In this paper EEXI, the proposed index for existing ships is presented and briefly analysed. Some Ro-Ro vessels, which are divided into three types by IMO, are highly impacted by the application of this index from 2023 as currently proposed because the ‘one size fits all’ approach used is not appropriate.

The index, which relates to vessel design and not operation, essentially penalises vessels designed to be operated at higher than average speeds. Under EEXI, new vessels may even have worse scores than 20+ year old ones.

The aim of this paper is to provide information about the index, the issues and potential impact for ships used by the finished vehicle logistics industry, especially for Ro-Ro cargo (vehicle carrier) vessels.

Contents

Background

IMO

International Maritime Organization (IMO), a specialized agency of the United Nations that is responsible for measures to improve the safety and security of international shipping and to prevent marine pollution from ships. The IMO sets standards for the safety and security of international shipping. It oversees every aspect of worldwide shipping regulations, including legal issues and shipping efficiency.

MEPC

The Marine Environment Protection Committee (MEPC) addresses environmental issues under IMO's remit. This includes the control and prevention of ship-source pollution covered by the MARPOL treaty, including oil, chemicals carried in bulk, sewage, garbage and emissions from ships, including air pollutants and greenhouse gas emissions.

MEPC convenes 3 times every two years and during its 5-day meetings, issues related to the above mentioned topics are discussed and further amendments and revisions to MARPOL are proposed and adopted.

Energy Efficiency Existing Ship Index (EEXI)

Overview

During the MEPC 75 in November 2020 amendments to MARPOL Annex VI were approved. Within these amendments the EEXI was introduced. EEXI is part of the IMO's Greenhouse Gas Strategy and falls within the short-term measures aiming at the reduction of carbon intensity.

Introduction

EEXI is the extension of EEDI (which concerns new builds) for existing ships. Its adoption is due for the next MEPC meeting (MEPC 76) in June 2021 and it will come to force in 2023. EEXI will be applicable in general for all vessels above 400 GT falling under MARPOL Annex VI but requirements start from larger thresholds for Ro-Ro vessel types (see Table 1 below). Subsequently the EEDI limits (Table 1) would be implemented to existing ships. In particular Ro-Ro cargo ships (vehicle carrier) will struggle to be compliant with EEXI required equivalent to EEDI Phase 2. Although limits and reduction rates have been agreed, calculation guidelines are work in progress.

Carbon Intensity Indicator (CII) and CII rating were also a part of the measures proposed during MEPC 75. The draft amendments apply to vessels of over 5,000 gross tonnage and they require to have their annual CII determined and compared to the CII rating. In this case the limits and the calculation method are both a work in progress. However, this paper does not cover CII.

Applicable Ship Types and Reduction Factors (in %)

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 and onwards
Bulk Carrier	20,000 DWT and above	0	10	20	30
	10,000 – 20,000 DWT	n/a	0-10	0-20	0-30
Gas Carrier	10,000 DWT and above	0	10	20	30
	2,000 – 10,000 DWT	n/a	0-10	0-20	0-30
Tanker	20,000 DWT and above	0	10	20	30
	4,000 – 20,000 DWT	n/a	0-10	0-20	0-30
Container Ship	15,000 DWT and above	0	10	20	30
	10,000 – 15,000 DWT	n/a	0-10	0-20	0-30
General Cargo Ship	15,000 DWT and above	0	10	15	30
	3,000 – 15,000 DWT	n/a	0-10	0-15	0-30
Refrigerated Cargo Carrier	5,000 DWT and above	0	10	15	30
	3,000 – 5,000 DWT	n/a	0-10	0-15	0-30
Combination Carrier	20,000 DWT and above	0	10	20	30
	4,000 – 20,000 DWT	n/a	0-10	0-20	0-30
LNG Carrier	10,000 DWT and above	n/a	10	20	30
Ro-ro cargo ship (vehicle carrier)	10,000 DWT and above	n/a	5	15	30
Ro-ro cargo ship	2,000 DWT and above	n/a	5	20	30
	1,000 – 2,000 DWT	n/a	0-5	0-20	0-30
Ro-ro passenger ship	4,000 GT and above	n/a	5	20	30
	1,000 - 4,000 GT	n/a	0-5	0-20	0-30
Cruise passenger ship having non-conventional propulsion	85,000 GT and above	n/a	5	20	30
	25,000 – 85,000 GT	n/a	0-5	0-20	0-30

Table 1: Ship Types and Reduction Factors (in %), Source: IRCLASS

EEDI

EEDI is an index that indicates the energy efficiency in terms of gCO_2 (generated) / tonne.mile (cargo carried) calculated for a specific reference ship operational condition. The application of the index aims to affect technologies of new vessels and achieve built-in technical standards that will subsequently be more energy efficient and environmentally friendly. EEDI must be calculated for existing vessels that undergo a major conversion and could be considered as a new.

Calculation

EEXI calculation

The calculation of the EEXI follows the 2018 calculation guideline of the EEDI, with some additional adaptations on existing vessels. Draft guidelines are available (submission ISWG-GHG 7/2/7). However, as drafting the guidelines is work in progress, the final proposal will only be adopted by the next MEPC meeting (MEPC 76) in June 2021.

EEXI, just like EEDI, is an index that estimates CO_2 emissions related to installed engine power, transport capacity and vessel speed. The EEXI is a design index, not an operational index. No measured values of past years are relevant and no on-board measurements are required; the index only refers to the design of the ship.

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

- Main engine part
- Auxiliary engine part
- Shaft motor
- Innovative energy efficiency technology for reduction of main engine power
- Innovative energy efficiency technology for reduction of auxiliary engine power
- Ship-type specific correction factors

EEXI calculation formula, source: DNV

The emissions are calculated from the installed power of the main engine, the corresponding specific fuel oil consumption of the main engine and of auxiliary engines, and a conversion factor between fuel and the corresponding CO_2 mass. The transport work is determined by capacity, which is usually the deadweight of a ship and the ship speed related to the installed power.

The calculation does not consider the maximum engine power, instead using 75% of this power for most ship types. Specific fuel oil consumption of the main engine and ship speed are used for this specific power.

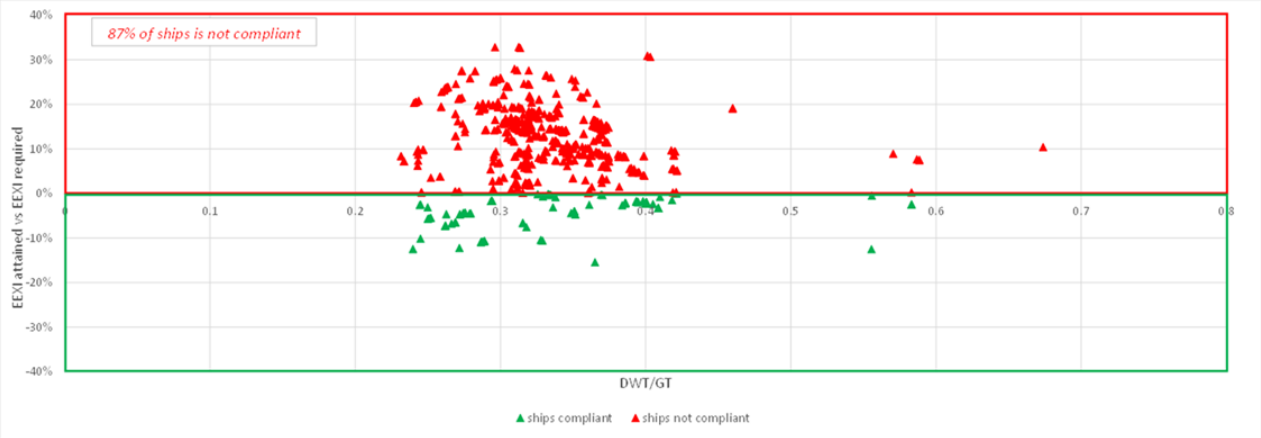
The EEXI is applied to almost all vessels above 400 gross tonnage. For different ship types, proper adjustments (correction factors) of the formula are necessary to allow a suitable comparison.

Issues

There are a variety of issues arising from the formula above but also from the definition and the differentiation of the vessels that MEPC is applying. Ro-Ro vessels are specifically split into just 3 categories under IMO's framework:

- Ro-Ro cargo ship (vehicle carrier) refers to PCCs and PCTCs (but IMO does not differentiate between short sea and deep sea)
- Ro-Ro cargo ships are vessels carrying cargo plus vehicles
- Ro-Ro passenger ship is the term for vessels that carry more than 12 passengers as well as vehicles

The above approach, one size fits all, creates issues for Ro-Ro vessel types. As seen in the graph below (Graph 1) 87% of Ro-Ro cargo ship(vehicle carrier) vessels are not expected to be compliant.



Graph 1: Predicted EEXI results for Ro-Ro cargo ship (vehicle carrier) fleet

An obvious suggested solution in this case is the reduction of power of engine that results in the reduction of speed.

It is obvious to all that the methodology proposed is not appropriate for all Ro-Ro types. The usage of Gross Tonnage (GT) instead of deadweight tonnage (DWT) could be more relevant in the case of Ro-Ro cargo and Ro-Ro cargo (vehicle carriers). However, the reduction rate is much more important.

The issue of incorrect data being used has also been identified. Data supplied to MEPC for some vessels contained errors creating further challenges.

In the case of EEDI, correction factors were introduced for some Ro-Ro vessels. Energy Efficiency Design Index correction factor on Ro-Ro passenger ships and Ro-Ro cargo ships (f_{jRoRo}) was adopted at MEPC 66 on April 2014 (Resolution MEPC 245(66): 2014 guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships). However, Ro-Ro cargo ships (vehicle carriers) were not included.

The risk for the industry is clear. Some ships may have to be disposed of earlier than planned while others will have to have their power reduced and be forced to sail at lower speeds. **This will result in a reduction of the industry's capacity to move cars.** Additionally, speed increases to meet urgent deliveries will no longer be possible.

Summary

It is vital to find a solution that addresses all three Ro-Ro vessel types equitably in order to protect the industry's capacity to support the recovery of the automotive sector.

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