INTERNATIONAL MARITIME ORGANIZATION

IMO

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INTERSESSIONAL MEETING OF THE
GREENHOUSE GAS WORKING GROUP
2nd session
Agenda item 2

GHG-WG 2/2/13
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CONSIDERATION OF THE ENERGY EFFICIENCY DESIGN INDEX FOR NEW SHIPS

Further development of index methodology as presented at MEPC 58

Submitted by INTERFERRY

SUMMARY

Executive summary:	This document provides information on ongoing work for developing an alternative methodology for calculating the attained Energy Efficiency Design Index for ships
Strategic direction:	7.3
High-level action:	7.3.1
Planned output:	7.3.1.1 and 7.3.1.3
Action to be taken:	Paragraph 11
Related documents:	MEPC 58/WP.8 and MEPC 58/23

Introduction

1 MEPC 58 approved the use of the draft Interim Guidelines on the method of calculation of the Energy Efficiency Design Index for new ships, for calculation and trial purposes with a view to further refinement and improvement, as set out in annex 11 of the report, document MEPC 58/23.

2 With regard to the ongoing work within IMO to establish a methodology for calculating the energy efficiency of new ships, INTERFERRY has looked into the methodology presented in MEPC 58/WP.8.

Objective

3 The objective of this document is to evaluate whether the MEPC 58/WP.8 methodology could be further developed in order to allow ship designers to more freely adjust all relevant ship design parameters in order to obtain higher energy efficiency.

Overall Conclusions

4 The regression analysis methodology for an implementation of an EEDI as proposed by the Working Group on Greenhouse Gas, in which the EEDI is in principle derived as a function of *Capacity* (DWT or GT), could possibly be applied on ship types engaged in trans-ocean trades where seagoing transit is the absolute dominating mode in an operation profile.

5 However, for ships engaged in short sea shipping, providing line services dictated by a timetable, and for ships having unconventional propulsion arrangements the proposed methodology does not grant the intended fair basis for comparison.

6 Moreover, a satisfactory approach for indexing shipboard auxiliary power that facilitates an incentive for improvement and optimization has not been presented. For Ro-Ro Passenger and Passenger Ships, due consideration must be given to the specific characteristics of these segments' services. An adequate indexing can not be achieved by utilizing a generic equation based on *Capacity*.

7 Consequently, a robust Energy Efficiency Design Index should be divided into two separate parts, .1 addressing propulsion and .2 addressing auxiliary power:

.1 Efficient Propulsion Design Index, EPDI, which, in principle, is expressed as the required Propulsion Power per *Capacity* as a function of Service Speed.

By using required power instead of installed power, proposed correction coefficients f_j and f_w can be omitted. Ships utilizing unconventional propulsion systems and ships with higher installed power due to ice strengthening can also easily be included. Furthermore, such an index is more in line with the expressed intent of an EEDI as it provides an enhanced possibility to more freely work on several ship parameters in the design work, aiming to reduce the required propulsion power and consequently the emissions; and

.2 Efficient Auxiliary and Utility Systems Design Index, which is yet to be defined.

Efficient Propulsion Design Index

8 The methodology for establishing a robust Efficient Propulsion Design Index (EPDI), would utilize ship parameters that describe performance characteristics, as given below:

$$EPDI = \frac{\left(\sum_{i=1}^{nME} C_{FMEi} SFC_{MEi} P_{B,MEi}\right) - \left(\sum f_{eff} P_{eff} C_{Feff} SFC_{MEi}\right)}{Capacity}$$

Where:

.1 C_F is a non-dimensional conversion factor between fuel consumption and CO_2 emission;

.2 *Capacity* is defined as follows:

- for dry Cargo Carriers, Tankers, Gas Tankers, Container Ships, Ro-Ro Cargo and Passenger Ships and General Cargo Ships; deadweight (DWT) should be used as Capacity;

- for Passenger Ships Gross Tonnage (GT) should be used as Capacity;

.3 the attained index $P_{B,MEi}$ is to be taken as predicted total brake power (P_B) required to propel the ship at service speed (V_s) in calm and deep water at the load condition corresponding to the *Capacity*;

.4 if available statistical data of Brake Power ($P_{B,MEi}$) at service speed (V_s) proves to be insufficient, for the purpose of generating a Baseline, P_{MEi} could be considered applying an adequate percentage of the rated installed power (MCR) for each main engine (in below figure 1, 75% of MCR in accordance with MEPC 58/WP.8 has been applied);

.5 V_S, is the ship's service speed in knots;

.6 L_{BP}, is the ship's length in meters between perpendiculars;

.7 Fn_L, is the ship's Froude number, defined as:

$$Fn_L = \frac{V_S * 0.51444}{\sqrt{9.81 * L_{BP}}} \quad 1)$$

.8 *SFC* is the specific fuel consumption, measured in g/kWh, of the engines at the power output of P_B determined by paragraph 5; and

.9 Reduction factors:

- f_{eff} is the availability factor to account for any innovative energy efficient technology;

- P_{eff} is the main engine power reduction due to innovative energy efficient technology;

- SFC_{eff} is the specific fuel consumption of the main engines at P_{eff}; and

- C_{Feff} is the CO_2 conversion factor of the fuel used in the respective main engine.

9 With this approach, the baseline is to be established as the EPDI as defined above versus Froude number, Fn_L. For ro-ro ships, for instance, the baseline is depicted in figure 1 below.

1) 0.51444 is a conversion factor between knots and m/s.

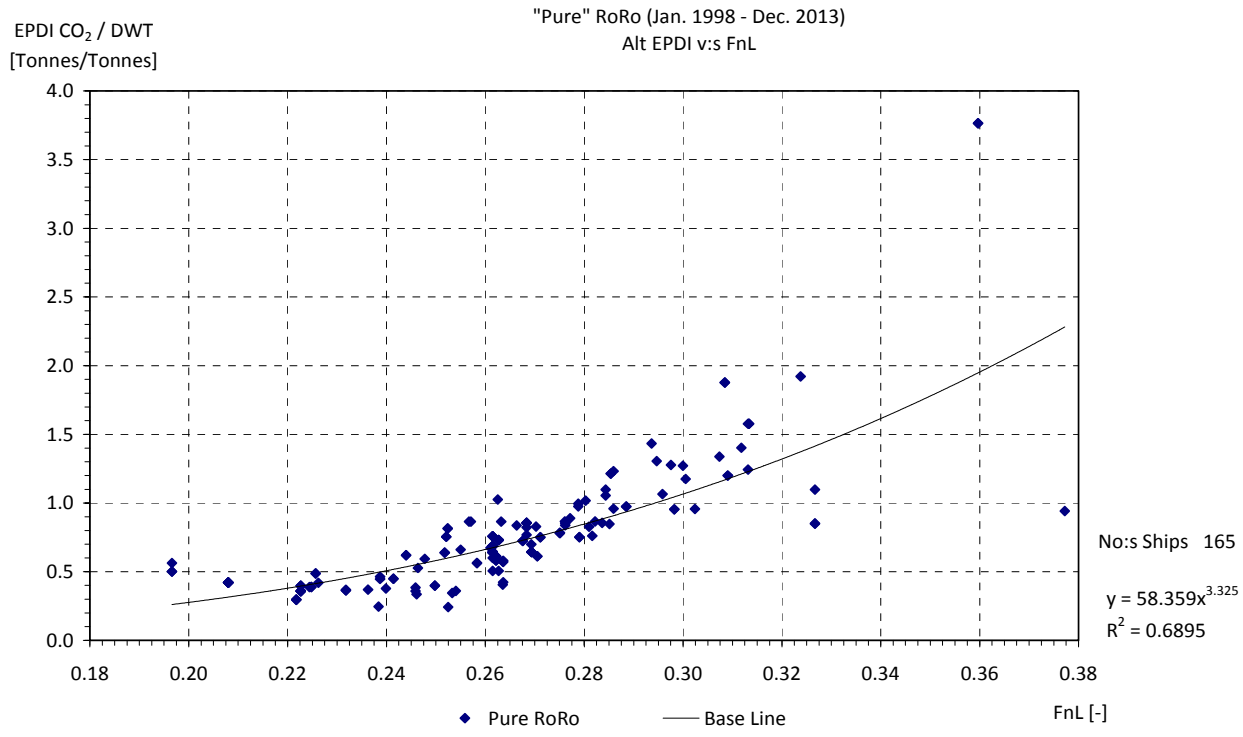

Figure 1 Alternative EPDI for "Pure" Ro-Ro Ships Baseline (1998-2013)

10 This methodology would enable Naval Architects a greater freedom on how to work on the individual parameters, while still meeting the overall objective of increasing the ship's energy efficiency.

Action requested of the Intersessional Meeting

11 The Intersessional Meeting is invited to note the findings made so far in this ongoing work, for the development of the discussion during the Intersessional Meeting.