargo and container ships as well as combination carriers (wet/dry bulk). For ship types not covered by the current EEDI formula, suitable formulas will be developed in the future according to a work plan agreed at MEPC 62.

6 The SEEMP establishes a mechanism for a shipping company and/or a ship to improve the energy efficiency of ship operations. The SEEMP provides an approach for monitoring ship and fleet efficiency performance over time using, for example, the Energy Efficiency Operational Indicator (EEOI) as a monitoring and/or benchmark tool. The SEEMP urges the ship owner and operator at each stage of the operation of the ship to review and consider operational practices and technology upgrades to optimize the energy efficiency performance of a ship.

7 In this study, scenario modelling was used to forecast possible world's fleet CO_2 emission growth trajectories to 2050. The scenarios included options for fleet growth, EEDI and SEEMP uptake, fuel price and EEDI waiver. Table ii shows the combined scenarios modelled in this Study.

8 A model, designed specifically to account for the uptake of emission reduction technologies and measures and the implementation of regulations to control emissions, has been used to predict CO_2 emission levels to 2050. The model keeps track of the year of build for all ships, and scraps the oldest and least energy efficient ships first. By including the scrapping rate, the renewal rate of the fleet is taken into account.

Scenario	IPCC growth scenario	EEDI Uptake scenario	SEEMP uptake	Fuel price scenarios	Waiver scenario
A1B-1	A1B	Regulation	Low*	Reference	5%
A1B-2	A1B	Regulation	Low	High	5%
A1B-3	A1B	Regulation	High**	Reference	5%
A1B-4	A1B	Regulation	High	High	5%
B2-1	B2	Regulation	Low	Reference	5%
B2-2	B2	Regulation	Low	High	5%
B2-3	B2	Regulation	High	Reference	5%
B2-4	B2	Regulation	High	High	5%
A1B-3W	A1B	Regulation	High	Reference	30%

* 30% ** 60%

Table ii – Combined scenarios

9 Based on scenarios modelled in this Study, results shows that the adoption by IMO of mandatory reduction measures from 2013 and onwards will lead to significant emission reductions by the shipping industry (see Figure i).

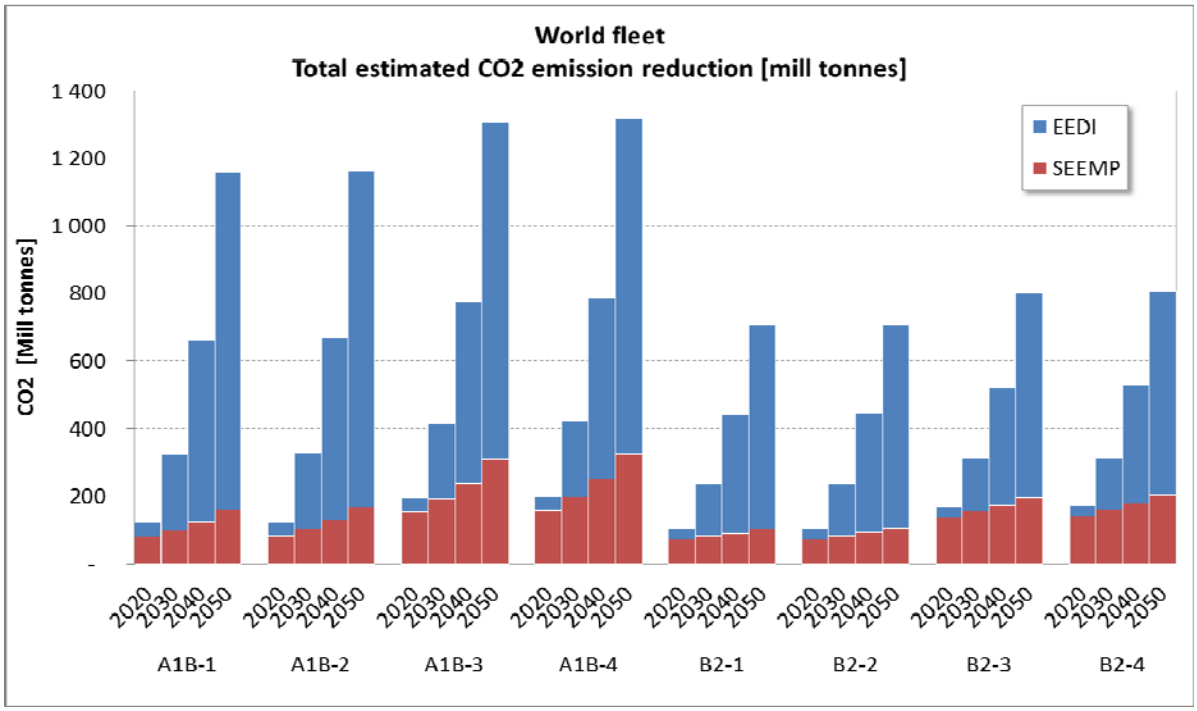


Figure i – Overall annual CO_2 reduction potential for SEEMP and EEDI (waiver 5%)

Findings

10 According to Figure i:

.1 By 2020, an average of 151.5 million tonnes of annual CO_2 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 an average of 330 million tonnes annually (Table iii, showing the average for scenarios A1B-4 and B-2);

Year	BAU Mill tonnes	Reduction Mill tonnes	New level Mill tonnes
2020	1103	152	951
2030	1435	330	1105
2040	1913	615	1299
2050	2615	1013	1602

Table iii - Estimated average CO_2 emission reductions (million tonnes) for world fleet compared with estimated BAU CO_2 emissions (million tonnes)

.2 Compared with Business as Usual (BAU), the average annual reductions in CO_2 emissions and fuel consumed are estimated between 13% and 23% by 2020 and 2030 respectively (Tables iii);

.3 CO_2 reduction measures will result in a significant reduction in fuel consumption (Table iv) leading to a significant saving in fuel costs to the shipping industry, although these savings require deeper investments in more efficient ships and more sophisticated technologies, as well as new practices, than the BAU scenario.

Year	2020		2030	
Scenarios	**Low (B2-1)** Mill tonnes	**High (A1B-4)** Mill tonnes	**Low (B2-1)** Mill tonnes	**High (A1B-4)** Mill tonnes
BAU fuel consumption	340	390	420	530
Reduction in fuel consumption	30	70	80	140
New fuel consumption level	310	320	340	390

Table iv - Annual fuel consumption reduction (in million metric tonnes) for world fleet

.4 The average annual fuel cost saving is estimated between US$20 and US$80 billion (average US$50 billion) by 2020, and between US$90 and US$310 billion (average US$200 billion) by 2030 (Table v).

	High (A1B-4)		Low (B2-1)	
Year	**2020** $billion	**2030** $billion	**2020** $billion	**2030** $billion
BAU fuel cost	490	1170	240	510
Reduction in fuel cost	80	310	20	90
New fuel cost level	410	860	220	420

Table v - Annual fuel cost reduction (in billion US$) for world fleet

11 The results of the study indicate that SEEMP measures (mainly operational) have an effect mostly in the medium term (e.g. 2020) whilst EEDI measures (technical) should have significant impact on the long term (e.g., 2030-2050) as fleet renewal takes place and new technologies are adopted; however, none of the scenarios modelled will achieve an absolute reduction in total CO_2 level relative to year 2010 (Figure ii).

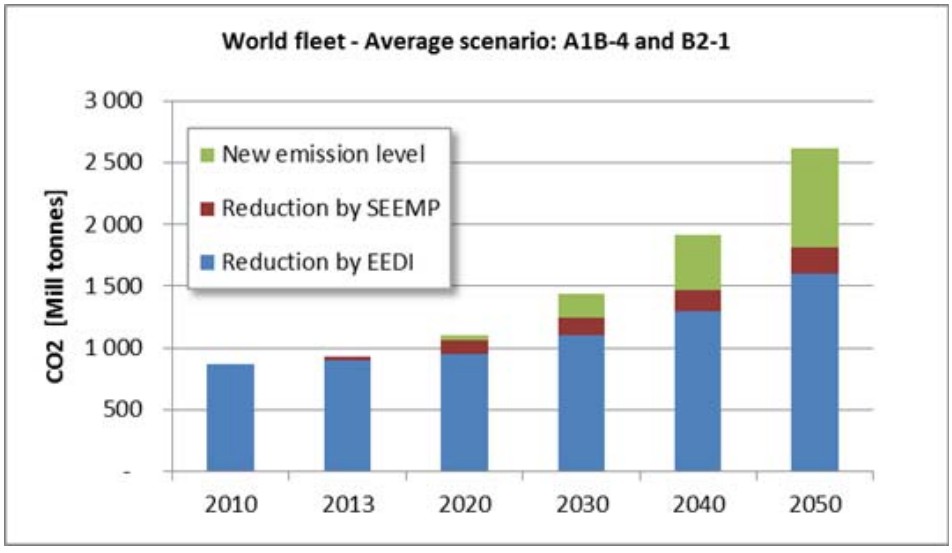


Figure ii - Annual emission reduction by 2050 and new emissions levels (average of A1B-4 and B2-1 scenarios)

Concluding remarks

12 Based on the results of this Study, the following conclusions may be made:

.1 Significant reduction of CO_2 emissions from ships due to EEDI and SEEMP regulations is foreseen to 2050 with emission reduction due to SEEMP (primarily operational measures) likely to be realised more rapidly than that for EEDI (primarily technical measures), as the effect of EEDI will occur only as and when older, less efficient, tonnage is replaced by new, more efficient tonnage.

.2 Mandatory application of EEDI will drive more energy efficient ship design and realise the CO_2 emission reduction potential associated with technical innovation and the use of lower or no carbon fuels. Calculations made within this Study suggest that the agreed EEDI limits can be achieved via technological developments and some design speed reduction as highlighted in this report.

.3 Forecasts with different scenarios indicate total annual CO_2 emissions in 2050 of 3215 million tonnes for BAU and new emissions level of 1895 million tonnes (1320 million tonnes reduced) for scenario A1B-4 (high growth combined with high SEEMP uptake and high fuel price) and a total annual CO_2 emissions in 2050 of around 2014 million tonnes for BAU and new emissions level of 1344 million tonnes (706 million tonnes reduced) for scenario B2-1 (low growth combined with low SEEMP uptake and reference fuel price).

.4 For EEDI, an annual reduction of about 1000 million tonnes of CO_2 for scenario A1B and 600 million tonnes of CO_2 for scenario B2 is foreseen in 2050. For SEEMP, an annual reduction of about 325 million tonnes of CO_2 for scenario A1B-4 and 103 million tonnes of CO_2 for scenario B2-1 is foreseen by 2050.

.5 Transport efficiency will improve with the same rate as the emission reduction taking into account the growth rate of the fleet. In addition to Figures 6a and 6b, Table vi provides the numeric transport efficiency development for different ship types. As indicated, various vessels' transport energy efficiency nearly doubles and the emissions per cargo unit nearly halves from 2005 to 2050.

Year	Bulk carrier	Gas tanker	Tanker	Container ship	General cargo ship	Refrigerated cargo carrier
2005	9	13	13	30	40	40
2010	9	12	12	28	37	37
2020	8	10	10	23	30	30
2030	7	9	9	20	27	27
2050	5	7	7	16	21	20

Table vi - Transport efficiency (g CO_2/tonne mile) improvement associated with the different ship types using scenario B2-4/A1B-4

.6 The impact of the waiver clause in Regulation 19.5 is estimated to be low on total emission reductions due to EEDI. A change of waiver level from 5% to 30% will result in a decrease in CO_2 reduction levels by 7 million tonnes per year in 2030 (overall reduction is 416 million tonnes for this scenario).

.7 Based on the analysis provided in this Study, it is concluded that the likelihood of Flag States or shipowners to opt for an EEDI waiver is low due to low compliance costs and commercial disadvantage of non-compliance. Accordingly, the uptake level taken in this Study as 5% (low) and 30% (high) is regarded as reasonable. It is most likely that waiver uptake will be at the level of 5% as current indications imply.

	EEDI reduction measure	SEEMP Related measure
1	Optimised hull dimensions and form	Engine tuning and monitoring
2	Lightweight construction	Hull condition
3	Hull coating	Propeller condition
4	Hull air lubrication system	Reduced auxiliary power
5	Optimisation of propeller-hull interface and flow devices	Speed reduction (operation)
6	Contra-rotating propeller	Trim/draft
7	Engine efficiency improvement	Voyage execution
8	Waste heat recovery	Weather routing
9	Gas fuelled (LNG)	Advanced hull coating
10	Hybrid electric power and propulsion concepts	Propeller upgrade and aft body flow devices
11	Reducing on-board power demand (auxiliary system and hotel loads).	
12	Variable speed drive for pumps, fans, etc.	
13	Wind power (sail, wind engine, etc.)	
14	Solar power	
15	Design speed reduction (new builds)	

Table vii-Technologies for EEDI reductions and SEEMP related measures

.8 Implementation of SEEMP-related energy efficiency measures are generally cost effective; however, it is likely that adoption of these measures will need to be stimulated. Follow-on monitoring and audits, and high carbon and fuel prices are expected to play a role in driving uptake of SEEMP efficiency measures. Although it is not anticipated to have a target-based regulatory framework for SEEMP in the foreseeable future; putting in place an effective audit/monitoring system, building awareness and resolving split incentive issues for operational energy efficiency measures will facilitate enhanced uptake of SEEMP measures in the world fleet.

.9 The mandatory use of SEEMP based on current IMO regulations will provide a procedural framework for shipping companies to recognise the importance of the operational energy saving activities. It will significantly boost the level of awareness and, if implemented properly, will lead to a positive cultural change. However, and in view of lack of regulatory requirements for target setting and monitoring, SEEMP's effectiveness will need to be stimulated / incentivised via other initiatives.

.10 To make the application of SEEMP more effective and to prepare the shipping industry for likely future carbon pricing via MBMs, it seems that use of the EEOI (Energy Efficiency Operational Indicator) or a similar performance indicator should be encouraged or mandated. This will involve more accurate and verifiable measurement of fuel consumption that could pave the way for CO_2 foot printing and data verification in the future.

.11 The estimated reductions in CO_2 emissions, for combined EEDI and SEEMP, from the world fleet translate into a significant annual fuel cost saving of about US$50 billion in 2020 and about US$200 billion by 2030; using fuel price increase scenarios that take into account the switch to low sulphur fuel in 2020.

.12 Investigations show that ship hydrodynamic and main engine optimisation will bring about energy saving opportunities of up to around 10% with no significant additional cost of shipbuilding. In addition, main and auxiliary engines are already available with reduced specific fuel consumption of about 10% below the values used in the reference line calculations. The above two combined effects is indicative that cost of compliance, for an "average ship", to phases 0 and 1 will not be significant.

.13 As a consequence of current developments in ship design and new technologies coming onto market, the cost of EEDI compliance in phase 1 seems to be marginal as the 10% reduction requirement may be achieved by low-cost hull form design and main engine optimisations. Cost of compliance for phase 2 and phase 3 may be higher and will involve some design-speed reduction for an average ship. However, the overall life-cycle fuel economy of the new ships will be positive as indicated by the high savings in fuel costs.

.14 Despite the significant CO_2 emission reduction potential resulting from EEDI and SEEMP regulations, an absolute reduction in total CO_2 emissions for shipping from the 2010 level appears not to be feasible using these two measures alone. For all scenarios, the projected growth in world trade outweighs the achieved emission reduction using EEDI and SEEMP, giving an upward trend, albeit at a very much reduced rate compared to BAU.

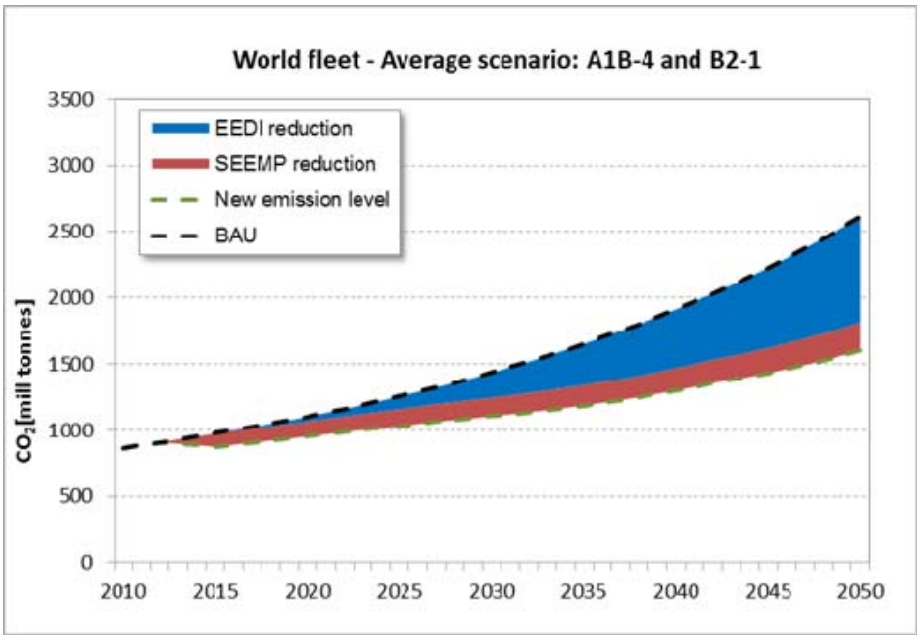


Figure iii – World fleet CO_2 level projections (average of A1B-4 and B2-1 scenarios)

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ANNEX 3

EXECUTIVE SUMMARY OF THE FULL REPORT ON THE WORK UNDERTAKEN BY THE EXPERT GROUP ON FEASIBILTY STUDY AND IMPACT ASSESSMENT OF POSSIBLE MARKET-BASED MEASURES (MEPC 61/INF.2)

BACKGROUND

1 The Marine Environment Protection Committee, at its 60th session decided to undertake a feasibility study and impact assessment of the Market-Based Measure (MBM) proposals submitted in accordance with the work plan for further consideration of MBMs.

2 In order to undertake this study, the Secretary-General established an Expert Group on Feasibility Study and Impact Assessment of Possible Market-Based Measures (the Expert Group). The Expert Group was made up of experts nominated by Member Governments and organizations, but each expert served in their own personal capacity. Consistent with the terms of reference given by the Committee, the experts were to evaluate the various proposals with the aim of assessing the extent to which they could assist in reducing greenhouse gas (GHG) emissions from international shipping. To guide its analysis, the Expert Group was given the following nine criteria:

.1 the environmental effectiveness, e.g., the extent to which the proposed MBM is effective in contributing to the reduction of GHG emissions from international shipping;

.2 the cost-effectiveness of the proposed MBM and its potential impact(s) on trade and sustainable development;

.3 the proposed MBM's potential to provide incentives to technological change and innovation – and the accommodation of current emission reduction and energy efficiency technologies;

.4 the practical feasibility of implementing the proposed MBM;

.5 the need for technology transfer to, and capacity building within, developing countries, in particular the least developed countries (LDCs) and the small island development states (SIDS), in relation to implementation and enforcement of the proposed MBM, including the potential to mobilize climate change finance for mitigation and adaptation actions;

.6 the MBM proposal's relation with other relevant conventions such as the UNFCCC, Kyoto Protocol, and WTO, as well its compatibility with customary international law, as depicted in UNCLOS;

.7 the potential additional administrative burden, and the legal aspects for National Administrations by implementing and enforcing the proposed MBM;

.8 the potential additional workload, economic burden, and operational impact for individual ships, the shipping industry and the maritime sector as a whole, of implementing the proposed MBM; and

.9 the MBM's compatibility with the existing enforcement and control provisions under the IMO legal framework.

3 This Expert Group study comes at a critical time in IMO's deliberations on how to address greenhouse gas (GHG) from the maritime sector. As noted in the Second IMO GHG Study 2009, international shipping contributed to 2.7% of the global emissions of CO_2 in 2007. This contribution is expected to increase in the future due to projected growth in world trade and the demand for seaborne transport. International shipping is, by far, the most energy efficient method of transporting goods; however, the resulting emissions will contribute to climate change due to the long lasting effects of CO_2 in the atmosphere.

4 The ten proposals analysed describe programmes that would target GHG reductions through in-sector emission reductions from shipping or out-of-sector emissions reductions through the collection of funds to be used for mitigation activities in other sectors that would contribute towards the overall goal of reducing global GHG emissions. The submission by Germany was not evaluated since this was an impact assessment and could not be reviewed against the nine criteria. It was thus treated as an information resource to assist in the assessment of the proposals under review.

5 To manage the work in a tight time scale, the Expert Group established four task-groups: Environment, Shipping and Maritime, Administrative and Legal, and Trade and Development and Developing Countries. In addition to the three meetings of the Expert Group, at the IMO headquarters, in London, the task-groups worked by various means including electronic correspondence, face to face meetings, and telephone conferencing. Two external consultants were commissioned to undertake detailed analytical work.

6 All of the proposals directed at establishing a MBM to reduce GHG emissions bring forward concepts that have merit for achieving cost-effective reductions in GHG emissions. However, many of the issues considered by the Group were complicated by the fact that none of the proposals have final legal text from which to evaluate the administrative and legal criteria given by the MEPC.

7 The MBM proposals seek to achieve similar objectives to a greater or lesser extent through differing methodologies. Some mechanisms clearly state all objectives and/or they are reflected in the design of the MBM. In other cases the policy objectives would need to be developed further and these could influence the environmental effectiveness and other benefits delivered by the MBM.

8 The Report is organized in five main parts related to the evaluation of the various mechanisms as follows:

- Proposals evaluated (Chapter 6)
- Assumptions (Chapter 7)
- Evaluation of the ten proposals against the nine criteria (Chapters 9 to 18)
- General impacts of market-based measures on trade, competition and consumer prices (Chapter 19)
- Conclusions (Chapter 20)

OVERVIEW OF THE VARIOUS PROPOSALS

9 The following provides a brief overview of the ten proposals analysed. The order of analysis was agreed by the Expert Group and this order follows the structure of the full report.

.1 **An International Fund for Greenhouse Gas emissions from ships (GHG Fund) proposed by Cyprus, Denmark, the Marshall Islands, Nigeria and IPTA (MEPC 60/4/8)** – would establish a global reduction target for international shipping, set by either UNFCCC or IMO. Emissions above the target line would be offset largely by purchasing approved emission reduction credits. The offsetting activities would be financed by a contribution paid by ships on every tonne of bunker fuel purchased. It is envisaged that contributions would be collected through bunker fuel suppliers or via direct payment from shipowners. The contribution rate would be adjusted at regular intervals to ensure that sufficient funds are available to purchase project credits to achieve the agreed target line. Any additional funds remaining would be available for adaptation and mitigation activities via the UNFCCC and R&D and technical co-operation within the IMO framework.

.2 **Leveraged Incentive Scheme (LIS) to improve the energy efficiency of ships based on the International GHG Fund proposed by Japan (MEPC 60/4/37)** – is designed to target "direct" reduction of CO_2 emission primarily from the shipping sector. The concept of the Leveraged Incentive Scheme is that a part of the GHG Fund contributions, which are collected on marine bunker is refunded to ships meeting or exceeding agreed efficiency benchmarks and labelled as "good performance ships".

.3 **Achieving reduction in greenhouse gas emissions from ships through Port State arrangements utilizing the ship traffic, energy and environment model, STEEM (PSL) proposal by Jamaica (MEPC 60/4/40)** – an IMO global agreement, Member States participate in levying a uniform emissions charge on all vessels calling at their respective ports based on the amount of fuel consumed by the respective vessel on its voyage to that port (not bunker suppliers). The proposal is directly aimed at reducing maritime emissions of CO_2 without regard to design, operations, or energy source. The Port State Levy would be structured to achieve the global reduction targets for GHG and could be leveraged in a manner as proposed by Japan to reward vessels exceeding efficiency targets.

.4 **The United States proposal to reduce greenhouse gas emissions from international shipping, the Ship Efficiency and Credit Trading (SECT) (MEPC 60/4/12)** – is designed to focus emission reduction activities just in the shipping sector. Under SECT, all ships, including those in the existing fleet, would be subject to mandatory energy efficiency standards, rather than a cap on emissions or a surcharge on fuel. As one means of complying with the standard, SECT would establish an efficiency-credit trading programme. The stringency level of these efficiency standards would be based on energy efficiency technology and methods available to ships in the fleet. These standards would become more stringent over time, as new technology and methods are introduced. Similar to the EEDI, these efficiency standards would be based on a reduction from an established baseline and would establish efficiency standards for both new and existing ships. The SECT is designed to achieve relative GHG reductions, i.e. reductions in emissions per tonne mile and not to set an overall target for the sector.

.5 **Vessel Efficiency System (VES) proposal by World Shipping Council (MEPC 60/4/39)** – would establish mandatory efficiency standards for both new and existing ships. Each vessel would be judged against a requirement to improve its efficiency by X% below the average efficiency (the baseline) for the specific vessel class and size. Standards would be tiered over time with increasing stringency. Both new build and existing ships would be covered. New builds must meet the specified standards or they may not operate. New builds, once completed, are not defined as existing ships. The system applicable to existing ships sunsets when today's fleet turns over. Existing ships may comply by improving their efficiency scores through technical modifications that have been inspected and certified by the Administration or recognized organizations. Existing ships failing to meet the required standard through technical modifications would be subject to a fee applied to each tonne of fuel consumed. The total fee applied (non-compliant ships only) would vary depending upon how far the vessel's efficiency (as measured by the EEDI) falls short of the applicable standard. A more efficient ship would pay a smaller penalty than a less efficient ship that falls short of the standard by a wide margin.

.6 **Global Emission Trading Scheme System (ETS) for international shipping proposal by Norway (MEPC 60/4/22) –** would set a sector-wide cap on net emissions from international shipping and establish a trading mechanism to facilitate the necessary emission reductions, be they in-sector or out-of-sector. The use of out-of-sector credits allows for further growth of the shipping sector beyond the cap. In addition the auction revenue would be used to provide for adaptation and mitigation (additional emission reductions) through UNFCCC processes and R&D of clean technologies within the maritime sector. A number of allowances (Ship Emission Units) corresponding to the cap would be released into the market each year. It is proposed that the units would be released via a global auctioning process. Ships would be required to surrender one Ship Emission Unit, or one recognized out-of-sector allowance or one recognized out-of-sector project credit, for each tonne of CO_2 they emit. The Norwegian ETS would apply to all CO_2 emissions from the use of fossil fuels by ships engaged in international trade above a certain size threshold. The proposal also indicates that limited exemptions could be provided for specific voyages to Small Island Developing States.

.7 **Global Emissions Trading System (ETS) for international shipping proposal by the United Kingdom (MEPC 60/4/26)** – is very similar in most respects to the global ETS proposal by Norway. Two aspects of the UK proposal that differ from the Norwegian ETS proposal are the method of allocating emissions allowances and the approach for setting the emissions cap. The UK proposal suggests that allowances could be allocated to national governments for auctioning. It also suggests the net emission cap would be set with a long term declining trajectory with discrete phases (for example, five to eight years) with an initial introductory or transitional phase of one to two years.

.8 **Further elements for the development of an Emissions Trading System (ETS) for International Shipping proposal by France (MEPC 60/4/41)** – sets out additional detail on auction design under a shipping ETS. In all other aspect the proposal is similar to the Norwegian proposal for an international ETS.

.9 **Market-Based Instruments: a penalty on trade and development proposal by the Bahamas (MEPC 60/4/10)** – does not set explicit standards or reductions to be achieved in the shipping sector or out-of-sector for GHG reductions. The proposal clearly sets forth that the imposition of any costs should be proportionate to the contribution by international shipping to global CO_2 emissions. Bahamas' Focal Point has indicated that it is assuming that mandatory technical and operational measures would be implemented such as the EEDI. The proposal would apply to all ships engaged in both domestic and international maritime transport as fuel prices impact all market segments and trades.

.10 **A Rebate Mechanism (RM) for a market-based instrument for international shipping proposal by IUCN (MEPC 60/4/55)** – focuses on a Rebate Mechanism to compensate developing countries for the financial impact of a MBM. A developing country's rebate would be calculated on the basis of their share of global costs of the MBM, using readily available data on a developing country's share of global imports by value as a proxy for that share (or another metric such as value-distance if data becomes available). The proposal indicates that, in principle, the Rebate Mechanism could be applied to any maritime MBM which generates revenue such as a levy or an ETS. In order to evaluate the proposal, the Rebate Mechanism has been assessed integrated with a MBM (see MEPC 60/4/55).

ENVIRONMENTAL OVERVIEW

10 The Environment task-group evaluated the various proposals against criteria numbers 1 and 2 (in part).

Reduction mechanism employed by the proposals

11 The proposed MBMs deliver reductions in GHG emissions through eight mechanisms. One or more of these mechanisms are used in combination by each MBM. These mechanisms work to deliver reductions in GHG emissions either within the sector or from outside the sector. The mechanisms are described below.

In-sector mechanisms

12 **Mandatory EEDI:** Mandatory EEDI design standards that apply to all new builds prior to entering the fleet. Reductions from the standards would be determined by the stringency of the standards over time and the penetration of new builds into the fleet.

13 **SECT with efficiency trading:** An efficiency standard which applies to all ships operating in the international fleet combined with an efficiency trading scheme. Ships which are more efficient than the standard could generate efficiency credits while ships below the standard could purchase credits as a second option for complying with the standard. Emission reductions would be determined by the stringency of the standards over time.

14 **VES existing ship standard combined with fuel based charge:** An EEDI standard which would apply to ships built prior to the scheme entering into force, with the option of paying a fee for ships failing to meet the standard. In general, existing ships for which it is technically feasible to meet the standard would comply with the standard or pay the charge depending on which option would be judged to be most cost-effective. The extent, to which in-sector emission reductions are stimulated in existing ships would therefore, largely be a function of the fee. The base fee would be a significant fraction of the fuel price.

15 **Price incentive applied to fuel**: A broad based price signal applying to all fuel consumed by ships engaged in international trade (above an agreed threshold). This price signal could arise from paying a contribution or levy on fuel, or through being required to purchase and surrender emission allowances or credits for emission from fuel use. The price would primarily influence the amount of in-sector reductions achieved through this element, and the MBMs under review differ on how this price is established.

16 **Leverage refund incentive:** Ships that meet certain 'good performance' criteria would be eligible to receive a full or partial refund on a levy (price signal) they are required to pay on fuel. This increases the incentive for in-sector reductions over a standard price signal by directing revenues back into the sector.

Out-of-sector mechanisms

17 **Purchase of out-of-sector credits by the shipping sector:** Ships would be required to surrender one Ship Emission Unit (an allowance) or credit/allowance from outside the sector for each tonne of GHG they emit. By only releasing a limited number of Ship Emission Units into the market each year, any emissions that exceed that limit would be offset by the sector's purchase of project credit/allowance from outside the sector.

18 **Prescribed purchase of out-of-sector reductions by a fund:** Revenue collected in the operation of an MBM would be used by a central (global) fund in accordance with agreed rules to purchase emissions reductions outside the sector. This mechanism is prescribed by two proposals: the GHG Fund, where the rules prescribe that sufficient offsets must be purchased to deliver a net emission target; and the Rebate Mechanism, where the rules prescribe that a fixed portion of the revenues must be used to purchase offsets.

19 **Remaining proceeds:** Revenue collected in the operation of a MBM which is not explicitly allocated to mitigation. This revenue could be used for a range of purposes including climate change adaptation and mitigation, R&D and technological cooperation, or as compensation. These are largely policy considerations, but to the extent that revenues would be used for mitigation it would increase the environmental effectiveness of the proposal, although there is an obvious trade-off between delivering environmental benefits and delivering other benefits. Rebates and other proceeds designated under the direct control of national governments are not included in Remaining Proceeds.

Emission reduction and other benefits

20 A model was developed to examine in-sector and out-of-sector emission reductions and costs of the MBM proposals under a range of scenarios. The "remaining proceeds" and the potential supplementary out-of-sector reductions that could be delivered should 100 per cent of proceeds be used for mitigation (calculated for comparative purposes) was also estimated in the modelling:

.1 two growth rates; B2 (1.65 per cent growth) and A1B (2.8 per cent growth);

.2 three targets 0%, 10% and 20% below 2007 GHG emission levels (as per Second IMO GHG study 2009) for the GHG Fund, and ETS proposals, with an additional 10 per cent contribution assumed under the GHG Fund for adaptation and R&D purposes (shown as remaining proceeds);

.3 28 per cent of revenues are used for mitigation under the Rebate Mechanism proposal and 25, 50 or 75 per cent of revenues refunded to "good performing ships" under the LIS proposal';

.4 three stringencies for efficiency index standards for the SECT and VES proposals; low, medium and high; and

.5 two carbon price scenarios; medium and high; and two fuel price scenarios; reference and high.

21 In-sector, out-of-sector and total emission reductions observed in modelling the MBMs for 2030 are shown in the table overleaf, along with remaining proceeds and supplementary out-of-sector reductions. The table also shows the mechanisms that deliver the in-sector and out-of-sector reductions for each MBM as described in the section immediately above. The values shown are the range of values observed under the following scenarios considered in the modelling:

	GHG Fund[1]	**Leveraged Incentive Scheme (LIS)**	**Port State Levy (PSL)**	**Ship Efficiency and Credit Trading (SECT)**	**Vessels Efficiency System (VES)**	**Emission Trading Scheme (ETS) (Norway, France)**	**Emission Trading Scheme (ETS) (UK)**	**Bahamas**	**Rebate Mechanism (RM)** [2]
Mandatory EEDI (Mt)				123-299	123-299			[3]	
SECT standard with efficiency trading (Mt)				106-142					
VES existing ship standard combined with fuel based charge (Mt)					14-45				
Price incentive applied to fuel (Mt)	1-31	32-153[4]	29-119			27-114	27-114		29-68
Leverage refund incentive (Mt)									
Purchase of out-of-sector project credits by shipping sector (Mt)						90-539	90-539		
Prescribed purchase of out-of-sector reductions by fund (Mt)	152-584								124-345
Total reductions (% of BAU)	13-40%	3-10%	2-8%	19-31%	13-23%	13-40%	13-40%	[2]	13-28%

1 Includes an illustrative additional contribution of 10% for the purposes of adaptation, R&D and technical cooperation.

2 The Rebate Mechanism has been integrated with an MBM system following the IUCN submissions to MEPC 60/4/55 and further details provided in the IUCN Technical Report submitted to the MBM-EG under paragraph 4.7 of the Terms of Reference of MBM-EG (MEPC 60/J/9). This option of the proposal is referred to in this document as "RM integrated" and illustrates how the mechanism can be operationalized; and allows the proposal to be comprehensively assessed.

3 Should the EEDI be accepted by the Committee, EEDI reductions would be taken into account in the BAU scenario, and thus accounted for in the evaluation of the Bahamas proposal.

4 Includes in sector reductions from the price incentive applied to fuel and the leverage refund incentive.

	GHG Fund	Leveraged Incentive Scheme (LIS)	Port State Levy (PSL)	Ship Efficiency and Credit Trading (SECT)	Vessels Efficiency System (VES)	Emission Trading Scheme (ETS) (Norway, France)	Emission Trading Scheme (ETS) (UK)	Bahamas	Rebate Mechanism (RM)
Remaining proceeds ($billion)	$4-14	$10-87	$40-118	$0	$5-18	$28-87	$0[5]	0	$17-23[6]
Potential for purchase of supplementary out-of-sector reductions using remaining proceeds(Mt)	104-143	232-919	917-1232	0	45-454	696-870	0[4]	0	187-517[5]

Certainty of emission reductions

22 Different MBMs provide different levels of certainty over an absolute or relative target (or in some cases no certainty over a target). The GHG Fund, SECT and shipping ETS are designed to deliver certainty over a particular outcome. For the GHG Fund and shipping ETS this outcome is to constrain the sector's net emissions to an agreed level. On the other hand, SECT is designed to deliver certainty over a relative target of emissions per tonne mile.

23 The other proposals are not designed with the goal of strict certainty of outcome in mind with regards to emissions reductions. Nevertheless this does not mean that the reductions achieved by these mechanisms could not be predictable, to a greater or lesser extent. Moreover, some of these proposals would generate remaining proceeds, which could be used for a range of purposes, and policies that guide the use of this revenue could have a significant bearing on the certainty of outcome.

24 The reductions shown in the table above for the different mechanisms indicate:

.1 There is a high degree of certainty that reductions achieved by mandatory technical standards would be delivered, as ships that do not meet the standard would not operate.

.2 The extent to which reductions would be achieved in response to a price signal (charge on fuel) are generally uncertain, due to the influence of non-price barriers. However, where a price signal is used in the context of the GHG Fund or ETS, more or less reductions in-sector would be compensated for by more or less reductions out-of-sector.

.3 Reductions achieved in response to a leverage refund incentive are also somewhat uncertain as shipowners would make decisions on whether or not to respond to this incentive on the basis of its likely costs and benefits.

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5 While this proposal would raise revenue from auctioning allowances it appears that auction revenues will remain with national Governments. This revenue has not been considered available for supplementary reductions. Such revenues could however be made available subject to decisions and implementation of mechanisms at the national level.

6 While this proposal would raise revenue from a levy it appears that 30 per cent of revenue which is rebated will remain with national Governments. This revenue has not been considered available for supplementary reductions. Such revenues could however be made available subject to decisions and implementation of mechanisms at the national level.

25 Certainty can also be viewed from the perspective of whether the reductions are verifiable. For all MBMs the integrity of the scheme depends on robust monitoring, reporting and verification requirements for the shipping industry and well designed compliance and enforcement systems. Similar, monitoring, reporting and verification systems as well as robust processes for managing the additionality would be required for any out-of-sector reductions accessed through the MBM. This element needs to be further developed for most of the proposals. In relation to other out-of-sector reductions accessed through the MBM, comparable system for monitoring, reporting and verifications is also required.

SHIPPING OVERVIEW

26 The Shipping task-group evaluated the various proposals against criteria numbers 2 (in part), 3 and 8. In its analysis, the task-group commissioned a marginal abatement cost study. Cost effective operational and technical emission reduction measures are available to the shipping sector. However barriers exist in the uptake of many of these measures.

Cost Effectiveness

27 All of the proposals were modelled to enable an assessment of their environmental effect together with the indicative cost. The cost of reductions was determined by relating the delivered in-sector and out-of-sector emission reductions to the cost to the industry.

28 The potential cost-effectiveness was determined by considering the combined effect of assessed in-sector emission reductions, together with the out-of-sector mitigation possible by utilization of all available remaining funds related to the cost to the industry.

Potential to Provide Incentives to Technological Change

29 The potential of each proposal to drive investments in additional energy efficiency measures was evaluated together with the benefit to be gained from early implementation of energy efficiency improvements.

Potential Additional Workload

30 The cost relating to the additional burden to crew associated with operation and maintenance was evaluated. This was then calculated as a percentage of the gross cost to the industry of each measure for comparative purposes. The table below highlights the Group's evaluations of each of the above considerations for the MBMs under evaluation.

MBM	Cost of MBM, based on A1B 2030 Scenario	Investment certainty comments	Early action benefit	Potential additional on board workload
GHG Fund (Denmark *et al*.)	The cost of reductions is estimated to be 50 \$/tonne CO_2 abated. The maximum cost-effectiveness potential of the proposal is 39 \$/tonne CO_2 abated assuming all funds are allocated to mitigation (including the additional 10% contribution rate)	Cost predictability involves two aspects: .1 inherent stability of fixing the price for a given time period; and .2 need to adjust the price between periods to compensate for any over/under collection in the period compared to the CDM market fluctuations within the same period. The level of contribution has to be set on the basis of the global carbon price. Averaging over several periods this proposal will not be more or less costly than other proposals hinging on the Model Carbon Price.	Neutral	\$0.1 billion or less than 0.5% of the gross cost of the proposal
LIS (Japan)	The cost of reductions is estimated to be 319 \$/tonne CO_2 abated. The amount of funds collected for other purposes is \$24 billion. The maximum cost-effectiveness potential of the proposal is 36 \$/tonne CO_2 abated assuming all funds are allocated to mitigation	Cost predictability involves aspects related to the inherent stability of fixing the price for a given time period.	Relatively high.	\$0.9 billion or about 2% of the gross cost of the proposal. It shall be emphasized that this value is a gross estimation.
PSL (Jamaica)	The cost of reductions is estimated to be 770 \$/tonne CO_2 abated. The amount of funds collected for other purposes is \$49 billion. The maximum cost-effectiveness potential of the proposal is 38 \$/tonne CO_2 abated assuming all funds are allocated to mitigation	Cost predictability involves two aspects: .1 inherent stability of basing the price on the carbon price; and .2 volatility of the carbon price.	Neutral	\$0.8 billion or about 1.5% of the gross cost of the proposal
SECT (USA)	Not possible due to the modelling approach selected	The cost-effectiveness could not be calculated as the gross cost for the scheme could not be determined. However new ships will	High	not priced

MBM	Cost of MBM, based on A1B 2030 Scenario	Investment certainty comments	Early action benefit	Potential additional on board workload
		be built to achieve the mandatory EEDI standards and therefore both comply with the less stringent existing ship efficiency index standards, and be eligible to earn project credits.		
VES (WSC)	The cost-of reductions is estimated to be 247 \$/tonne CO_2 abated. The amount of funds generated for other purposes is \$7.4 billion. The maximum cost-effectiveness potential of the proposal is 34 \$/tonne CO_2	The Vessel Efficiency System is based on the EEDI. Investment in any improvement of the EEDI for an existing ship towards meeting the standard will thus generate a well-defined return in limiting the costs applied to fuel consumption.	High	The cost of additional workload onboard is \$0.4 billion or 5% of the gross cost.
ETS (Norway)	The cost of reductions is estimated to be 96 \$/tonne CO_2 abated The amount of funds collected for other purposes is \$31 billion. The maximum cost-effectiveness potential of the proposal is 38 \$/tonne CO_2 abated assuming all funds are allocated to mitigation	The existing carbon market shows that volatility of the carbon price is similar to the volatility of the bunker price. However, the absolute variance (the amplitude) in terms of the difference between the maximum and the minimum level of the carbon price is much lower than the absolute variance of the bunker fuel price. It should be noted that shipowners are experienced in coping with fluctuating bunker prices.	Neutral	\$0.7 billion or about 1.5% of the gross cost of the proposal
Bahamas	There are no additional costs of the Bahamas proposal to those that would arise under business as usual, which include the normal costs of fuel.	The volatile price of fuel has historically been an inhibitor for investment stability in shipping.	Neutral	Introduction of a mandatory EEDI for new ships may add to the onboard workload due to addition of technology to reduce emissions.
RM (IUCN)*	The cost-of reductions is estimated to be 121 \$/tonne CO_2 abated. The amount of funds generated for other purposes is \$21 billion, The maximum cost-effectiveness potential of the proposal is 53 \$/tonne CO_2 assuming all funds are allocated to mitigation	The adjustment of the levy is relatively frequent (every 3 months) which potentially makes the price fluctuate more than the GHG Fund proposal where the re-setting of the contribution is anticipated to take place at years intervals	Neutral	\$0.8 billion or about 1.5% of the gross cost of the proposal

* Assessment refers to Rebate Mechanism (RM) integrated with MBM as referenced in MEPC 60/4/55

ADMINISTRATIVE AND LEGAL

31 The Administrative and Legal task-group evaluated the various proposals against criteria numbers 2 (in part), 4, 6, 7, and 8.

Relation with Other Conventions

32 The administrative and legal task-group was successful in highlighting some of the policy sensitivities inherent when discussing compatibility with the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. The experts recognized that the principle of common but differentiated responsibilities and respective capabilities apply in the context of the UNFCCC and its Kyoto Protocol and the IMO Convention specifies non-discrimination in IMO instruments. However there are different views on application of these principles among the experts. One view is that the UNFCCC provides the central policy infrastructure for global climate change action and the proposed market-based measures must take into account the principle of common but differentiated responsibilities and respective capabilities. Another view is that the principles of the UNFCCC do not apply in the IMO and that all of the market-based measures that aim to reduce emissions are therefore consistent with the UNFCCC.

Practical Feasibility

33 The experts agreed that all of the proposals could be implemented in a practical and feasible manner notwithstanding the challenges associated with the introduction of new measures. For all the proposals, the time necessary for the development of a legal instrument would be impacted by broader policy considerations.

34 The experts noted that all the proposals need further development so as to minimize concerns over possible carbon leakage, potential for fraud, and global implementation.

Administrative Burden and Compatibility with the Existing IMO Enforcement and Control Provisions

35 The administrative requirements of the proposals vary, but all of the MBM proposals require some additional administrative burden from flag States, port States, and shipowners/operators. Some proposals clearly identify the additional administrative issues, in other cases these issues will need to be developed further, which could impact the administrative burden.

36 The majority of administrative issues associated with the GHG Fund are related to the central administrative body collecting and distributing the revenue generated. There will also be port and flag State requirements.

37 The Emission Trading Scheme(s) would also require administration of a fund to collect and distribute revenue associated with the proposals. There will also be flag State requirements and port State rights.

38 The Rebate Mechanism would have the administrative characteristics of whatever proposals it is connected to. However, the Rebate Mechanism itself would require additional administrative responsibilities.

39 The Port State Levy does not specify what body will collect and distribute the revenues raised, but that body would have administrative requirements. Administrative requirements for the port State, flag State, and owner/operator will also exist under the Port State Levy programme and could be more than for some other proposals.

40 The Leveraged Incentive Scheme has many of the Administrative features in common with the GHG Fund, but as some of the revenues will be distributed to enhance in-sector reductions, it will likely have higher administrative burden than the GHG Fund itself for the administrative body as well as for shipowners/operators.

41 The Vessel Efficiency System would require an Administrative body to collect and distribute the revenues collected. Administrative requirements for the port State, flag State, and owner/operator will also exist under this programme.

42 The Ship Efficiency and Credit Trading proposal is solely designed to deliver reductions within the shipping sector and as such, does not require any administrative functions from a fund. Administrative requirements for the port State, flag State and owner/operator will also be necessary to ensure efficiency standards are met or an efficiency credit has been purchased.

43 The Bahamas proposal focuses on the need to deliver reductions within the sector through technical efficiency and operational measures and will only necessitate any administrative requirements associated with other regulations developed and agreed by IMO (e.g., EEDI).

TRADE AND DEVELOPMENT AND DEVELOPING COUNTRIES

44 The task-group evaluated the various proposals against criteria numbers 2 (in part) and 5.

45 Most countries, but developing countries in particular, have a strong reliance on international trade for their economic development and thus have a keen interest in proposals likely to increase the cost of shipping goods by sea thereby impacting on their GDP and general economic development.

Potential impact(s) on trade and sustainable development

46 The task-group reviewed a number of existing studies on trade impacts and commissioned additional quantitative analysis on consumer impacts of applying the MBM proposals. In general, the results showed that impacts will vary by trade route, vessel type, cargo shipped (especially value by weight), and by the structure of the market in the importing and exporting countries in terms of both local and other land based competition.

47 When discussing impacts of market-based measures for the maritime sector, one outcome of the analysis was that developing countries, especially SIDS and LDCs, should not be treated as a collective bloc or blocs of countries. Since the various proposals will have differing impacts on individual LDCs, SIDS and other developing countries.

48 For the most part, indirect economic costs and benefits were not considered in the quantitative assessment, despite their importance.

49 The analysis undertaken also showed that where there is a larger market share for domestic production, the less likely it is that the exporter would be able to pass an increase in transportation costs through to the end consumer due to competition from domestic

producers. Conversely, where there is little or no domestic production, the exporter is more likely to be able to pass the increased costs on to the end consumer.

50 Increased freight costs will also have a larger impact where goods have a low value to weight ratio, as the increase in freight cost is a larger share of the final cost than for higher value added products. The impact on producers in exporting and importing countries will vary, depending on market shares and price elasticities.

51 To the extent that the measures provide incentives to increase the fuel efficiency of ships, there could also be a reduction in operating costs from fuel savings. What the effect might be of efficiency measures for any particular trade route or cargo was not modelled.

52 An impact assessment of the proposed MBMs was carried out by Indian National Shipowners' Association on some of their internationally trading vessels and the findings showed that implementation of technical and operational measures to reduce fuel consumption would result in substantial cost savings and reduce GHG emissions. However, ship operators would face challenges in implementing mitigation measures, including access to technology and additional finance.

Technology Transfer

53 All the proposals provide some form of incentives for shipowners to improve their ships technically or their operational efficiencies. While a number of measures or technologies that could result in fuel saving for ships exist, there may be hurdles to adopting such measures or technologies, including long payback periods. There could be a need for technology transfer to help improve ship and operational efficiencies.

CONCLUSIONS

54 The evaluation of the proposals was completed as requested by the Committee in accordance with the terms of reference and each evaluation provides the required assessment as described in the terms of reference specifically in its paragraph 2.5.

55 The evaluation was complicated by the different levels of maturity of the proposals. Proposals with a high level of maturity generated more discussion compared to those that were less developed.

56 The Group would like to point out that elements of the proposed measures would require further elaboration and development. Proposals at an early stage of development would be required to be developed further.

57 The Group reached its conclusions by consensus apart from a few instances where the evaluation of legal, administrative and other aspects led to different views as captured in the report.

58 All proposals address reduction of GHG emissions from shipping. Some of the proposals go beyond mitigation and propose a mechanism that provides for substantial contribution to address the adverse effects of Climate Change.

59 The proposals have different ways of reducing emissions, some focus on "in-sector" reductions and others also utilize reductions in other sectors. The extent of such reductions is detailed within the individual evaluation of each proposal in the report.

60 Cost effective operational and technical emission reduction measures are available to the shipping sector. However barriers exist in the uptake of many of these measures.

61 The Group has considered sustainable development in a holistic way so that it became an inherent part of the assessment, rather than as an isolated criterion because this was the best approach.

62 The Group has identified that the implications of implementing the different MBM proposals for international shipping are directly related to the stringency of the proposed measure. Irrespective of this, the Group concluded that all proposals could be implemented notwithstanding the challenges associated with the introduction of new measures.

63 The assessment of the impacts of an increase in bunker fuel prices and freight costs showed that implementation of the proposed measures would affect some countries and products more than others. In some cases even small increases in costs could have relatively significant consequences. Indirect economic costs and benefits were not considered in the analysis. Some of the proposed measures include mechanisms aiming to provide means to mitigate negative impacts.

64 The proposals lack, to various degrees, sufficient details for the necessary evaluation of issues such as international harmonization in implementation, carbon leakage, fraud, and traffic of vessels between non-party states, among others. These issues require further policy considerations in order to be more properly addressed.