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PREVENTION OF AIR POLLUTION FROM SHIPS

Further details on the United States proposal to reduce greenhouse gas emissions from international shipping

Submitted by the United States of America

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Introduction

1   This document provides further details on the proposal submitted by the United States (US) at MEPC 59 proposing a method to address greenhouse gas emissions from international shipping through efficiency index standards and allowing the trade of efficiency credits as one way for ships to meet the efficiency index standards. New details of this proposal are elaborated upon in this submission and take into account the outcome of the 15th Conference of the Parties to the UNFCCC, particularly the "Copenhagen Accord," including its recognition of the scientific view that the increase of global temperature should be below 2 degrees Celsius.

2   This proposal recognizes the importance of international shipping to the global economy and acknowledges that greenhouse gas emissions from this sector are growing and need to be addressed in a comprehensive manner. The proposal focuses exclusively on improving the energy efficiency of the maritime sector. Significant potential exists to improve the efficiency of existing ships through technologies such as waste heat recovery and propeller optimization as well as operational improvements such as optimized voyage planning. Increased efficiency would reduce fuel consumption and greenhouse gas emissions, provide financial rewards to efficient shipowners and operators, and illustrate the maritime sector's commitment to tackling climate change even while carrying the majority of the world's trade.

Key elements and rationale of the proposal

3   This proposal builds on the traditional strengths of IMO by employing technical standards to create a simple, pragmatic and cost-effective solution to reduce greenhouse gas emissions from existing ships. The US believes that the world fleet, both new and existing ships, can and should be made more efficient. The proposal focuses on how best to address emissions from existing ships and it complements the current effort within IMO to develop efficiency index standards for new ships through the Energy Efficiency Design Index (EEDI). By implementing this proposal for existing ships along with the EEDI standard for new ships, IMO would be implementing a comprehensive and workable standard that will improve the efficiency of international maritime shipping.

4   This proposal provides equitable treatment of different ship types and different ship sizes (based on capacity), while including a method to periodically measure ship technical and operational modifications affecting overall efficiency. There are four key elements to the proposal. Each of these key elements is briefly explained below with further details in specific sections of this document.

    .1   **Develop required efficiency index standards for existing ships ("EI_R").** The first step would be to develop efficiency index baselines for existing ships, which could be the same as the ship-type and ship-size specific baselines for new ships that IMO is currently developing through the EEDI. IMO would then use the baselines to derive efficiency index standards for existing ships, so that for any given year, individual ships would have a specific efficiency index standard that reflects feasible technology and operational efficiency improvements for that ship. This approach ensures equitable treatment of different ships because the baselines themselves are specific for each ship type and each baseline is a continuous function of ship size (i.e. capacity). The standard, which is proposed to be called the required efficiency index (EI_R), would be calculated as a per cent above or below the applicable baseline curve, and would be made more stringent over time by amounts and intervals to be determined. The units of EI_R and the EEDI for new ships are identical and while a new ship is subject to the EEDI standard when it is first built, it would only be subject to EI_R once it begins operating. The EI_R would be the only efficiency index standard for ships in operation.

    .2   **Each ship calculates its attained efficiency index ("EI_A").** The most straightforward method for determining the attained efficiency index of a ship (EI_A) is to calculate it using the same equation that is used for the new ship energy efficiency design index (EEDI) along with the ship performance test and actual parameters from the ship operational data. Alternatively, the US also proposing to include methods such as direct determination of the fuel consumed and cargo carried, that account for operational performance as influenced by efficient technologies or operational measures.

.3 **Establish efficiency credit (EC) trading for ships**. Under this proposal, the fundamental requirement is that a ship's EI_A be better (lower) than or equal to, EI_R. However, recognizing that not all ships would be able to meet this requirement, the US proposes efficiency credit (EC) trading whereby those ships that are more efficient may sell their EC surplus to ships whose EI_A does not meet EI_R. The concept of efficiency credit trading is distinct from other emissions trading in that it does not directly cap maritime activity or emissions, yet it has the potential to quickly achieve significant emissions reductions from the maritime sector. As illustrated in the equation below, the difference between a ship's EI_R and EI_A is multiplied by a ship's activity level over a reporting period to determine the EC for that ship. Options for measuring activity include reporting of actual cargo tonne-miles, reporting miles only or using a tonne-mile default value based on type and size of ship. Generated EC could be positive or negative in a given period. For example, a ship operating more efficiently than the efficiency index requirement (EI_A is less than EI_R) would generate positive efficiency credits, which could be sold to ships needing credits. If a ship is not meeting its required efficiency index (EI_A greater than EI_R) it would generate negative efficiency credits (-EC) and would have to obtain positive efficiency credits to offset its negative efficiency credits. In order to continue operation, a deficient ship's EC would have to be periodically reconciled to zero. Individual ships would be able to meet this EC requirement through:

.1 Technologies that improve EI_A;

.2 Operational measures that improve EI_A;

.3 Fleet activity optimization to manage efficiency credits;

.4 Efficiency credit trading within the maritime sector, as explained below, where:

$$\pm EC = \left(EI_R - EI_A\right) * Activity$$

.4 **Regulatory authorities would certify and enforce each ship's compliance.** The ship's flag State, or its authorized recognized organizations, would validate reporting and certify compliance with the efficiency credit requirement, either by verifying that a ship's EI_A is better (less) than or equal to EI_R or by verifying that a ship has obtained necessary efficiency credits. Flag States and port States would enforce the efficiency credit trading consistent with current obligations under MARPOL Annex VI.

Details on the structure of our proposal

5 The next few sections of this document provide further detail on the following:

.1 how efficiency index standards for existing ships (EI_R) are established;

.2 relationship between the EEDI (new ship) and EI_R (existing ship) efficiency index standards;

.3 how a ship would calculate its attained efficiency index (EI_A);

.4 how a ship would calculate efficiency credits (EC);

.5   options for Compliance;

.6   how efficiency credits are traded, purchased or sold; and

.7   regulatory timing and applicability.

How efficiency index standards for existing ships (EI$_R$) are established

6   As noted above, the US proposes that the required efficiency index standard for existing ships (EI_R) should be established by first determining the baselines for existing ships and then determining (the level of) the standards, relative to the baselines, for existing ships over time. This follows the same approach as the development of the EEDI standard for new ships, which recognizes that a tanker is not the same as a container ship, and every ship type and size (as measured by capacity) should have a unique baseline value on which standards would be based.

7   The US recommends using the EEDI baselines (which are currently based upon data from a 1998-2007 subset of the Lloyd's Fairplay database) as the baselines for existing ships, which means the baseline for each different ship type would be a continuous curve that is a function of ship size. Using identical baselines for both EEDI and the EI_R, would be simple and build upon the work IMO has already completed with respect to new ships.

8   All existing ships would be subject to the same *per cent* improvement in efficiency relative to their respective baselines at any point in time. As the baselines are scaled by type and size, the required improvement is also scaled by type and size; creating an equitable and straightforward approach that is consistent across the entire international maritime fleet. While all ships are subject to the same percent (relative) efficiency improvement over time, the required level of the efficiency index (EI_R) of a specific ship, would be based upon its unique baseline. For example, EI_R for a 100,000 DWT dry cargo carrier would be different from a 150,000 DWT dry cargo carrier or a 100,000 DWT tanker. As an illustration – all three ships would need to meet the same percentage improvement from their efficiency index baseline over the same time period, which would result in different absolute EI_R improvements for each ship.

9   The efficiency index requirements for both new and existing ships (EEDI and EI_R respectively) would gradually become more stringent over time. Setting the required efficiency index standards well in advance of their effective dates would provide certainty to the international fleet and to the firms and shipyards responsible for developing installing and measuring the performance of more efficient technologies and operational measures.

10   The EI_R for existing ships need not be as strong as the EEDI requirements for new ships. This is because new ships are more likely to incorporate more efficient technologies or operational methods and thus have somewhat greater energy efficiency than existing ships of the same type and size.

Relationship between the EEDI (new ship) and EI$_R$ (existing ship) efficiency index standards

11   For new ships, the US recommends mandatory adoption of the currently proposed scheme for the EEDI as soon as possible. A new ship's calculated EEDI value would be used to gain entry into the fleet by meeting the required EEDI applicable to the size and type of ship at time of build or contract. The proposal for existing ships complements the new ship EEDI requirement, but it does not replace it. The new ship EEDI would continue to serve an important role for increasing the efficiency of new ships prior to entry into the fleet. Under the US proposal, once

a ship has entered into service, it would immediately be subject to the existing ship standard (EI_R), and its compliance would be periodically verified and certified.

12   Once a new EEDI compliant ship enters into service and becomes an existing ship, it is likely that it would generate positive efficiency credits compared to older ships of equivalent type and size. Furthermore, it would continue to generate positive efficiency credits until, over time, the applicable EI_R became more stringent than the EEDI to which the ship was constructed. This provides an incentive for the construction of new efficient ships, or to employ new innovative technologies or operational measures, as these positive efficiency credits are available to be sold or traded to offset the negative credits that older existing ships would generate.

How a ship calculates its Attained Efficiency Index (EI$_A$)

13   As noted above, the term EI_A is used to distinguish an existing ship efficiency index value from a new ship's initial EEDI value. There are a number of ways to consider how EI_A is determined, all of which need to accommodate the variety of technical and operational measures that may be employed to improve a ship's efficiency in order to meet the EI_R standard.

14   The most straightforward method is to use the EEDI equation, shown below for reference, but the variables used in the equation would be based partially on formal sea-trial data and partially on current and historic operational data. For example, in the EEDI equation the term f_{eff} is a *predicted* usage factor for innovative energy efficient measures such as kites or sails which reduce a ship's overall power requirement. In the EI_A calculation this *predicted* value would be replaced with an *actual* value based on historical operating usage to reflect accurate usage and subsequent power reductions from this energy efficient device or system.

$$EEDI = EI_A = \frac{\prod\limits_{j=1}^{M} f_j \left(\sum\limits_{i=1}^{nME} P_{ME(i)} C_{FME(i)} SFC_{ME(i)} \right) + (P_{AE} C_{FAE} SFC_{AE}) + \left(\left(\prod\limits_{j=1}^{M} f_j \sum\limits_{i=1}^{nPTI} P_{PTI(i)} - \sum\limits_{i=1}^{nWHR} f_{eff(i)} P_{AEeff(i)} \right) C_{FAE} SFC_{AE} \right) - \left(\sum\limits_{i=1}^{neff} f_{eff(i)} P_{eff(i)} C_{FME} SFC_{ME} \right)}{f_i \times Capacity \times V_{ref} \times f_W}$$

15   As an alternative method, the US also proposes a second approach similar to the simplified NO$_x$ Technical Code methodology, which uses simplified in-service at-sea test instead of a formal sea-trial. The in-service at-sea test data would be collected using a standardized procedure to be further developed under IMO's guidance along with historical data in the EEDI equation. This updated ship efficiency index value would reflect actual technology and operational performance for existing ship equipment and predicted performance of newly installed equipment when appropriate. An advantage to this approach is that it would not require any initial or periodic sea trials.

16   There would be a need to establish the period of time for required updates to the calculated efficiency index value (EI_A). For this proposal, a maximum update periodicity of five years and an option for earlier updates to take advantage of a ship's technology or operational improvements should be considered. Such updates would be verified by the ship's flag Administration.

17   The shortcoming in using the EEDI equation in paragraph 14 is that it does not account for periodic operational measures such as regular maintenance and cleaning to increase efficiency, and optimal voyage planning. Therefore, consideration of a different optional calculation to include these operational measures would be needed. For instance, the US recommends developing an optional methodology using records of the actual fuel consumed divided by the work performed (cargo tonne-miles), as the means for calculating the ship's EI_A.

How a ship calculates efficiency credits (EC)

18   The efficiency credits (EC) generated by a ship over a given period of time is calculated by multiplying the difference between the EI_A and the EI_R by a measure of the ship's activity in cargo tonne-nautical miles. EC could be positive or negative as described in paragraph 4.3 above.

19   The measure of ship activity for the compliance period, e.g., one year, could be determined by several methods. In order to provide simplicity and flexibility, this proposal provides two options.

   .1   Ships could report actual cargo tonne-miles of activity, based upon cargo and navigational logs.

   .2   Alternately, one of the following methods for approximating activity could be used:

      .1   use a default activity indicator as a function of ship type and ship size. Using this method; a ship would be assigned a specific default cargo tonne-mile value based solely on the ship type and ship size in deadweight tonnes (DWT) as extrapolated from MEPC 59/INF.10, or

      .2   another method could involve reporting activity miles only with the tonnes capacity per each ship, the same as the capacity term in the EI_A equation.

20   There might be value in allowing a ship to choose either approach during a given reporting period, which would combine the simplicity of the second option with the opportunity to use more specific information in the first option if it benefits the ship.

Options for compliance

21   At the end of a compliance period, a ship must demonstrate either that its EI_A is better than or less than EI_R or that the efficiency credit for the ship for that period of time is either equal to or greater than zero, and report such data to its flag Administration. Ships with a negative EC value, where EI_A does not meet EI_R, must employ one or a combination of the options below to bring its EC value to zero, or purchase credits as detailed in point four below:

   .1   **Technology improvements to improve ship efficiency**: Although maritime transport is generally the most efficient mode of transport, significant technological improvements could be made to ships to improve their efficiencies (EI_A) even further. These technologies can be organized into two broad categories: propulsion efficiency technology and ship resistance technology.

      .1   Propulsion efficiency technology includes but is not limited to advanced engine designs, improved waste heat recovery, and advanced propeller design.

      .2   Ship resistance technology includes but is not limited to optimization of hull shape, optimization of hull structure, application of low friction hull coatings, and use of stern fins or ducts.

.2   **Operational improvements to improve ship efficiency**: Operational improvements to improve a ship's efficiencies and EI_A include speed reduction, weather routing, and improved cargo management to maximize cargo carrying capacity.

    .1   Deciding to permanently operate slower than the design speed of the ship by permanent engine derating would provide the opportunity to improve the ship's efficiency index by reducing the power and speed terms in the EI_A equation.

    .2   Periodic operational methods that are not accounted for in the EI_A equation could be addressed by a different, optional calculation for the attained efficiency index consisting of actual fuel consumed divided by the transport work performed (cargo tonne-miles) as described in paragraph 17.

.3   **Fleet activity optimization**: There would be a disincentive to use ships that perform worse than the efficiency index requirement, as keeping them in service would require the purchase of efficiency credits. Increased use of an efficient ship, in contrast, would generate efficiency credits, which could be held or sold to other ships.

.4   **Efficiency credit trading**: In some cases it may not be possible to improve a ship's energy efficiency index enough through technology or operational means in a cost-effective or timely manner to meet EI_R. These ships could also comply with the efficiency credit requirement through efficiency credit trading to obtain efficiency credits sufficient to offset the difference between EI_R and EI_A.

    .1   Efficiency credit trading also provides an incentive to improve energy efficiency beyond the requirement. Highly energy efficient ships could generate more efficiency credits and trade or sell them for monetary rewards. Therefore, this system would inherently incentivize highly energy efficient ships and operations.

    .2   Ultimately, efficiency credit trading would provide a means for the maritime sector to collectively invest in the most cost-effective efficiency improvements, which would in turn enhance efficiency within the entire industry.

22   If the shipowner or operator decides to implement new technological and/or operational improvements to a ship at some time during the compliance period, it could perform a prorated efficiency credit calculation using both its old and new efficiency index values.

How efficiency credits are traded, purchased or sold

23   Under the scheme being proposed in this document, there would be an incentive to use ships that have an EI_A that is better (lower) than the EI_R because the generated tradable efficiency credits can then be sold or traded to ships that fail to meet the required efficiency index standard. The strength of this incentive could be changed by adjusting the level of the required efficiency index standard or through fleet turnover and/or the utilization of more or less efficient ships. At no point does this market-based measure cap activity levels, and as such, incentives to be more efficient would remain consistent even if the international fleet increases or decreases in

number, capacity, or activity. Changes in fleet activity and the market mechanisms in place for the cost containment of credits could impact the volume and/or price of credits traded, but not the level of\the requirement.

24   IMO would have to identify how owners and operators could most efficiently buy or sell efficiency credits among credit generators and credit purchasers. This document proposes that this be done through a Ship Efficiency Credit Trading Scheme (SECTS), for which IMO would develop the necessary regulations and oversight, but which IMO would not operate or implement. While further discussion is required regarding the most appropriate administrative entities to regulate and oversee the SECTS, the following three components would help ensure a transparent and efficient scheme that provides ships' responsible parties (i.e. Registry Account Holders in the SECTS) with real-time data to support trading and to assist in managing reduction targets and compliance status:

> .1   **Registry:** The Registry would be an electronic database that serves as the official record holder and transfer mechanism for efficiency credit accounts. The ships' responsible parties would have an SECTS Efficiency Credit account.
>
> .2   **Trading Platform:** The Trading Platform would be a marketplace for executing trades among Registry account holders, and for completing and posting trades established through private, bilateral negotiations.
>
> .3   **Clearing and Settlement Platform:** The Clearing and Settlement platform would process all transaction information from the SECTS Trading Platform on all trade activity, as a service to Registry Account Holders.

25   Under the SECTS, the ship's responsible party would calculate the efficiency credits according to its required and attained efficiencies and its activity level. The calculated efficiency credits of each ship would be enforced by flag Administrations and subject to port State control as with current obligations under MARPOL Annex VI.

26   The ship's owner/operator could use its SECTS account to continuously monitor the amount of credits that it must buy or sell to meet its requirements in a given compliance period. Options to trade credits include:

> .1   Privately trading credits between ships within a company headed by the responsible party,
>
> .2   Trading over the counter, using a broker to privately match buyers and sellers, or
>
> .3   Trading credits on the SECTS Trading Platform among Registry Account Holders.

27   When efficiency credit ownership changes, the SECTS registry would be used to validate the transaction as well as maintain a record of all transactions.

Regulatory timing and applicability

28   The US holds the view that efficiency index standards for both new and existing ships should come into force as soon as possible. Prior to the final implementation of these standards, the US proposes a brief phase-in period starting as soon as possible, where new and existing ships would have to begin reporting their attained efficiency (EI_A) index values. This allows time to finalize the initial efficiency index standards, determine feasible ship efficiency improvements for future efficiency requirements and other details as necessary.

29   The US proposes that only ships 400 gross tonnes and greater engaged on international voyages be included in this programme. Initially, only ship types with approved EEDI baselines would be required to comply. This implies a phasing in of other ship and propulsion types as those values are determined and adopted by IMO. Annex VI to MARPOL could potentially be used as the mechanism to implement efficiency index standards for new and existing ships.

30   Each ship would be required to have an "energy efficiency index" certificate indicating the ship's current efficiency index (EI_A) and certifying that the responsible party is calculating and reporting efficiency credits properly and is in compliance with the efficiency requirements over the compliance period. The "energy efficiency index" certificate could be modelled after the MARPOL Annex VI IAPP certificate, and it would be expected that during surveys and inspections the Administration would verify the ship's compliance. To allow such verification, including verification of a ship's activity and its attained and required efficiency indices, ships would be required to record relevant shipboard data, maintain record books for inspection, and report efficiency credit transactions.

Advantages of the United States approach

31   The United States believes the proposal above is a pragmatic, simple, and cost-effective solution to encourage increased efficiency and reducing emissions from ships engaged in international trade. It has significant advantages, including the following:

.1   efficiency improvements provide significant cost savings through reduced fuel costs;

.2   promoting efficiency improvements and keeping the exchange of efficiency credits within the international maritime sector ensures that the sector will maximize efficiency improvements, thereby enhancing sustainability in support of the global economy;

.3   none of the revenues from this scheme funds projects outside of the international maritime sector, further ensuring that the maritime sector will reduce its emissions;

.4   efficiency credit trading makes the most cost-effective efficiency gains available to all in the sector. For example, if a large tanker installs a new technology that is difficult to implement on a small container ship, then that small container ship could trade efficiency credits with the large tanker, taking advantage of lower cost efficiency improvements;

.5 units traded under this approach are calculated from the *difference* between the ships' required and attained efficiency indexes (respectively EI_R and EI_A). This ensures efficiency improvements without capping activity or absolute emissions, and catalyzes action by industry leaders wishing to build and use more efficient ships;

.6 establishing efficiency index standards many years into the future would also provide stability to the efficiency credit and ship technology markets. Due to the high capital cost and long service life of ships, such long-term market confidence and stability would drive investment in efficiency improvements;

.7 the proposal could potentially be accomplished with an amendment to MARPOL Annex VI, which would be faster and less burdensome than developing a new annex or a new convention;

.8 the efficiency improvements are likely to achieve reduced greenhouse gas emissions as well as other regulated emissions such as NO_x, SO_x, and particulate matter. Additionally, they could drive investments into sustainable low-carbon fuels; and

.9 this proposal complements IMO's new ship EEDI, but it does not replace it. IMO's new ship EEDI efficiency index standard would continue to serve an important role for increasing the efficiency of new vessels during construction and entry into the fleet service.

32 Given these significant advantages, the United States intends to submit more specific details on this proposal to MEPC 61, taking into account comments received during this session.

Action requested of the Committee

33 The Committee is invited to consider and further discuss this proposal in the consideration of measures to reduce greenhouse gas emissions from international shipping.

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