INTERNATIONAL MARITIME ORGANIZATION

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MARINE ENVIRONMENT PROTECTION COMMITTEE
75th session
Agenda item 6

MEPC 75/6/9
24 January 2020
Original: ENGLISH
Pre-session public release: ☒

ENERGY EFFICIENCY OF SHIPS

Application of energy efficiency measures on existing ro-ro cargo and ro-ro passenger ships, building on experiences from the EEDI

Submitted by INTERFERRY

SUMMARY

Executive summary:	As experienced during the development and application of the EEDI requirements, the diversity of the ro-ro cargo and ro-ro passenger ship fleets presents challenges in approaching energy efficiency by fleet average performance. This document argues that requiring existing ro-ro type ships to match the perceived performance of new designs needs to be carefully considered; that the metrics used as proxy for transport work should be revisited and that a period of data gathering and experience gaining should precede an entry into force of compulsory efficiency requirements.
Strategic direction, if applicable:	3
Output:	3.7
Action to be taken:	Paragraph 31
Related documents:	MEPC 75/7/2; MEPC 74/7/4; ISWG-GHG 6/2/3, ISWG-GHG 6/2/11, ISWG-GHG 6/2/13 and resolution MEPC.308(73)

Introduction

1 When the EEDI framework was developed it was noted that, due to the large diversity of ship particulars and design speeds within the respective ro-ro shipping segments (cargo-, passenger- and vehicle carriers), an acceptable level of statistical correlation for the application of a mandatory instrument that would be 'fair and robust', was not readily available.

2 It was also recognized that as these segments were in head-on competition with other modes of transport, relying on speed reduction as a primary approach – or a fall-back position – would not be conducive to maintaining or increasing current levels of short sea shipping.

3 Furthermore, it was recognized that for redundancy purposes, for example when frequently operating in harbours (without tug assistance) and for crossing busy shipping lanes, these ships (especially ro-ro passenger ships) will have significantly more installed power than what is required for their operational design speed. This redundancy is typically achieved via a multi-engine installation, where one or more engines are held as a reserve that should ideally not be included in the EEDI calculation.

4 Taken altogether, a methodology was therefore developed to establish correction factors aiming to normalize ships' particulars and varying design speeds. This so-called Ship Design Variable would later be included as f_{jRoRo} in the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships, as amended* (resolution MEPC.308(73)):

$$f_{jRoRo} = \frac{1}{Fn^{\alpha} \cdot \left(\frac{L_{pp}}{B_S}\right)^{\beta} \cdot \left(\frac{B_S}{d_s}\right)^{\gamma} \cdot \left(\frac{L_{pp}}{\sqrt[3]{\nabla}}\right)^{\delta}}$$

Where:

Fn	Froude number, as defined in resolution MEPC.308(73)
B_S	Moulded Breadth
Lpp	Length between perpendiculars
d_S	Summer load line draught
∇	Volumetric displacement

α, β, γ and δ are as defined in resolution MEPC.308(73)

5 Due to the complexity of developing this solution, the implementation of the EEDI requirement was delayed for ro-ro type ships and the first phase requirement was for a 5% improvement as compared to 10% for other segments.

6 During a subsequent IMO review of the EEDI framework, it came to light that, despite all efforts put in to ensure that the scattered data set for ro-ro type ships could be used as the baseline for mandatory requirements, the original reference lines were significantly incorrect.

7 Therefore MEPC 71 agreed to correct the reference lines for ro-ro cargo and ro-ro passenger ships. Furthermore, a size threshold was introduced to cater for the lack of large ships in the reference data set.

8 While these adjustments have made EEDI more viable in its current format, it has always been clear to Interferry that the general EEDI approach – which was originally developed for trans-ocean, relatively homogenous ship types – does not lend itself well to sectors where there is significant diversity in operating speed, dimensional constraints and seasonal operating profiles.

Technical requirements on existing ships

9 The technical requirements prompted by EEDI can be addressed when designing a new ship and a ro-ro type ship can demonstrably be made to meet the current EEDI-requirement, but that does by default mean that the ship is actually optimized for energy efficiency.

10 Existing ships, i.e. pre-EEDI, cannot on the other hand be re-engineered to meet retroactive requirements. There is a degree of energy efficiency enhancing technology that can be deployed, but largely any significant gains in actual energy efficiency will likely need to be addressed either through low-carbon fuels or by adapting power and speed.

11 The speed element is, to our understanding, one of the appeals with the suggested EEXI by Japan and Norway (ISWG-GHG 6/2/3), since many pre-EEDI ships in the ocean-going shipping segments have a potential to reduce their operational speed (power) and/or they operate in a segment where ships over a certain age are already being phased out.

12 Due to their bespoke nature, ro-ro ships tend to individually put more financial burden on the owner/operator than many other ship types, in particular in relation to their earning capacity. For ro-ro passenger ships, there is also another financial dimension in meeting additional safety requirements and to equip the ship for passengers' needs.

13 To that end, at 22 and 25 years, respectively, the average age for ro-ro cargo and ro-ro passenger ships is actually higher than the age of the ships making up the reference line for EEDI (1999-2010). This means that the majority of the ships that would fall under EEXI are not even represented in the reference line.

14 As noted in the EEDI review, due to the small sample, the reference line can quite easily be misrepresentative, which prompted the 20% correction decided by MEPC 71. Arguably, if also the ships older than the population making up the reference line had been included, the reference line would have been nominally higher.

15 If one then imagines a potential requirement that a pre-EEDI ship has to meet the equivalent of EEDI Phase 2 or Phase 3 by its first renewal survey after 2023 or 2025, respectively, it is evident that asking for such a significant step change in efficiency enhancement is disproportionate. From an equity point of view, it is not a realistic option to retire a ro-ro type ship that may perhaps not even have reached the average age of the fleet. Furthermore, due to the correction factor f_{jRoRo}, there may be only very limited numerical benefits by reducing the installed power of the ship, notwithstanding any safety implications of limiting the redundancy.

16 It should be observed that f_{jRoRo} was developed for new designs and was never intended for retroactive application. Therefore, a future EEXI for ro-ro cargo and ro-ro passenger ships should be assessed both with and without these specific correction factors, in order to ascertain if either option will present a 'fair and robust' solution.

17 Figures 1 and 2 provide an initial assessment for ro-ro cargo ships, building on the original reference line data set, with additional data gathered by the submitter. Many individual existing ships are very far from meeting the "EEXI Phase 2 compliance level" both when applying the correction factor (figure 1) and in a non-corrected setting (figure 2). While the magnitude of the non-compliance is larger in the non-corrected version, most existing ships are far from meeting the requirements, even with the correction factor deployed.

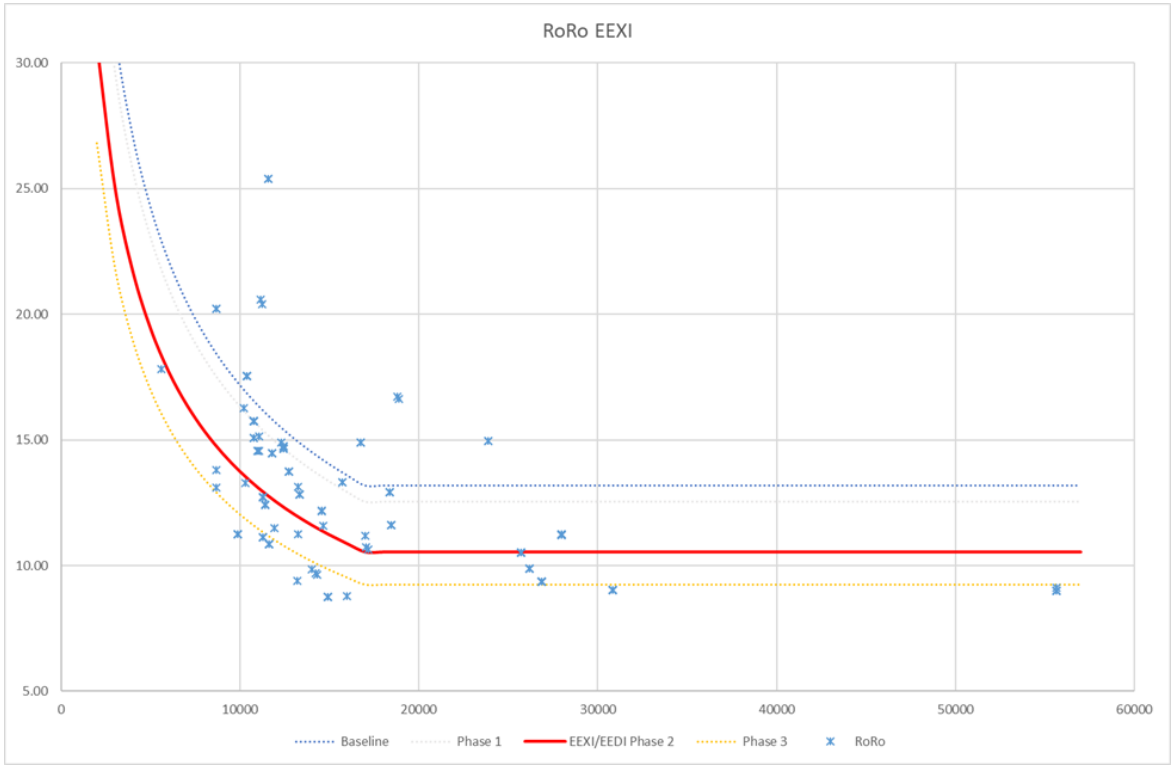

Figure 1 - EEXI for ro-ro cargo ships (with correction factor f_{jRoRo})

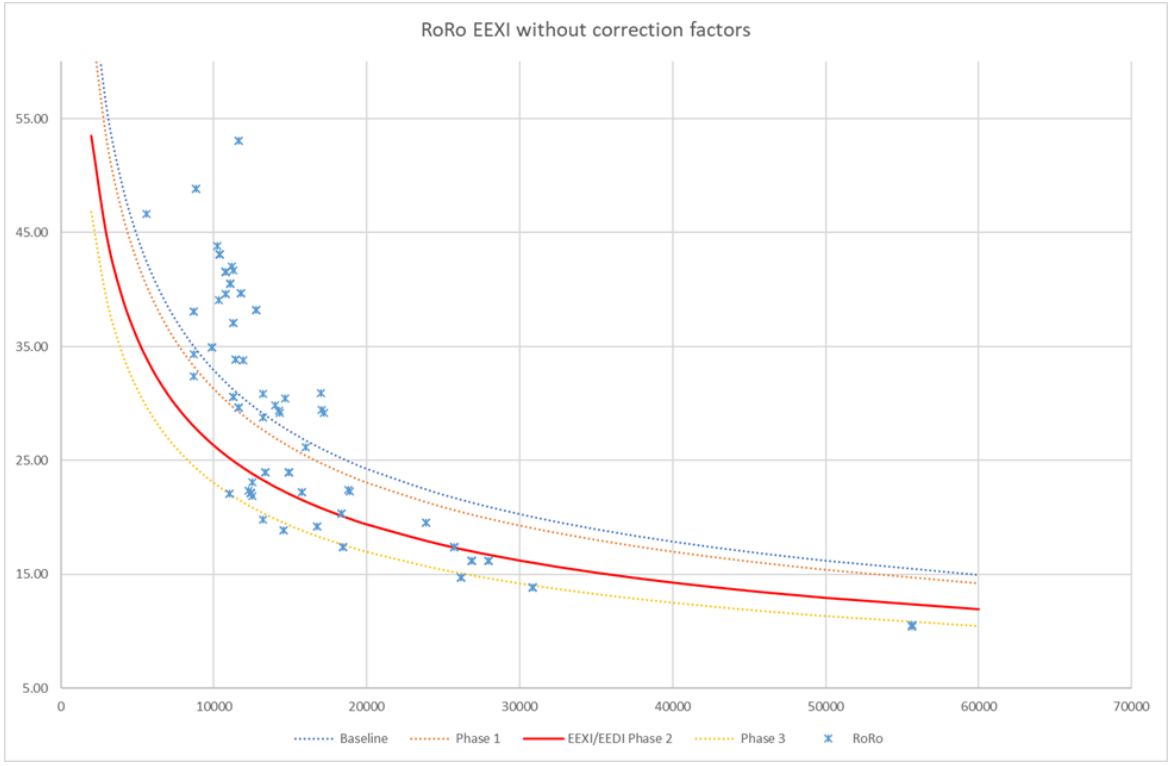

Figure 2 - EEXI for ro-ro cargo ships (without correction factor f_{jRoRo})

Operational requirements on existing ships

18 Another main approach was offered in document MEPC 74/7/4 where Denmark et al. suggested that the existing fleet may be addressed through a goal-based short-term measure. Under this approach, it is noted that there must be a baseline and it is suggested, inter alia, that EEDI reference lines could be used, in order to establish the initial level of achieved reduction, as well as the associated gap to the 40% target, but also as the basis against which the operational metric may be compared.

19 While Interferry is supportive of the concept of operational requirements, using EEDI for the baselines is, for aforementioned reasons, complicated.

20 Some initial examination and analysis of this proposal suggests that the operational metric generally results in a figure somewhat larger (worse) than the attained EEDI and would therefore increase the gap to the 40% target rather than reduce it. It is not known at this stage if there are any feasible solutions to improve the operational metrics to the level needed if EEDI is used as a baseline, however it should be recalled that the split-incentive problem does not exist in the sector and significant investment and innovation occurs, such as the many energy efficiency technologies that are first trialled in passenger only and ro-ro passenger vessels, and subsequently adopted if shown to work, e.g. batteries.

21 Such battery packs have quite recently been introduced as a means to improve overall energy efficiency, either through peak shaving or by utilizing low carbon shore electricity as a complementary energy source for propulsion and auxiliaries. Battery packs also offer an alternative for a spinning reserve redundancy, but currently there is no clear linkage within the EEDI framework to the actual energy saving potential from hybrid technologies.

Transport work

22 Regardless of which methodology is finally agreed as the way to address existing ships, it is very important that the transport work metrics are chosen with a view to encourage true energy efficiency improvements.

23 The submitter would in this context caution against using the existing EEDI reference line metrics as the basis for any goal-based measure or technical requirement. For both ro-ro cargo and ro-ro passenger ships, using DWT as the denominator does not offer good correlation to actual energy efficiency, since transport work in these segments is not strongly linked to DWT.

24 By means of example, one on-going ro-ro cargo new building project reports that, while maintaining the same engine power as for the ship that is to be replaced, the new design doubles (+105%) the number of lane-metres for cargo. The corresponding increase in DWT, on the other hand, is 70%. This means, numerically, that if the EEDI reference line was used as is, only two thirds (70/105) of the actual energy efficiency improvement would be credited.

25 The ro-ro segments have for long sought to develop a universal and robust metric for transport work, but due to the inherent diversity within the segment, this has not been realized. For the European Union MRV system, a rather elaborate approach was developed and while on a ship-individual basis it is reasonably fair as a year-on-year comparison tool, the submitter believes that it would not be appropriate to use as a mandatory requirement under MARPOL Annex VI.

26 While a perfect metric has not been found, the industry would support that the transport metric for ro-ro cargo is expressed in a volumetric manner, for instance expressed as g CO_2 per lm*H*nautical mile, where a trailer lane metre (lm) is defined to be (minimum) 2.80 metres wide and (minimum) 4 metres high (H).

27 This would both reward benefits of scaling up ship size and recognize that ro-ro cargo ships typically run out of ro-ro space volume before they run out of deadweight.

28 For ro-ro passenger ships, the challenge is similar, but further complicated by a large variation in passenger vs. freight utilization of the ship. Additionally, many ro-ro passenger ships will have hoistable decks that are utilized for cars when the demand is high, otherwise retracted to allow for higher rolling cargo in that area. Either solution will yield quite different lane-meter utilization but would per a volumetric measure be reasonably similar.

29 For simplicity, and for ease of establishing a relevant baseline, it is therefore suggested that the transport metric for ro-ro passenger ships could be GRT*nm to better, although not perfectly, reflect the volumetric nature of this ship type's operation.

Proposal

30 The submitter welcomes the development of proposals for improved operational efficiency. Care must be taken, however, to ensure that such operational requirements are based on reliable and relevant data and actually address the true energy efficiency in an equitable manner.

Action requested of the Committee

31 The Committee is invited to consider the establishment of a data gathering and experience gaining phase, followed by a review before compliance with such retroactive requirements can be made mandatory for existing ro-ro cargo and ro-ro passenger ships.