

Outlines of EEXI & CII Regulations



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Initial IMO Strategy on Reduction of GHG emissions from ships (adopted on April 2018)

- ✓ The Initial IMO GHG Strategy including goals of reduction of GHG emissions from ships was adopted. It shall be reviewed every 5 years.
- ✓ First effort aimed at the GHG zero emissions from global sector without distinction between developed countries and developing countries.

Levels of ambition of the Initial Strategy

1. Vision (Final target)

- Final target: **GHG zero emissions** at earliest in this century

2. Levels of ambition

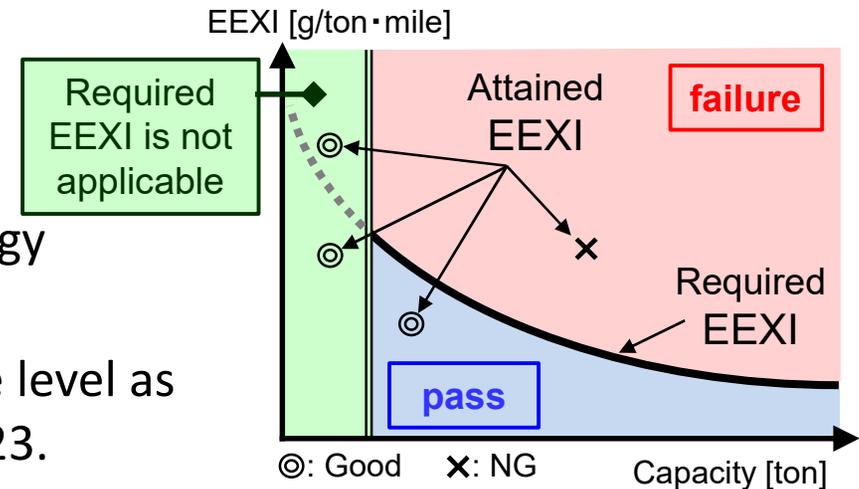
- Target of transportation efficiency (CO2 emissions per transport work) compared to 2008;
At least 40% improvement by 2030, 70% improvement by 2050
- Target of total annual GHG emissions compared to 2008;
At least 50% reduction by 2050, effort for zero emissions at earliest in this century

MEPC 76 (June 2021)

The amendments to MARPOL Annex VI (MEPC.328(76)) were adopted at MEPC 76.

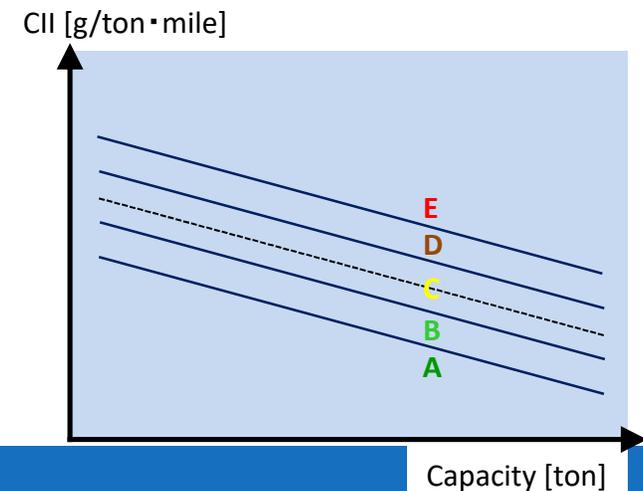
➤ Technical approach (EEXI)

- Introduce the Energy Efficiency Existing Ship Index (EEXI) as the energy efficiency index for existing ship.
- The required EEXI is almost the same level as required EEDI for new ships as of 2023.



➤ Operational approach (CII rating)

- Ship is rated on a scale of A to E based on the annual operational carbon intensity indicator (CII).
- A ship rated D for three consecutive years, or E, would have to submit a corrective action plan.



Outlines of the EEXI regulation

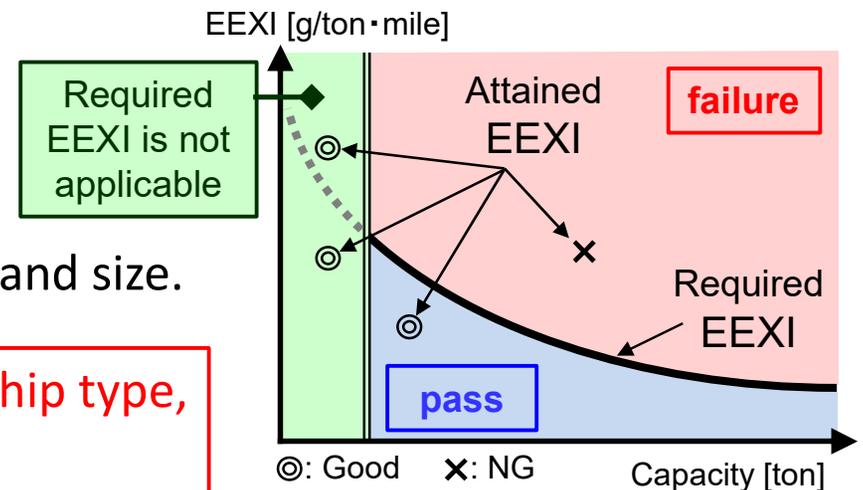
■ Attained EEXI

EEXI value is calculated by an individual ship.

■ Required EEXI

Required EEXI is specified for each ship type and size.

➔ For ships with a certain size of specified ship type,
 $\text{Attained EEXI} \leq \text{Required EEXI}$



EEXI requirements shall apply to all ships of 400 GT and above which are engaged in the international voyages **regardless of ship's delivery date**, except the following ships as with the case of EEDI.

- Ships not propelled by mechanical means
- Platforms including FPSOs and FSUs and Drilling rigs, regardless of their propulsion
- Category A ships as defined in the Polar code
- Ships which have non-conventional propulsion such as diesel electric, turbine or hybrid propulsion system (except LNG carrier and cruise passenger ship)

Calculation formula of Attained EEXI

■ EEXI is calculated by the same formula as EEDI.

EEXI [g/ton·mile]=

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



Concept formula

$$\text{EEXI [g/ton·mile]} = \frac{\text{CO}_2 \text{ Conversion factor} \times \text{SFC [g/kW·h]} \times \text{Engine Power [kW]}}{\text{Capacity [ton]} \times \text{EEXI Speed [knots]}}$$

CO₂ emissions (gram) from a ship when ship sail transport 1 (ton) cargo for 1 (nautical mile)

CO ₂ Conversion factor (C _F)	C _F corresponds to the fuel used when determining SFC (DM grade: 3.206)
SFC	Fuel consumption at 75%MCR (M/E), at 50%MCR (A/E)
Engine Power	75% of the rated installed power (MCR) (In case of EPL, 83%MCR _{lim})
Capacity	Deadweight (For container ships, 70% of the deadweight)
EEXI Speed (V _{ref})	Ship speed at 75%MCR under the draught condition corresponding to the capacity

Calculation formula of EEXI (Differences from EEDI)

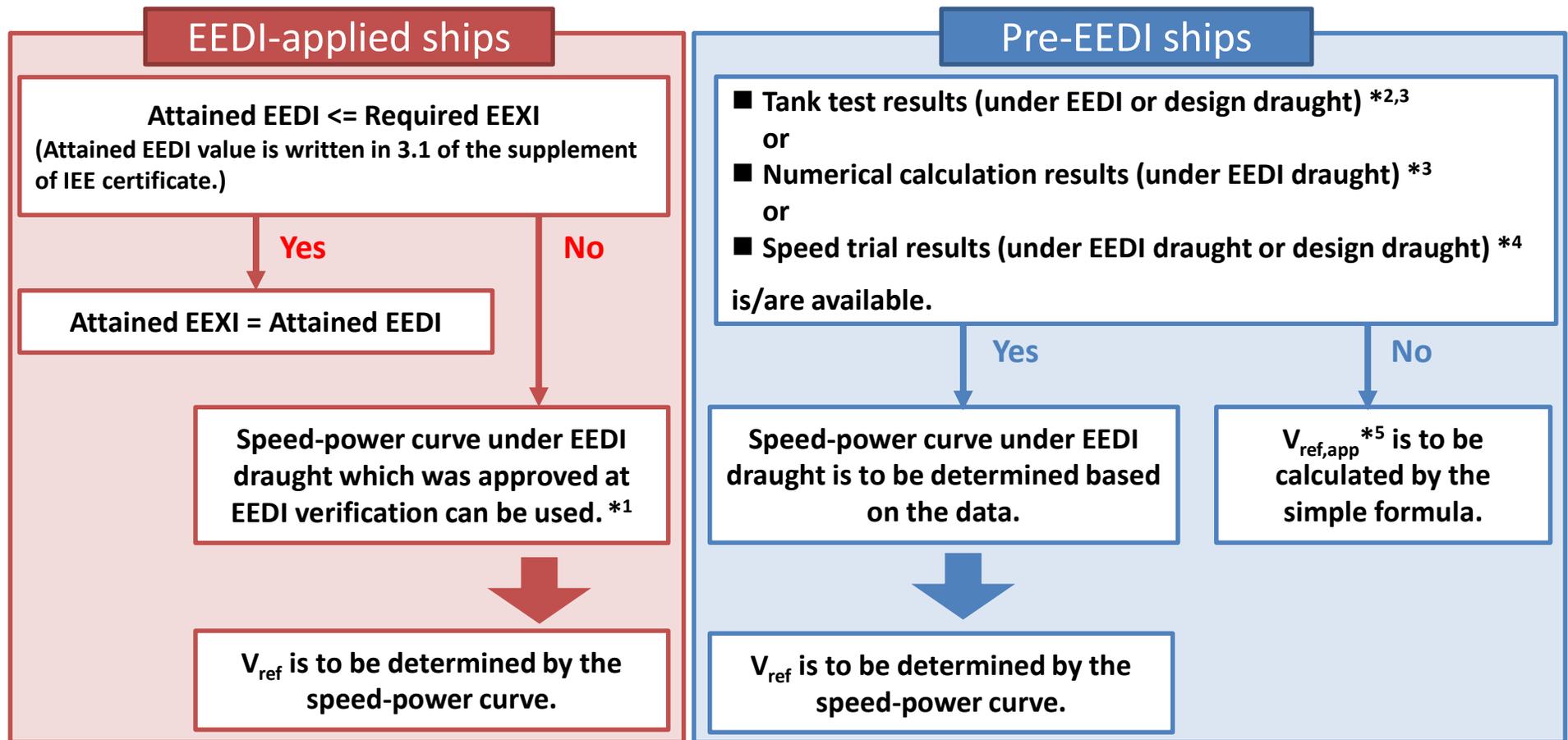
- The formula of EEXI is the same as EEDI, but some parameters' definitions are different.

Concept formula

$$\text{EEXI [g/ton} \cdot \text{mile]} = \frac{\text{CO2 Conversion factor} \times \text{SFC [g/kW} \cdot \text{h]} \times \text{Engine Power [kW]}}{\text{Capacity [ton]} \times \text{EEXI Speed (Vref) [knot]}}$$

SFC	<p>Fuel consumption at 75%MCR (M/E), at 50%MCR (A/E) specified in NOx technical file</p> <ul style="list-style-type: none"> • In cases where the installed engines don't have NOx technical file, approximated default values including margin, SFC_{app} (i.e. M/E: 190 g/kW·h, A/E: 215 g/kW·h), are available. • In cases where the NOx regulation doesn't apply to the propulsion system (e.g. steam turbine, etc.), SFC specified by the manufacturer or confirmed by the verifier is available.
Engine Power (P_{ME})	<p>75% of the rated installed power (MCR) (In cases where the propulsion system is diesel electric or steam turbine, P_{ME} is 83% of MPP or MCR.)</p> <ul style="list-style-type: none"> • In cases where EPL is installed, P_{ME} is 83% of the limited installed power (MCR_{lim}).
V_{ref}	<p>Ship speed at P_{ME} and under the maximum summer load draught (for container ships, under 70%DWT draught.)</p> <ul style="list-style-type: none"> • In cases where both of tank test results and speed trial results are not available, an approximated ship speed including margin, $V_{\text{ref,app}}$ is to be calculated by the simple formula. The parameters of this formula are ship type, DWT, and MCR.

Methods for obtaining V_{ref}



*1 The approved speed-power curve is available without any corrections.

*2 The tank test results can be corrected/calibrated by numerical calculation such as CFD, etc.

*3 In case of using numerical calculations, estimation process and methodology of the power curves are to be submitted. (It should include documentation on consistency with the defined quality standards and the verification of the numerical setup with parent hull or the reference set of comparable ships.)

*4 The sea conditions and ship speed should have been measured in accordance with ISO 15016:2002 or the equivalent and the measured ship speed was calibrated, if necessary, by taking into account the effects of wind, tide, waves, etc. If the speed trial was carried out under design draught, the ship speed shall be calibrated under EEDI draught by using Admiralty Coefficient, etc.

*5 $V_{ref,app}$ is an approximated ship speed obtained by a certain correction applies to the average ship speed of each ship type and size (including margin).

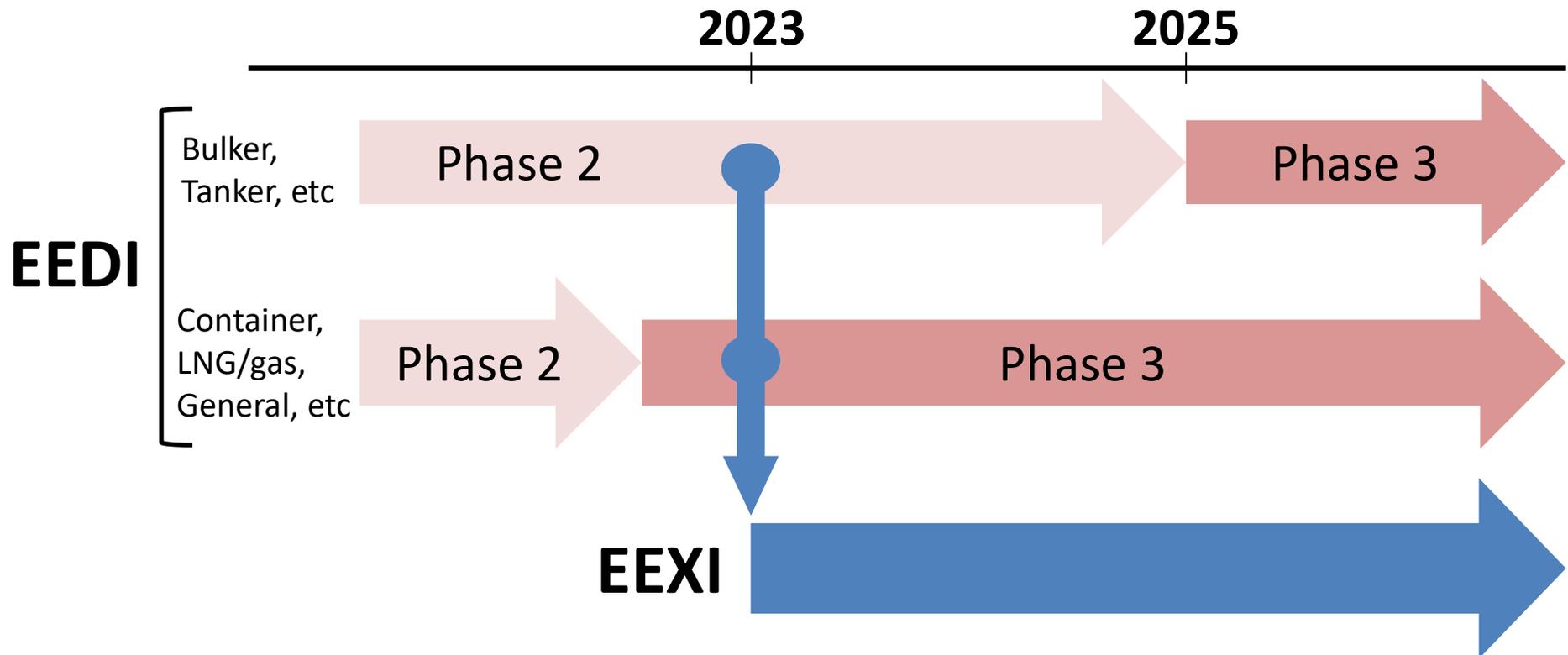
Application of EEXI

The “**calculation of EEXI (Attained EEXI)**” and “**conformity to required value (Required EEXI)**” shall apply to the following ship type and size as with the case of EEDI.

Type of ship	Calculation of Attained EEXI	Conformity to Required EEXI
Bulk carrier	400 GT and above	10,000 DWT and above
Gas carrier	400 GT and above	2,000 DWT and above
Tanker	400 GT and above	4,000 DWT and above
Containership	400 GT and above	10,000 DWT and above
General cargo ship	400 GT and above	3,000 DWT and above
Refrigerated cargo carrier	400 GT and above	3,000 DWT and above
Combination carrier	400 GT and above	4,000 DWT and above
Ro-ro cargo ship (Vehicle carrier)	400 GT and above	10,000 DWT and above
Ro-ro cargo ship	400 GT and above	1,000 DWT and above
Ro-ro passenger ship	400 GT and above	250 DWT and above
LNG carrier	400 GT and above	10,000 DWT and above
Cruise passenger ship (non-conventional)	400 GT and above	25,000 GT and above

Required EEXI

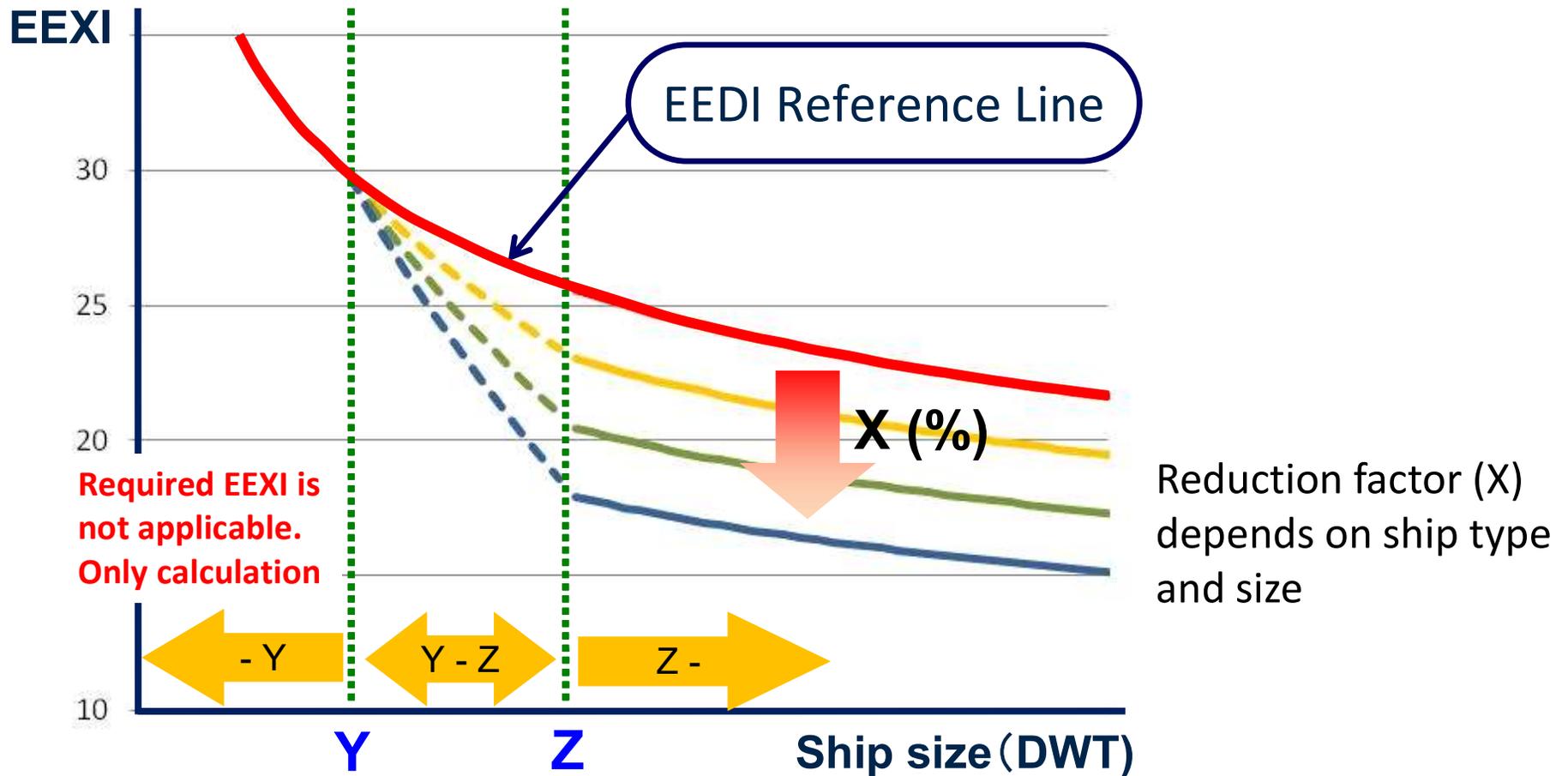
Almost the same level as **required EEDI for new ships as of 2023***



*However, very large tanker and bulk carrier, small and middle containership, Ro-ro cargo ship and Ro-ro passenger ship are relaxed for technical difficulty to improve the efficiency.

Required EEXI (1/4)

$$\text{Required EEXI} = \left(1 - \frac{X}{100} \right) \times \text{EEDI Reference Line}$$



Y, Z value depends on ship type

Required EEXI (2/4)

EEDI Reference Line

✓ Required EEXI is set based on the EEDI reference line

Type of ship		Reference Line
Bulk carrier	DWT ≤ 279,000	$961.79 \times DWT^{-0.477}$
	DWT > 279,000	$961.79 \times 279,000^{-0.477}$
Gas carrier		$1120.00 \times DWT^{-0.456}$
Tanker		$1218.80 \times DWT^{-0.488}$
Containership		$174.22 \times DWT^{-0.201}$
General cargo ship		$107.48 \times DWT^{-0.216}$
Refrigerated cargo carrier		$227.01 \times DWT^{-0.244}$
Combination carrier		$1219.00 \times DWT^{-0.488}$
Ro-ro cargo ship (vehicle carrier)	DWT/GT < 0.3	$(DWT/GT)^{-0.7} \times 780.36 \times DWT^{-0.471}$
	DWT/GT ≥ 0.3	$1812.63 \times DWT^{-0.471}$
Ro-ro cargo ship	DWT ≤ 17,000	$1686.17 \times DWT^{-0.498}$
	DWT > 17,000	$1686.17 \times 17,000^{-0.498}$
Ro-ro passenger ship	DWT ≤ 10,000	$902.59 \times DWT^{-0.381}$
	DWT > 10,000	$902.59 \times 10,000^{-0.381}$
LNG carrier		$2253.7 \times DWT^{-0.474}$
Cruise passenger ship having non-conventional propulsion		$170.84 \times GT^{-0.214}$

Required EEXI (3/4)

Type of ship	Size	Reduction factor (X) %
Bulk carrier	200,000 DWT and above	15
	20,000 - 200,000 DWT	20
	10,000 - 20,000 DWT	0 - 20 *
Gas carrier	15,000 DWT and above	30
	10,000 - 15,000 DWT	20
	2,000 - 10,000 DWT	0 - 20 *
Tanker	200,000 DWT and above	15
	20,000 - 200,000 DWT	20
	4,000 - 20,000 DWT	0 - 20 *
Containership	200,000 DWT and above	50
	120,000 - 200,000 DWT	45
	80,000 - 120,000 DWT	35
	40,000 - 80,000 DWT	30
	15,000 - 40,000 DWT	20
	10,000 - 15,000 DWT	0 - 20 *

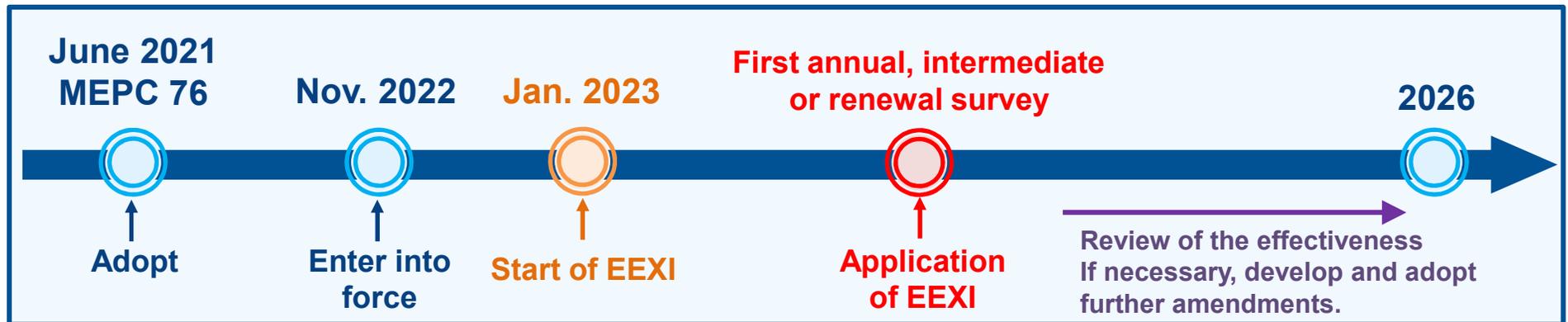
* Reduction factor to be linearly interpolated between the two values dependent upon ship size.

Required EEXI (4/4)

Type of ship	Size	Reduction factor (X) %
General cargo ship	15,000 DWT and above	30
	3,000 - 15,000 DWT	0 - 30 *
Refrigerated cargo carrier	5,000 DWT and above	15
	3,000 - 5,000 DWT	0 - 15 *
Combination carrier	20,000 DWT and above	20
	4,000 - 20,000 DWT	0 - 20 *
Ro-ro cargo ship (vehicle carrier)	10,000 DWT and above	15
Ro-ro cargo ship	2,000 DWT and above	5
	1,000 - 2,000 DWT	0 - 5 *
Ro-ro passenger ship	1,000 DWT and above	5
	250 - 1,000 DWT	0 - 5 *
LNG carrier	10,000 DWT and above	30
Cruise passenger ship having non-conventional propulsion	85,000 GT and above	30
	25,000 - 85,000 GT	0 - 30 *

* Reduction factor to be linearly interpolated between the two values dependent upon ship size.

Timeline of EEXI regulation

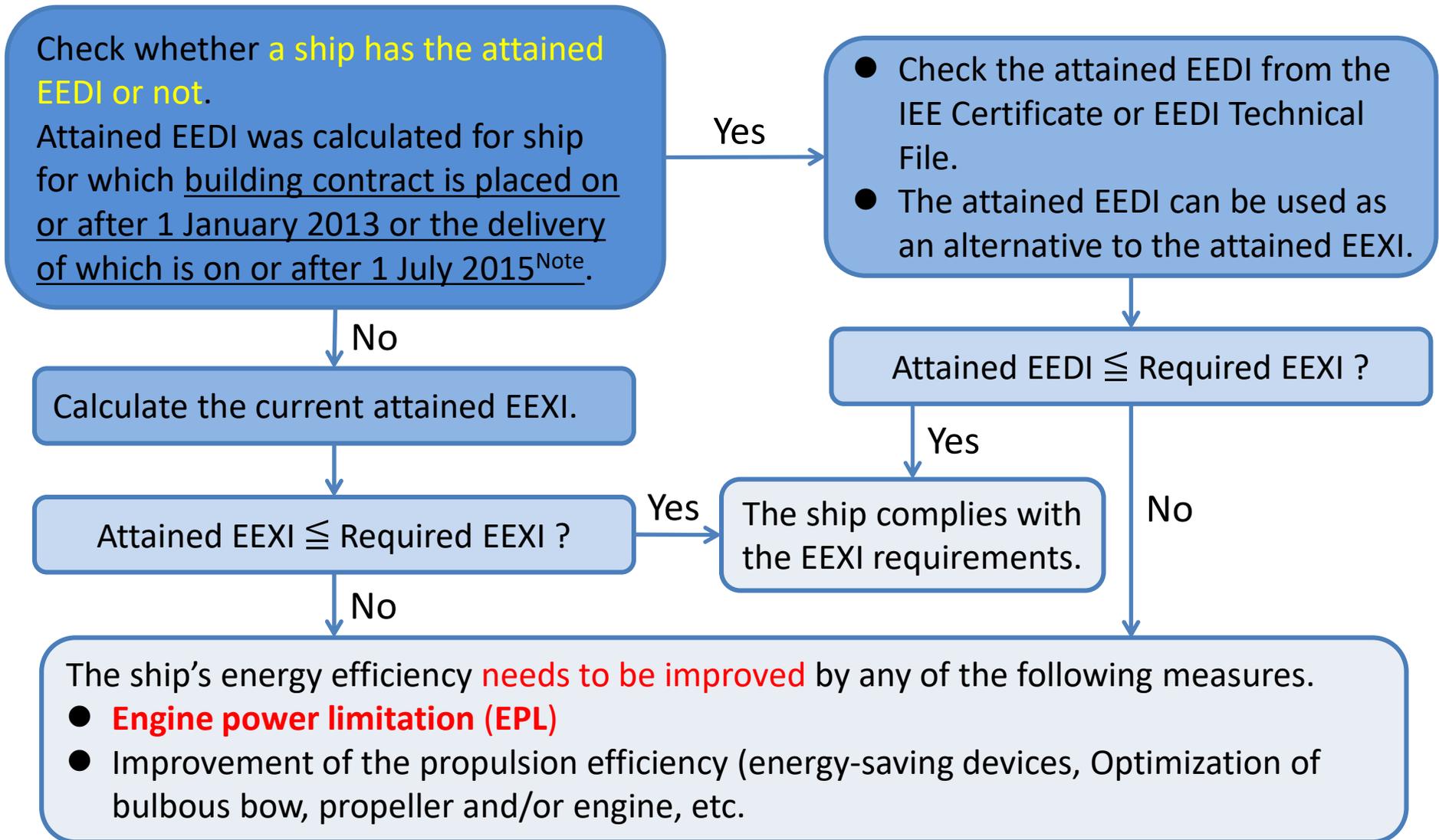


■ Timing of EEXI application

- ✓ The amendments to MARPOL ANNEX VI will enter into force on 1 November 2022.
- ✓ EEXI requirements will start from **1st January 2023**.
- ✓ The EEXI verification shall take place at the following timing.

Ships delivered before 1 January 2023	First annual, intermediate or renewal survey of the International Air Pollution Certificate (IAPP Certificate), whichever is the first, on or after 1 January 2023
Ships delivered on or after 1 January 2023	Initial survey of the International Energy Efficiency Certificate (IEE Certificate)

Flow chart of EEXI application



Note : In case of LNG carrier and Cruise passenger ship, building contract is placed on or after 1 September 2015 or the delivery of which is on or after 1 September 2019.

The un-limiting EPL is only allowed for the purpose of **securing the safety of a ship or saving life at sea**, consistent with regulation 3.1 of MARPOL Annex VI.

Examples)

- ✓ Operating in adverse weather and ice-infested waters, or avoidance voyaging in such areas
- ✓ Participation in search and rescue operations
- ✓ Avoidance of pirates
- ✓ Engine maintenance (e.g. removing soot, etc.)

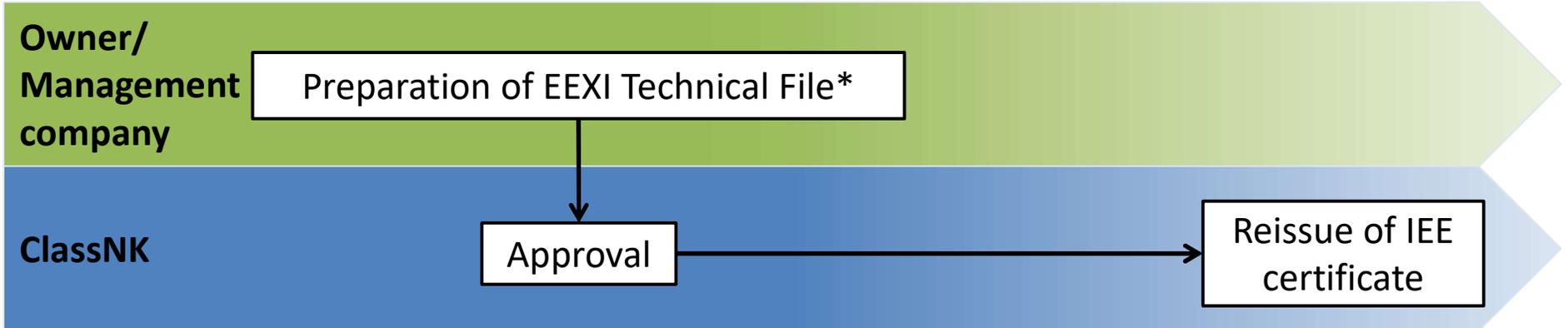


■ Necessary procedures in cases where EPL is un-limited

- ✓ Recording the status in Onboard Management Manual for EPL
Reason of the un-limiting, Ship speed, Maximum un-limited power, Beaufort number and Wave height, Position and Timestamp, etc.
- ✓ Notifying Administration or RO
- ✓ Reactivating/Replacing EPL system immediately after the risks have been prevented
- ✓ Confirmation of the reactivated/replaced EPL system by Administration or RO (Remote confirmation may be acceptable.)

Flow of EEXI verification

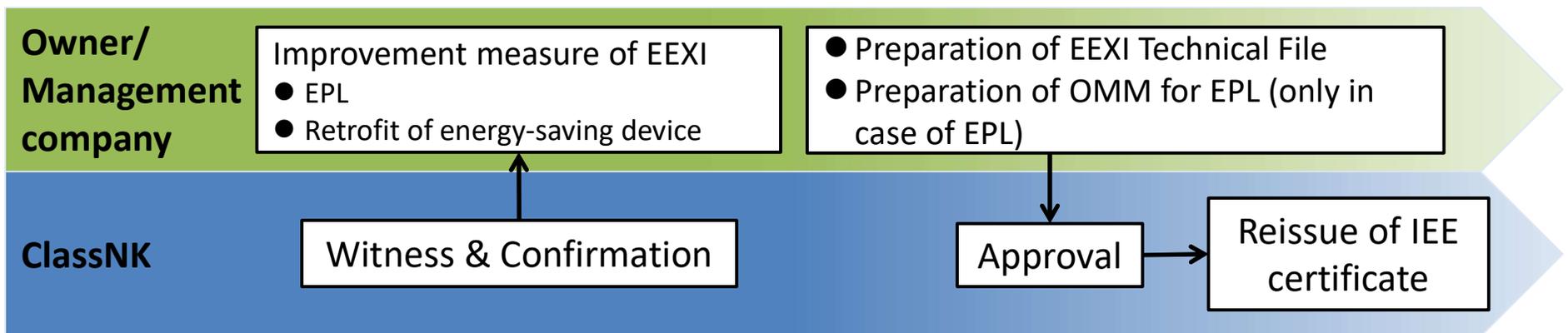
Improvement of energy efficiency (EEXI) is **not needed**. (only Pre-EEDI ship)



* Document including the information necessary for the calculation of the attained EEXI

Note: In the case of EEDI ship, EEXI Technical File is not necessary. IEE certificate will be re-issued without any approval.

Improvement of energy efficiency (EEXI) is **needed**.



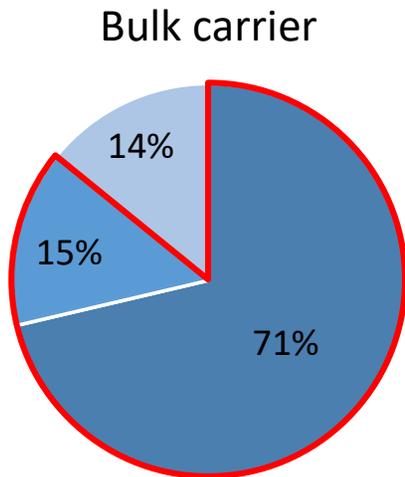
Status of compliance with EEXI on NK classed ship

■ Number of ships subjected to EEXI	7,200 ships
✓ Pre-EEDI ship	5,300 ships
✓ EEDI ship (not comply with EEXI)	750 ships
✓ EEDI ship (comply with EEXI)	1,150 ships

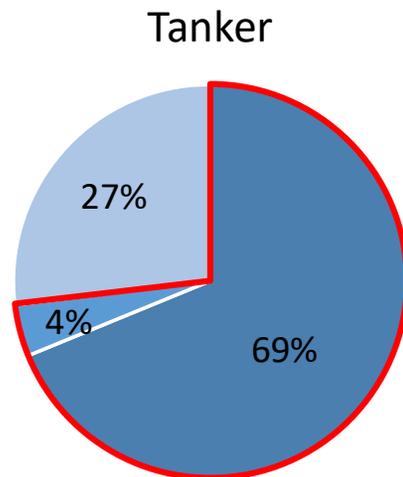


Action needed:
6,050 ships (84%)

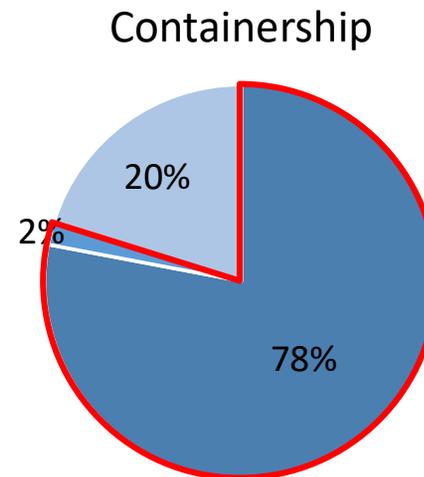
No action needed:
1,150 ships (16%)



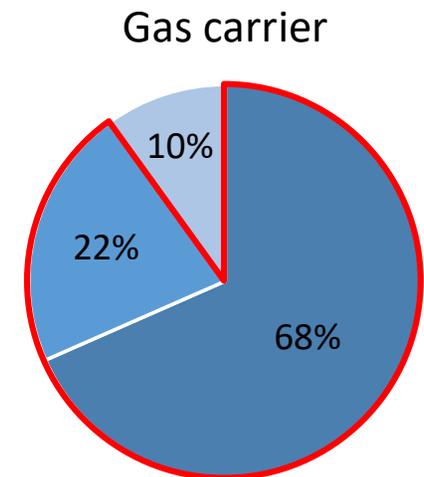
Action needed: 86%



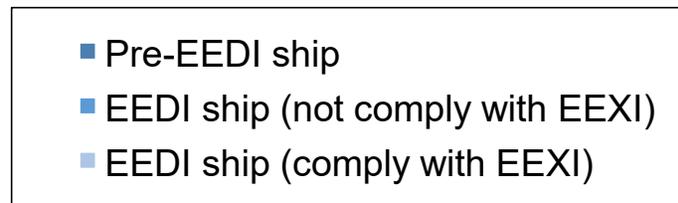
Action needed: 73%



Action needed: 80%



Action needed: 90%



CII (Carbon Intensity Indicator)



Outline of CII Rating

- Application: 5000GT and above / International voyage / EEDI applied ship type
- Rating each vessels by CII from 2023 consumption data (CII Guideline, G1) , then first verification will be carried out in 2024
- Attained CII will be calculated in accordance with calculation guideline (G1) based on IMODCS fuel reporting data
- CII and “A” – “E” rating will be added on SOC of IMODCS in accordance with Reference Line (G2), Reduction Factor (G3) and Rating guideline (G4)
- Low rated vessels (“E” or “D” on 3 consecutive years) should develop a plan of corrective actions and the plan should be approved by the Administration or RO

Form of Statement of Compliance – Fuel Oil Consumption Reporting and Operational Carbon Intensity rating

STATEMENT OF COMPLIANCE – FUEL OIL CONSUMPTION REPORTING AND OPERATIONAL CARBON INTENSITY RATING

Issued under the provisions of the Protocol of 1997, as amended, to amend the International Convention for the Prevention of Pollution by Ships, 1973, as modified by the Protocol of 1978 related thereto (hereinafter referred to as “the Convention”) under the authority of the Government of:

.....
(full designation of the Party)

by.....
(full designation of the competent person or organization authorized under the provisions of the Convention)

Particulars of ship¹

Name of ship.....

Distinctive number or letters.....

IMO Number².....

Port of registry.....

Gross tonnage.....

Deadweight.....

Type of ship.....

THIS IS TO DECLARE:

1 That the ship has submitted to this Administration the data required by regulation 22A of Annex VI of the Convention, covering ship operations from (dd/mm/yyyy) through (dd/mm/yyyy); and

2 The data was collected and reported in accordance with the methodology and processes set out in the ship’s SEEMP that was in effect over the period from (dd/mm/yyyy) through (dd/mm/yyyy);

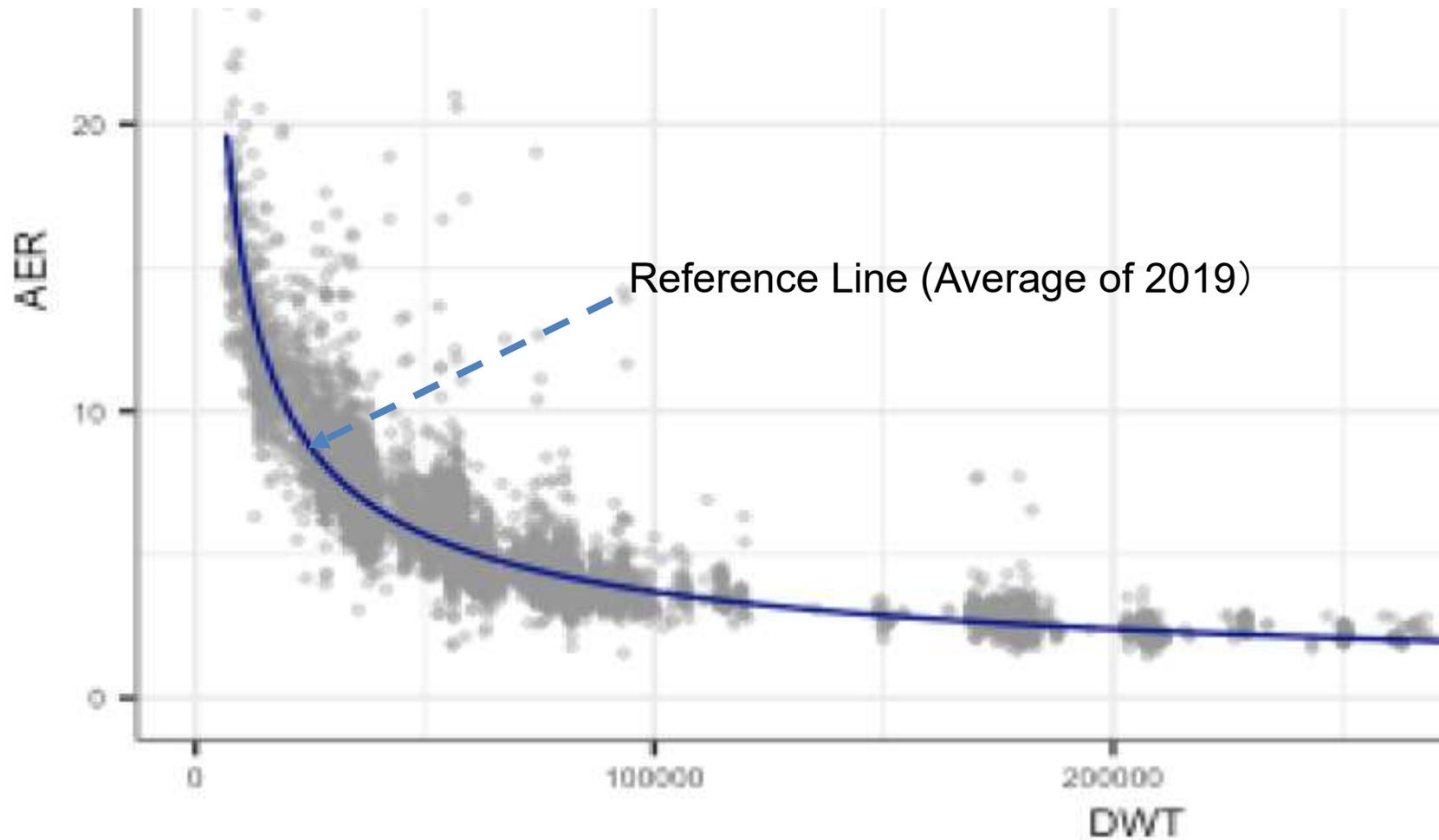
3 The attained annual operational CII of the ship from (dd/mm/yyyy) through (dd/mm/yyyy) was:

4 The operational carbon intensity of the ship in this period is rated as

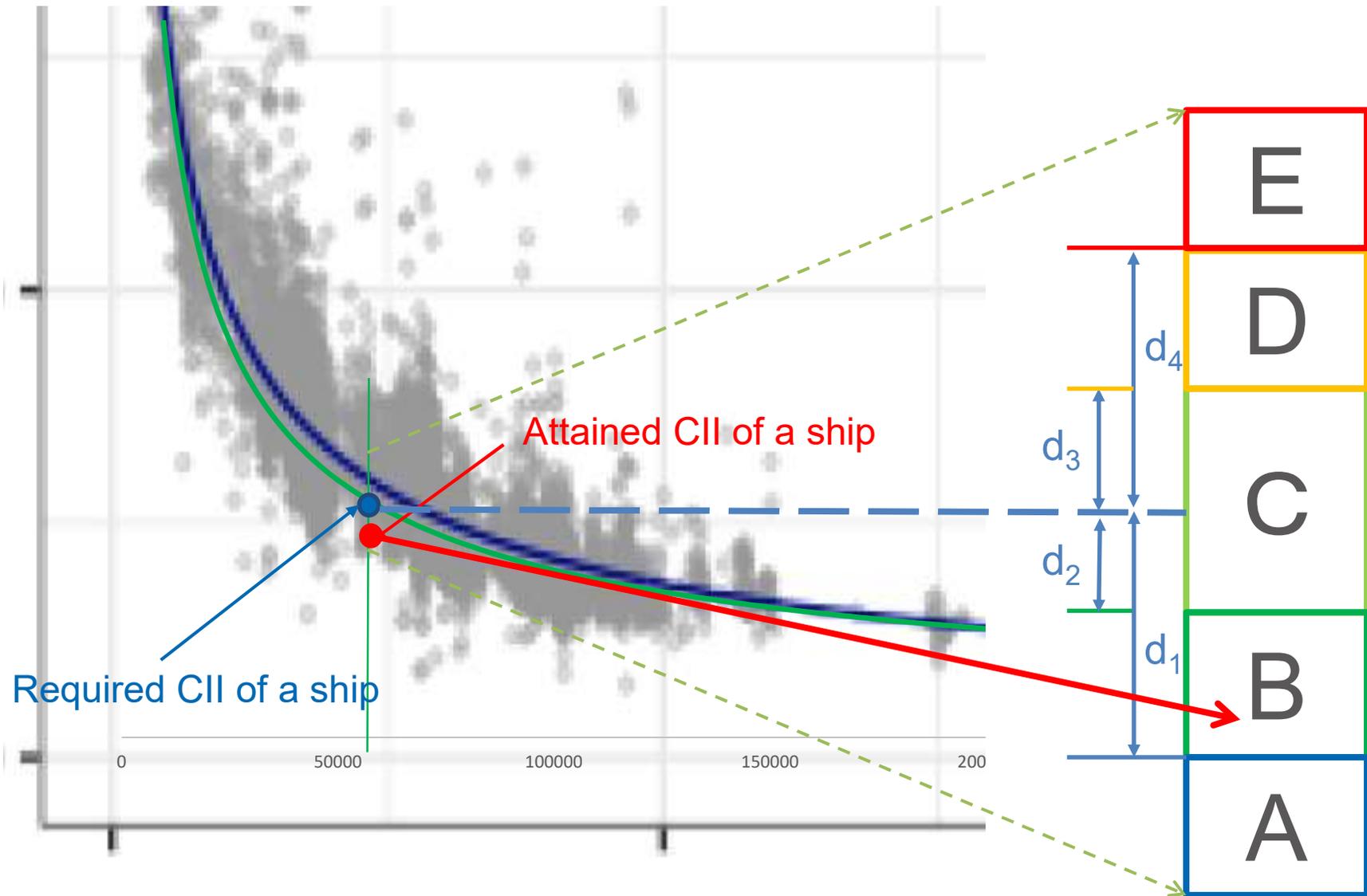
Ship types	Calculation method	Note
Bulk carriers, Tankers, Container ships, Gas carriers, LNG carriers, Ro-ro cargo ships, General cargo ships, Refrigerated cargo carrier Combination carriers	$\frac{CO_2 \text{ Emission}}{Deadweight \times Distance sailed}$	Deadweight: Corresponding to Maximum Summer load line = the value on IEE Cert supplement
cruise passenger ships Ro-ro cargo ships (vehicle carriers) Ro-ro passenger ships	$\frac{CO_2 \text{ Emission}}{Gross Tonnage \times Distance sailed}$	

Point: CII calculation by only IMO DCS collected data (No additional data)

Report data of 2019 IMODCS fuel reporting



Attained CII and Required CII (Example)



CII Calculation example

Items	
Ship type	Bulk Carrier
Deadweight	62000
Gross tonnage	33255
Distance Travelled (NM)	60045
CO2 emissions (ton)	17477
Attained CII (G1)	4.69
a (G2)	4745
c (G2)	0.622
CII ref (G2)	4.96
Required CII (G3, 2023)	4.71
Attained CII / Required CII	0.99
Rating (2023)	C

Data source from IMODCS fuel reporting (started from emission of 2023)

$$\begin{aligned} \text{Attained CII (g/ton mile)} \\ &= \frac{17477 \text{ (ton)}}{62000 \times 60045 \text{ (ton mile)}} \times 10^6 = 4.69 \end{aligned}$$

$$\text{CII ref} = 4745 \times 62000^{-0.622} = 4.96$$

Rating (on 2023 reduction factor)

$$\text{Required CII} = 4.96 \times \frac{100-5}{100} = 4.71 \text{ (2023)}$$

$$\frac{\text{Attained CII}}{\text{Required CII}} = 0.99 < d2 \text{ (1.06)}$$

Effect of reduction factor

Items	
Ship type	Bulk Carrier
Deadweight	62000
Gross tonnage	33255
Distance Travelled (NM)	60045
CO2 emissions (ton)	17447
Attained CII (G1)	4.69
a (G2)	4745
c (G2)	0.622
CII ref (G2)	4.96

If the vessel keep their emission score same, the rating will be slightly worse year by year



Reporting Year	Reduction factor (%)	Required CII	Rating
2023	5	4.71	C
2024	7	4.61	C
2025	9	4.51	C
2026	11	4.41	D

Required CII

$$\text{Required CII} = \frac{100 - Z}{100} \text{CII}_{Ref}$$

Table 1: Reduction factor (Z%) for the CII relative to the 2019 reference line
Year Reduction factor relative to 2019

Year	Reduction Factor (Z)
2023	5%
2024	7%
2025	9%
2026	11%
2027	**
2028	**
2029	**
2030	**

Reduction factor Z will be starting from 5% in 2023 and 2% will be added yearly

**Z factors for the years of 2027 to 2030 to be further strengthened and developed taking into account the review of the short-term measure.

THANK YOU

for your kind attention