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REDUCTION OF GHG EMISSIONS FROM SHIPS

Refrigerated container cargoes

Submitted by ICS and WSC

SUMMARY

Executive summary:	This document outlines why calculating the energy consumption associated with refrigerated containers is critical to creating an equitable CII rating system for container ships transporting chilled and frozen cargoes. The document also outlines the importance of addressing this issue to avoid disproportionate impacts on specific Member State exports and imports that are heavily dependent upon the shipment of goods requiring refrigeration.
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 20
Related document:	MEPC 76/7/5

Introduction

1 This document outlines why it is critical to account for the power demands associated with refrigerated containers and other cargoes that require significant energy consumption to maintain specific temperature requirements demanded of a given cargo. This document expands on the brief explanations outlined in the recent IMO Correspondence Group effort and reported in MEPC 76/7/5 (China et al.).

Cargo penalties and geographic discrimination

2 Refrigerated cargoes represent a very significant trade commodity that make up a major economic segment of the world economy, with numerous countries around the globe exporting and importing various food stocks that must be chilled or frozen. Many of these commodities constitute major export markets for specific countries where these exports represent a significant share of the national economy.

3 Specific countries export significant quantities of goods requiring refrigeration and the vast majority of these goods are transported via refrigerated containers because these containers provide a highly efficient mode to move a specific volume of chilled or frozen product while enabling smaller, customer-specific volumes to be shipped to a multitude of destinations across the world. These cargoes include a wide range of foods (fruits, vegetables, fish, poultry, meat), medical supplies, and other goods that must be transported at a given temperature to avoid spoiling or damaging perishable cargos that become worthless unless specific temperatures are maintained in transit.

4 Since no one ship carries the same amount of refrigerated cargo in a given year and the amount of refrigerated cargo carried by different ships varies dramatically in both volume and over time, a standard correction factor (Cf) is inappropriate. The issues highlighted in this document illustrate a serious problem that certain countries and ships will face absent a defined and accepted mechanism for accounting for energy consumed to refrigerate cargoes that cannot be transported or traded absent refrigeration. Simply put, when carrying refrigerated cargo, the ship is not less efficient, the ship is simply carrying cargo that requires significant additional energy to transport.

5 Failure to calculate the energy consumed by these cargoes and to factor these cargoes into the CII rating of a given ship would discriminate against ships that serve trades moving refrigerated cargoes. In short, the ship itself is no less efficient than a sister ship carrying dry containers, but one ship would be rated as less efficient while the ship carrying dry containers would be deemed more "efficient" not because the ship is better designed and operated, but merely because it is carrying cargo that must be refrigerated.

6 Ships carrying refrigerated containers should not be treated as inefficient or less efficient simply because the cargo requires refrigeration. Failure to incorporate the calculations as proposed in this document would discourage carriers from moving refrigerated cargoes and discriminate against those countries and markets that export and import a significant volume of goods that require refrigeration.

Extreme variability in the relevant loads requires consideration in CII ratings

7 It is important to recognize that the energy consumption associated with refrigerated containers (and many other cargoes that require cooling or heating) is not a uniform source of energy demand across container ships. Some container ships are designed and built to accommodate a larger number of refrigerated containers or "reefers", but the energy demand varies dramatically from ship to ship and from one trade lane to another. A ship serving a given trade lane with certain commodities that require refrigeration may sail with every available reefer slot in use, while another container ship may be sailing in a given trade where few or no reefers are being carried. In short, the energy demand is highly variable between different container ships and is also highly variable when looking at the reefer loads carried by a single ship from one season or year to another.

8 The energy consumption also varies significantly demanding on whether the cargo needs to be chilled or frozen, the length of the voyage, time in port, and the ambient temperature the ship is operating in since hotter ambient temperatures and longer voyages require higher energy demand.

9 The energy required to keep specific containerized cargoes cool or frozen can represent a very significant part of the power consumption on many container ships. To illustrate how significant these loads can be, consider a 4,300 TEU container ship fitted with 1,121 reefer sockets with an installed electric power of 14,840 kW (12,614 kW at 85% load), the total reefer consumption can represent 6,501 kW (as high as 51.5%) of the electrical power generated.

A 23,000 TEU container ship fitted with 2,024 reefer sockets and an installed electric power of 19,500 kW (16,575 kW at 85% load), the total reefer consumption* can represent 11,739 kW (as high as 70%) of the electrical power generated.

10 Because energy consumption associated with refrigerated container cargoes can be very significant and because the energy consumed varies widely among ships of the same size and design and is related to the trade the ship is serving at a given point in time, it is critical to include provisions in the CII framework that do not automatically assign inferior ratings to a specific ship carrying refrigerated cargoes.

11 Recognizing the significant variability in the energy demanded is a function of the actual number of refrigerated containers carried, and how long they are onboard (both in transit and while at berth) one must utilize a mechanism that allows the relevant energy consumption to be accurately recorded. It is also important to develop a mechanism that is clear, detailed, and fully capable of verification by the Administration or the duly recognized organization.

Relationship to a broader framework for monitoring energy consumption associated with cargoes requiring cooling and heating

12 Significant energy consumption associated with the cooling and heating of cargoes is a common consideration for multiple ship types including not only container ships, but also chemical tankers and petroleum tankers. While the specific calculations necessary to monitor and account for the energy consumed for cooling and heating cargoes are unique to specific ship types, the principles and basic framework needed to properly account for this consumption when considering the CII rating of a ship should be accommodated through a common framework of guidelines that specify the specific record-keeping and verification procedures.

13 Use of a common framework, that includes specific calculations appropriate for these ships would enable flag States and port States to easily reference the verification procedures used to account for this significant source of energy consumption that is unique to certain ships and highly variable from one ship to another and highly variable over time for a given ship.

Proposed solution

14 The co-sponsors propose a detailed method for calculating the relevant energy consumed to refrigerate containers onboard. The methodology is designed to monitor energy consumed by the specific number of chilled and frozen containers carried, the number of days carried ("reefer days"), and related energy consumption for the annual reporting period. The specific calculations are included in the annex to this document.

15 Following the concept proposed by the Netherlands during the Correspondence Group, the co-sponsors propose a percentage-based correction of 85% of the calculated fuel consumption with an annual adjustment of 2% each year. The 85% percentage correction and annual adjustment is intended to encourage efficiency improvements in those engines responsible for powering the refrigerated containers while in transit and at berth.

* Total actual reefer consumption will vary by the number of reefers carried, the relevant temperature settings (chilled vs. frozen), the ambient temperatures the ship is operating in which will impact energy consumption, and the total hours involved in the voyage.

16 Following a review of kW energy loads associated with the transport of refrigerated containers the co-sponsors have lowered the suggested average loads for Cx_c and Cx_f specified under part A.2 of appendix 1 of the draft *guidelines on operational carbon intensity indicators and the calculation methods* (CII guidelines, G1) to 4.8 kW and 3.2 kW, as annexed to this document.

17 The proposed CII calculations for refrigerated containers proposed in this annex and included in MEPC 76/7/5 are clear, detailed procedures that allow both ships and the Administration to specifically identify fuel consumed for refrigerated container cargoes. Calculations are based on the specific number and type of refrigerated containers carried (chilled or frozen), and do not employ gross estimates based on reefer plugs installed. This provides a clear and unambiguous record that the Administration can verify at the voyage level as well as total annual figures for the ship. This allows the relevant verifier to assess what portion of the ship's fuel consumption results from the need to maintain refrigerated cargoes actually carried by the ship in a given period.

18 The co-sponsors propose that the total fuel consumption for the ship – including fuel consumed for refrigeration purposes – would be fully reported each year to the IMO DCS. The specific fuel consumption associated with cooling, however, would be accounted at a factor of 85% and considered when the Administration assigns the CII rating of the ship consistent with the relevant guidelines developed by the Organization.

19 Failure to incorporate the proposed calculations and associated guidelines would result in a situation where ships carrying refrigerated cargoes would be penalized (through inferior CII ratings) simply because of the cargo they are asked to carry.

Action requested of the Committee

20 The Committee is invited to consider the information and proposal presented in this document and to take action as appropriate.

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ANNEX

CORRECTION FACTORS FOR USE IN CII CALCULATION

Part A. Correction factors for refrigerated containers

For ships carrying refrigerated containers (reefers), the following specific correction factors may be applied:

.1 For ships that have the ability to monitor reefer electrical consumption, the ship may calculate container ship reefer kWh consumption as follows:

- kWh for cooling or heating of cargo on the vessel (*reefer kWh*) should be measured on the vessel by the kWh meter counter on the vessel and verified.

- Refrigerated container fuel oil consumption (FOC_{reefer}) should be calculated as:

$$FOC_{reefer} = (reefer\ kWh)\ x\ (SFOC\ AE)$$

- The following calculation should be used:

$$Cii\ = Cf \times \frac{FOC_{total} - [0.85] FOC_{reefer}}{Distance\ \times\ DWT}$$

where:

- FOC_{reefer} *(Reefer fuel oil consumption) represents the e*stimated fuel consumption attributed to in-use refrigerated containers carried.[1] [85% of the] Total reefer consumption to be deducted from the ship's total annual fuel consumption.

- FOC_{total} represents the total fuel consumption of the ship over the declared period.

- *Cf* represents the conversion factor between fuel consumption and CO_2 emission (default value 3.114 g CO_2 per tonne of fuel to be applied or appropriate carbon factor if using an alternative fuel).

- *SFOC AE (auxiliary engine) represents* the specific fuel oil consumption associated with the relevant auxiliary engines [as per EEXI technical file].

.2 For ships that do not have the ability to monitor reefer electrical consumption, the ship may calculate container ship reefer kWh consumption as follows:

In ports where shore-power is not used, the number of in-use reefers at port should be calculated as:

[1] The actual number of in-use reefers carried is documented in the Baplie file for auditing purposes.

$$Days_{Rc,port} = \frac{No_c\ Arrival + No_c\ Departure}{2} \times Days_{port}$$
$$Days_{Rf,port} = \frac{No_f\ Arrival + No_f\ Departure}{2} \times Days_{port}$$

where:

- *Days* $_{port}$ represents…
- *Days* $_{Rc,\ port}$ represents the number of chilled in-use reefer days while at port[2]
- *Days* $_{Rf,\ port}$ represents the number of frozen in-use reefer days while at port[3]
- $No_c\ Arrival$ *represents…*
- $No_c\ Departure$ *represents…*
- $No_f\ Arrival$ *represents…*
- $No_f\ Departure$ *represents…*

Then, total fuel consumption should be calculated as:

$$\begin{aligned} FOC_{reefer} = \quad & \left[(Cx_c)\left(Days_{Rc} \times 24\ \frac{hrs}{day}\right)(SFOC_{AE})\right] \\ & + \left[(Cx_f)\left(Days_{Rf} \times 24\ \frac{hrs}{day}\right)(SFOC_{AE})\right] \\ & + \sum\left[\left(Days_{Rc,port} \times Cx_c\right.\right. \\ & \left.\left. + Days_{Rf,port} \times Cx_f\right)\left(24\ \frac{hrs}{day}\right)(SFOC_{AE})\right] \end{aligned}$$

$$Cii = Cf \times \frac{FOC_{total} - [0.85]FOC_{reefer}}{Distance \times DWT}$$

where:

- FOC_{reefer} *(Reefer fuel oil consumption)* represents the estimated fuel consumption attributed to in-use refrigerated containers carried.[4] [85% of the] total reefer consumption to be deducted from the ship's total annual fuel consumption.
- FOC_{total} represents the total fuel consumption of the ship over the declared period.
- Cx_c represents the in-use chilled reefer consumption (4.8 kW average value suggested).

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2 The number of reefers onboard while in port, should be calculated to equal the number of reefers at arrival and at departure as calculated above. Same calculation applies for Days Rc in port and Days Rf in port.

3 Ibid.

4 The actual number of in-use reefers carried is documented in the Baplie file for auditing purposes.

- Cx_f represents the in-use frozen reefer consumption (3.2 kW average value suggested).

- *Days* $_{Rc}$ represents the number of chilled in-use reefer-days over the declared period.

- *Days* $_{Rf}$ represents the number of frozen in-use reefer-days over the declared period.

.3 For ships for which this correction factor is applied, the fraction of FOC_{reefer} which may be deducted starts at [85%] and is reduced by [2%] per year (encouraging improved reefer efficiency while underway and at berth).

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