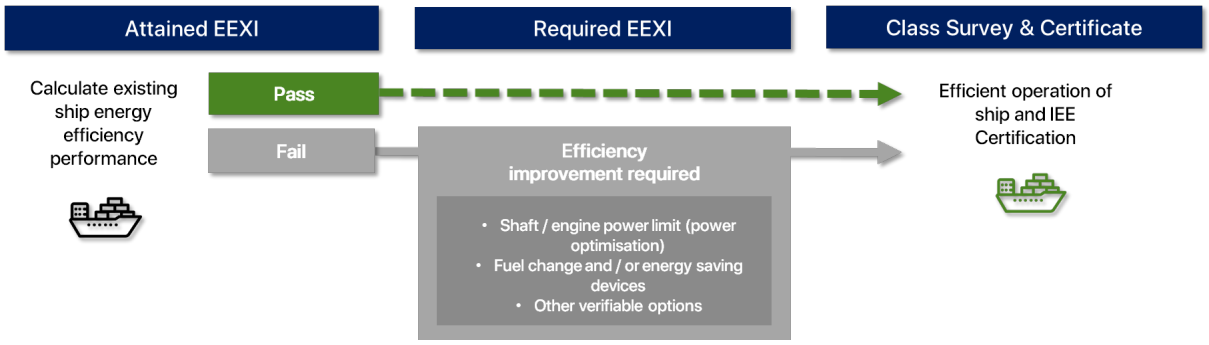
The Energy Efficiency Design Index for Existing Ships (EEXI)

During 2023 the majority of existing ships over 400 Gross Tonnes will require to carry a verified EEXI "Technical File" demonstrating compliance with MARPOL Annex VI (air pollution requirements).

The Energy Efficiency Design Index for Existing Ships (EEXI) calculates a theoretical grams of CO_2 per ton of cargo per nautical mile. Strict targets have been set reducing CO2 output by up to 30% compared to 2008 fleet average values. The % reduction depending on ship type and size.

Calculating EEXI is not straightforward, but Morson Projects Marine have developed a free online tool which gives ship owners the ability to accurately calculate and produce a technical file which can be verified by their Flag State or Classification Society. Flag of Class can then issue an International Energy Efficiency certificate, which will be required to continue trading beyond 2023.

If the outcome of the EEXI calculation finds that the ship fails the requirement then Morson Projects Marine will provide consultancy services to the ship owner to help improve their EEXI score.



EEXI will apply to the following ships types above 400 Gross Tonnes involved in international trade.

1. Bulk Carrier
2. Gas Carrier
3. Tanker
4. Containership
5. General Cargo Ship
6. Refrigerated Cargo Carrier
7. Combination Carrier
8. LNG Carrier
9. Ro-Ro Cargo Ship (Vehicle Carrier)
10. Ro-Ro Cargo Ship
11. Ro-Ro Passenger Ship
12. Cruise Passenger ship (Non-Conventional Propulsion)

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The Background to EEXI

The "IMO" – the International Maritime Organization – is the United Nations specialised agency with responsibility for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships. The IMO is based in London.

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships.

MARPOL is governed by members of the Marine Environment Protection Committee (MEPC), which meets regularly to consider revisions to the MARPOL convention.

MARPOL Annex VI seeks to address:

- the impact of air pollution from shipping activities on human health and environments, and
- the impacts of emissions from shipping activities on climate change and ozone layer depletion

At the MEPC (75) meeting in November 2020, the IMO approved amendments to the air pollution section of the MARPOL regulations, covered under Annex VI. **These introduced an Energy Efficiency Design Index for existing ships (EEXI).**

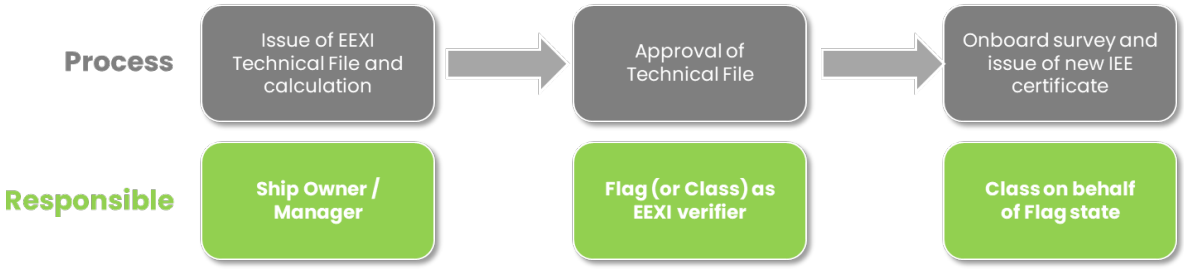
The EEXI regulations will enter into force on the 1st January 2023. EEXI will be applicable for all vessels engaged in international trade above 400 GT falling under MARPOL Annex VI.

EEXI is the extension for existing ships of the newbuilding related Energy Efficiency Design Index (EEDI). Most procedures will be the same as for the EEDI, with some adaptations regarding limited access to design data.

EEXI implementation

Each ship will require an EEXI Technical File showing the detail of the calculations used to determine the vessels EEXI rating. This must be submitted to the administration (or class) for approval and is required to be carried on board. During the first annual, intermediate or renewal survey after the effective date of the EEXI requirements, meaning within the year 2023, verification of the attained EEXI takes place and, subsequently, a new International Energy Efficiency Certificate will be issued.

Ships which do not pass the EEXI requirement will not be able to continue trading after 2023.



EEXI calculation

The calculation of the Energy Efficiency Design Index for Existing Ships (EEXI) follows the format of the Energy Efficiency Design Index (EEDI) introduced in 2018 for new ships. However, many existing ships do not have access to their original design information such as tank test or sea trial reports, and adaptations to the EEDI formula have been necessary.

As of March 2021 only draft guidelines on the application of EEXI are available. These will be ratified at MEPC (76) in June 2021, with possible minor amendments.

EEXI calculates the CO_2 emissions of a ship per cargo ton per nautical mile. A "Reference Value" of gCO_2/tnm emissions for a similar ship from 2008 is also calculated (based on a regression analysis of ship type, engine power, capacity and speed). A reduction factor is applied to the Reference Value to determine a Required EEXI. If the Attained EEXI is less than the Required EEXI value then the ship passes.

Emissions are calculated from the installed power of the main engine, the corresponding specific fuel oil consumption (estimated or certificated by the engine manufacturer), and a conversion factor between fuel and the corresponding CO_2 mass.

The transport work is determined by capacity, which is usually related to the deadweight of a ship (gross tonnage is the measure for passenger ships)

The reference speed is determined at 75% of the engine power (for most ship types). The ship speed can be estimated or calculated from results of a tank test or other means.

EEXI applies to almost all ocean-going cargo and passenger ships above 400 gross tonnage. Several correction factors are defined to modify the installed power, e.g., for Ice-class ships, as well as to correct the capacity, e.g., to consider structural enhancement.

Energy saving devices, Power Take Off (PTO) and Power Take In (PTI) devices on the propulsion train can be taken into consideration, as can other enhancements to ship efficiency measures.

- Concept

$$\text{EEDI} = \frac{\text{Actual } CO_2 \text{ emission}}{\text{Transport work}}$$

- Specific Formula

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

Attained EEXI = $[gCO_2/t.nm]$