

An aerial photograph of the NHH building, a large, modern, multi-story structure with a prominent clock tower. The building is situated on a hillside overlooking a large body of water, with mountains in the background. The foreground shows a courtyard with trees and a paved area where people are walking. A dark blue semi-transparent box is overlaid on the left side of the image, containing the NHH logo, icons, and text.

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Maritime environmental policy
and green shipping.

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Shipping

Hard to kill: Not even AI is powerful enough to make shipbrokers disappear

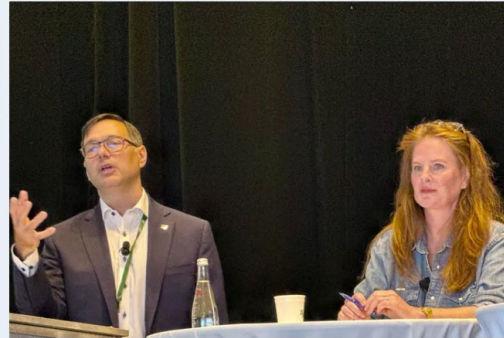
Audience at Miami Beach cargo conference gets reassuring news from the tech crowd

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TradeWinds
Global Shipbuilding Forum 2025

Busan, South Korea | 21 October 2025

Presented by



Panel moderator Evan Efthathiou makes a point as Cynthia Worley of Sedha looks on during a discussion of AI in Miami Beach. (Photo: Joe Brady)

TradeWinds
Shipowners Forum Japan 2025

Osaka, Japan | 02 October 2025

Register now

TradeWinds
Shipowners Forum Japan 2025

Osaka, Japan | 02 October 2025

Register now

Presented by

Joe Brady
TradeWinds correspondent | Miami Beach

Published 26 September 2025, 10:29

They're tough to kill, these men and women who stand in the middle of transactions between buyer and seller, shipowner and charterer.

Their inevitable obsolescence has been wrongly proclaimed before, and it's not surprising that the surging advent of artificial intelligence platforms is again raising the question of whether shipbrokers are under threat.

It was quite the relevant topic for the gathering of the Association of Ship Brokers & Agents on Friday for the annual cargo conference in Miami Beach.



Star Bulk Carriers Corp

NASDAQ: SBLK

19.27 USD ▲ **+12.43 (+181.73%)** past 5 years

19.23 ▼ 0.04 (0.21%) After Hours · 26. september 18:49 EDT · Market Closed

1D 5D 1M 1Y **5Y** Max Projection



Open	19.43	P/E	18.23	Vol	520.10 K
High	19.54	52wk High	23.82	Avg Vol	1.18 M
Low	19.25	52wk Low	12.06	Mkt Cap	2.20 B

See more on [MSN](#) · Data from Refinitiv · Price in USD · Market closed · [Disclaimer](#)

our fleet

On a fully delivered basis Star Bulk comprises of 142 owned vessels, with an aggregate capacity of more than 14.0 million DWT, consisting of Newcastlemax, Capesize, Post Panamax, Kamsarmax, Panamax, Ultramax and Supramax vessels with carrying capacities between 55,569 and 209,537 DWT.

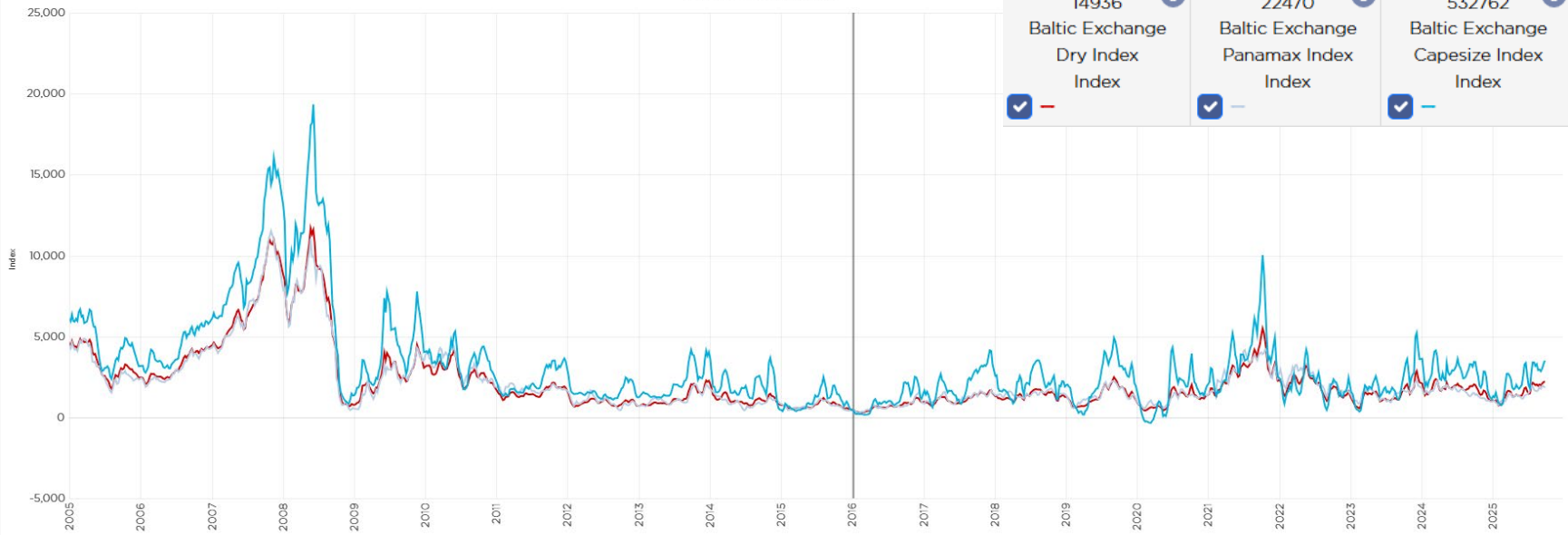
FIND OUT MORE →



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Baltic Exchange Dry Index and others



Source: Clarksons Research



our fleet

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[FIND OUT MORE](#)



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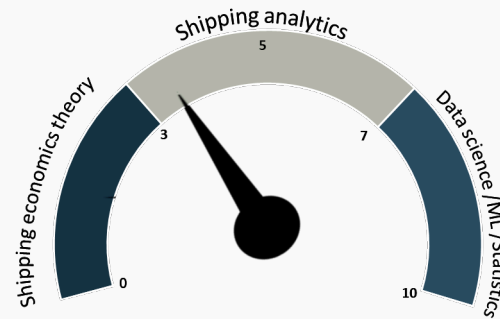
This lecture

Before break (45 min)

- Intro – (5 min)
- Shipping governance and political structure
- Evolution of environmental policies
- The Carbon Intensity Indicator (CII)
- IMO GHG strategy and EU related policies

After the break (45 min).

- Net Zero Framework
- Fuel EU
- EU ETS



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Learning outcomes

This lecture will help with the following learning outcomes:

Knowledge

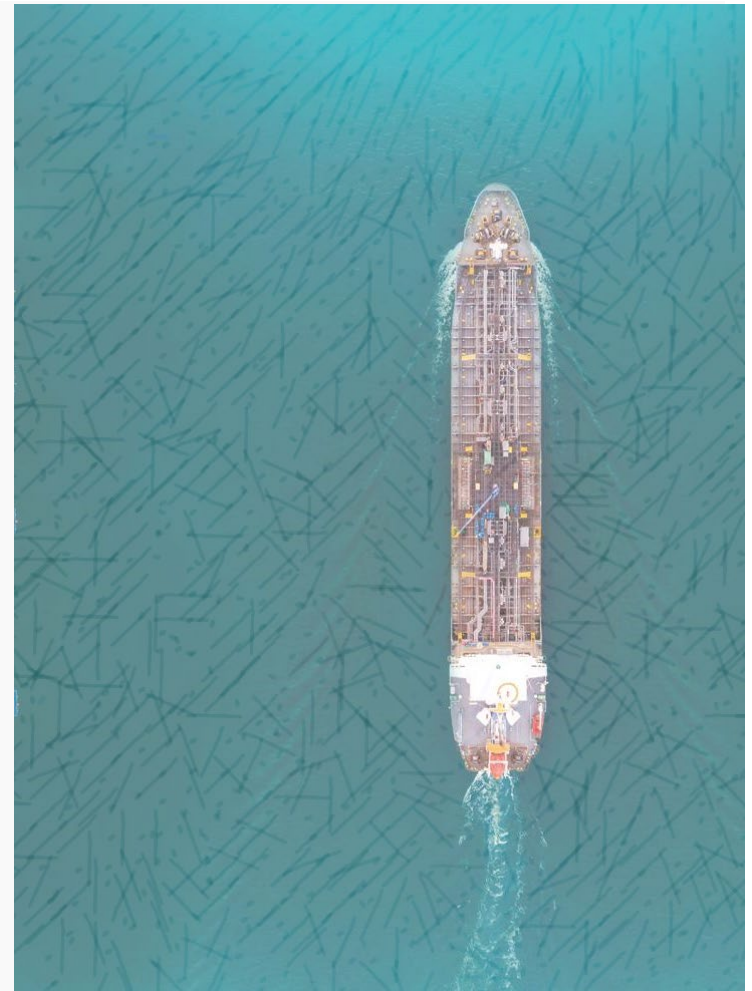
- understand the main results in recent research within shipping economics and analytics

Skills

- can communicate with industry practitioners using correct terminology
- considers the economic, political, and ethical issues relevant to the shipping industries

Competency

- exchanges opinions and experiences with others with a background in the field



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An investment decision

We are requested to make a very brief assesment of whether to invest in retrofitting to e-ammonia capable Internal Combustion Engine for an MR tanker or remain to operate with the current fuel HFO.

- E-ammonia has a LHV of 18,600MJ/t and HFO has LHV of 41,000MJ/t

- 1) Identify the cost sources for e-ammonia retrofit

- 2) Estimate the NPV for both options. (Excel attached)

- Discount rate = 5%

- HFO Price = 550 \$/t and E-ammonia=\$900\$/t

- The energy demand for your vessel annual operation is approx. 270 million MJ

- Remaining lifetime 10 years (2025-2035)

Which one is better. Why?

- 3) Rerun the NPV, now by adding the GFI carbon penalty using the calculator using <https://gcformd.org/calculator/>

Which alternatives makes the e-ammonia more competitive?

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Shipping governance and political structure

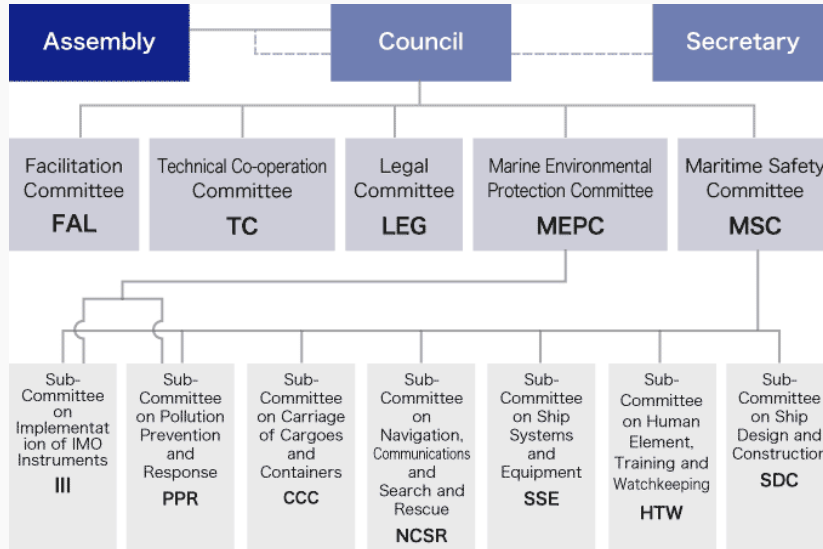
- Shipping is regulated by the International Maritime Organization (IMO), a specialized agency of the UN since 1958
- Why a multinational body regulates shipping?
 - Short answer: shipping is an international industry and international waters have no jurisdiction.
- They cover all aspects of shipping: from ship plan, design, construction, equipment, manning, operation and disposal (whole lifespan of a ship)
- Regulation is enforced in the form of international conventions. They are responsible for ca. 50 international conventions



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Shipping governance and political structure



Source: ClassNK



Source: IMO

- **The process for a convention to become binding is:**
 - Adopting a convention
 - Ratifying (accepting) the convention
 - Entry into force
 - Amended as needed (a less burdensome process than adopting a new convention)
 - A protocol is a way of amending a convention when there is significant change to the original or if a new chapter is added e.g., Annex VI of MARPOL
 - Amendments could also enter into force via resolutions “tacit acceptance”

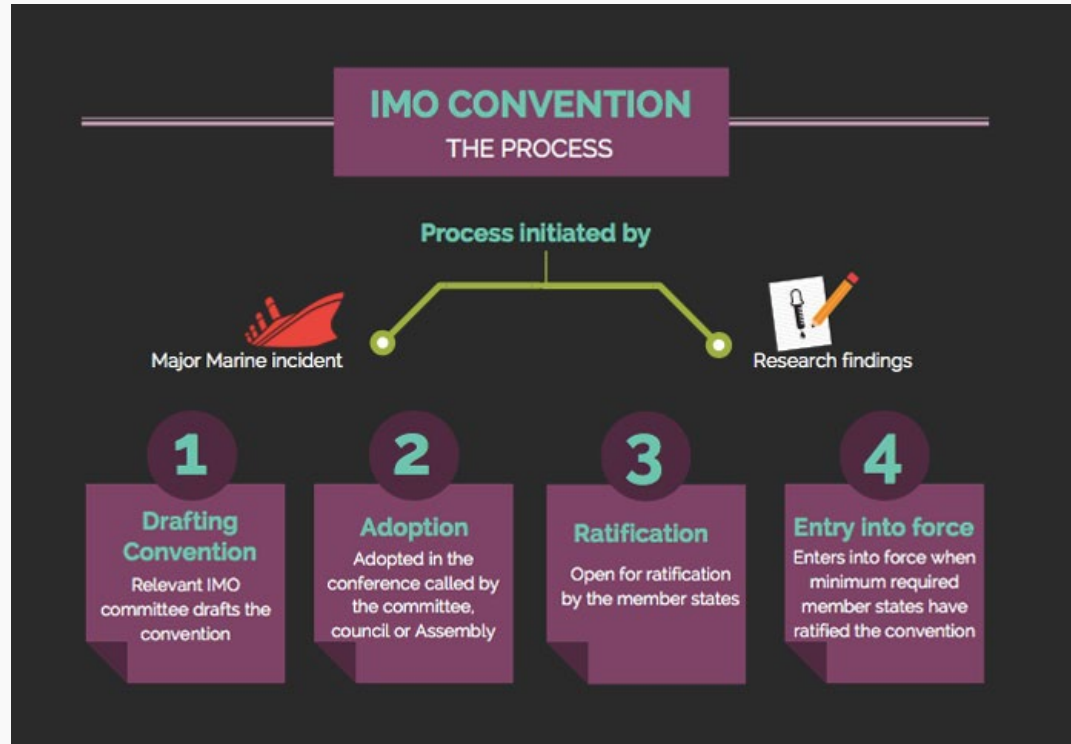
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When is a convention passed for discussion?

- Titanic – SOLAS (International Convention for the Safety of Life At Sea) 1914
- Torrey Canyon 1967 plus other oil spills – MARPOL (International Convention for the Prevention of Pollution from Ships) 1973, 1978 protocol and 1997 protocol
- The other two pillar conventions to IMO: Maritime **Labour** Convention (**MLC**) and the International Convention on Standards, **Training**, Certification and Watchkeeping for Seafarers (**STCW**)
- Other relevant to our course:
 - Load Lines Convention (**LL**) – save loading limits
 - The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (**Hong Kong convention**)
 - **Ballast Water Convention** – Ballast treatment to avoid species exchange





Article 18 *Entry into Force*

1 This Convention shall enter into force twelve months after the date on which not less than thirty States, the combined merchant fleets of which constitute not less than thirty-five percent of the gross tonnage of the world's merchant shipping, have either signed it without reservation as to ratification, acceptance or approval, or have deposited the requisite instrument of ratification, acceptance, approval or accession in accordance with Article 17.

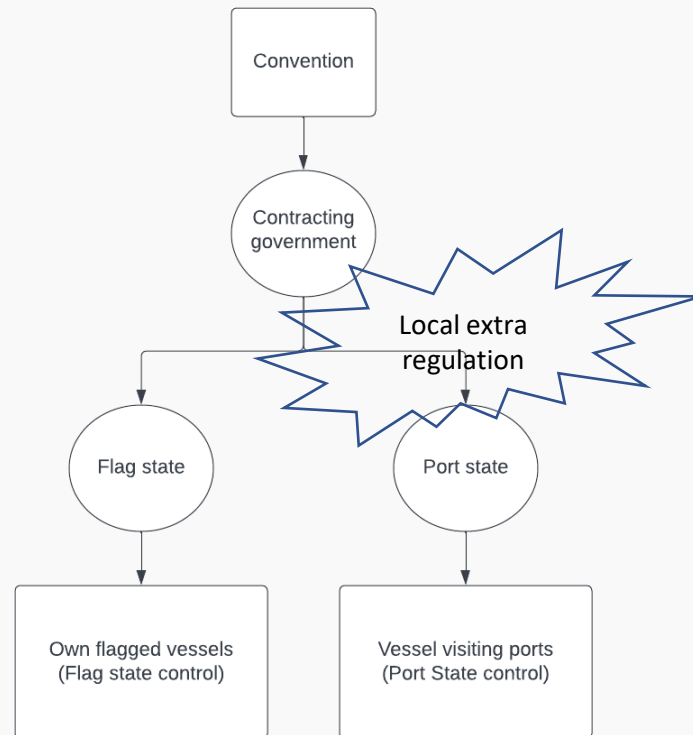
Source: Capt. Rajeev Jassal

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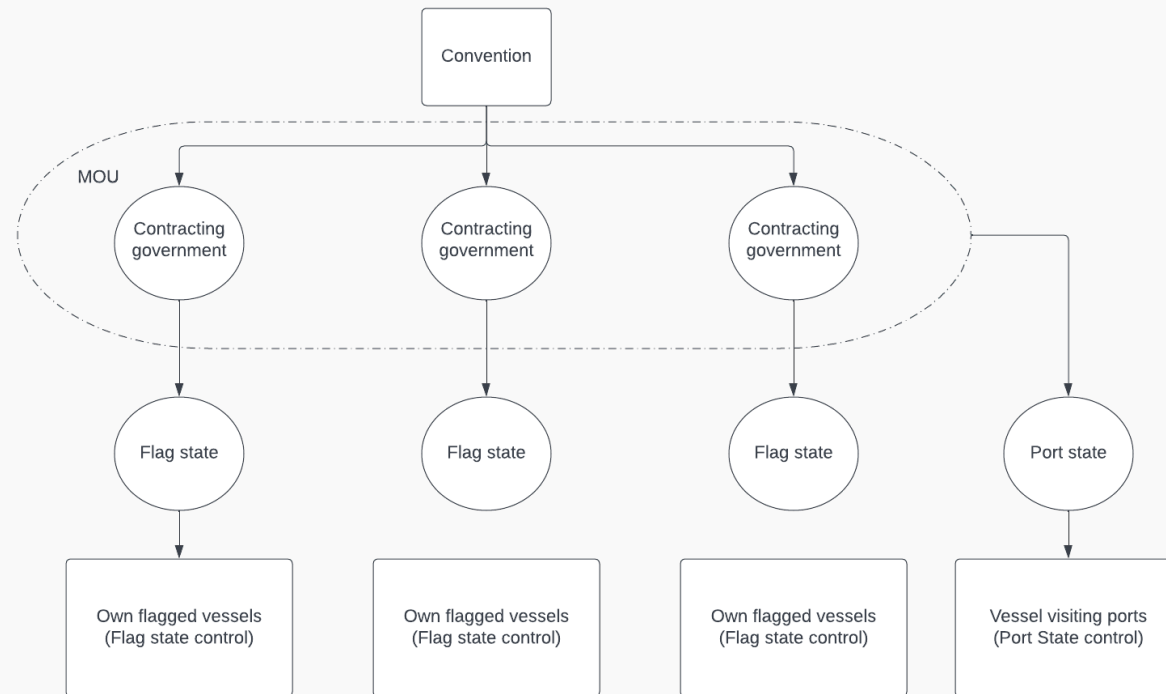
How are conventions enforced?

- IMO puts the place and the framework for policy making, but it is not itself the police policy. It pass that to the member states.
- Flag state is the primary enforcer. Port states are effective “safety nets” for substandard ships

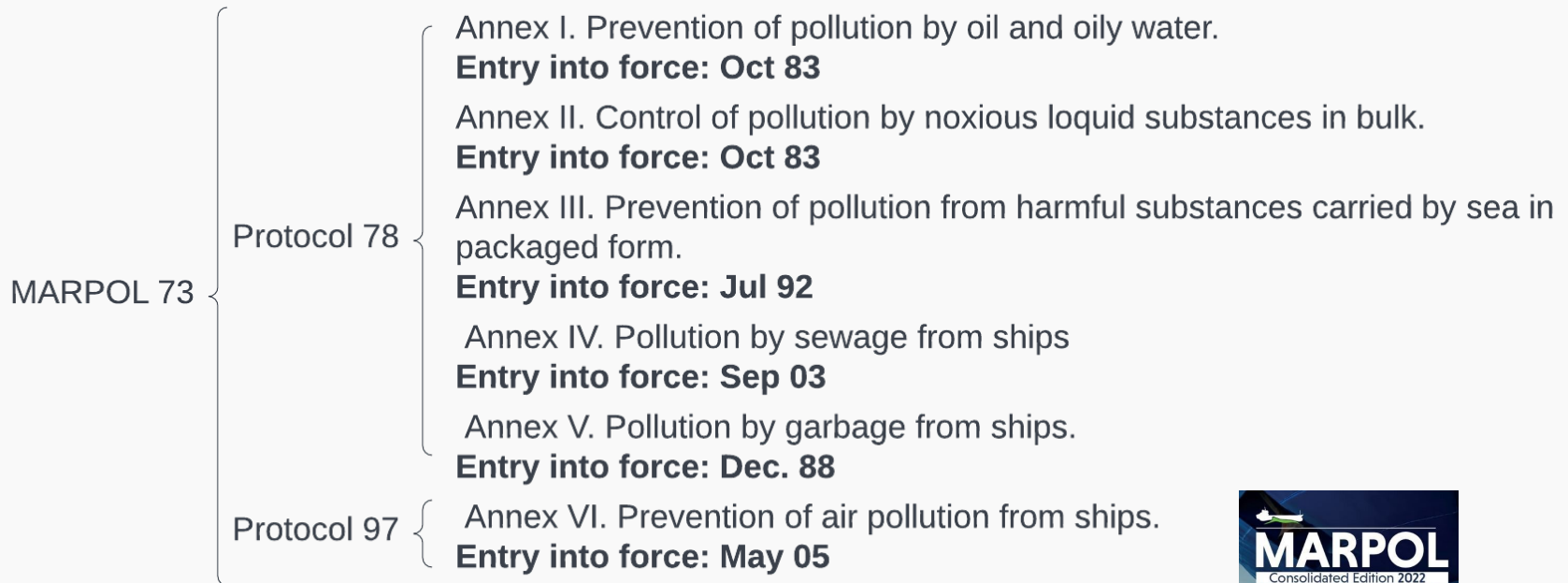


How are conventions enforced?

- Via Memoranda of understanding (MoU)–regional agreements for port state control
 - Paris MoU (Europe and North Atlantic)
 - Tokyo MoU (Asia and the Pacific)
 - Acuerdo de Viña del mar (Latin America) ... and six others



Evolution of environmental policy



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Evolution of environmental policy

- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION), 1969
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter(LC), 1972 (and the 1996 London Protocol)
- International Convention on Oil Pollution Preparedness, Response and Co-operation(OPRC), 1990
- Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol)
- International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), 2001
- International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004
- The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009

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Is it enough?

Report: Wakashio Left Route for Cellphone Signal More Than Once



Two years ago the Japanese bulk carrier *Wakashio* ran aground at Mauritius looking for a cellphone signal (Panama Maritime Authority photo)

PUBLISHED JUN 30, 2022 3:50 PM BY THE MARITIME EXECUTIVE

Nearly two years after the Japanese bulk carrier *Wakashio* went aground on Mauritius and created a disastrous fuel oil spill, the Japan Transport Safety Board has issued a preliminary report based on its investigation. While the events at the time of the ground are well known, the Japanese authority is looking broader at the voyage, the crew, and the interaction between the vessel and the owner and charterer in Japan.

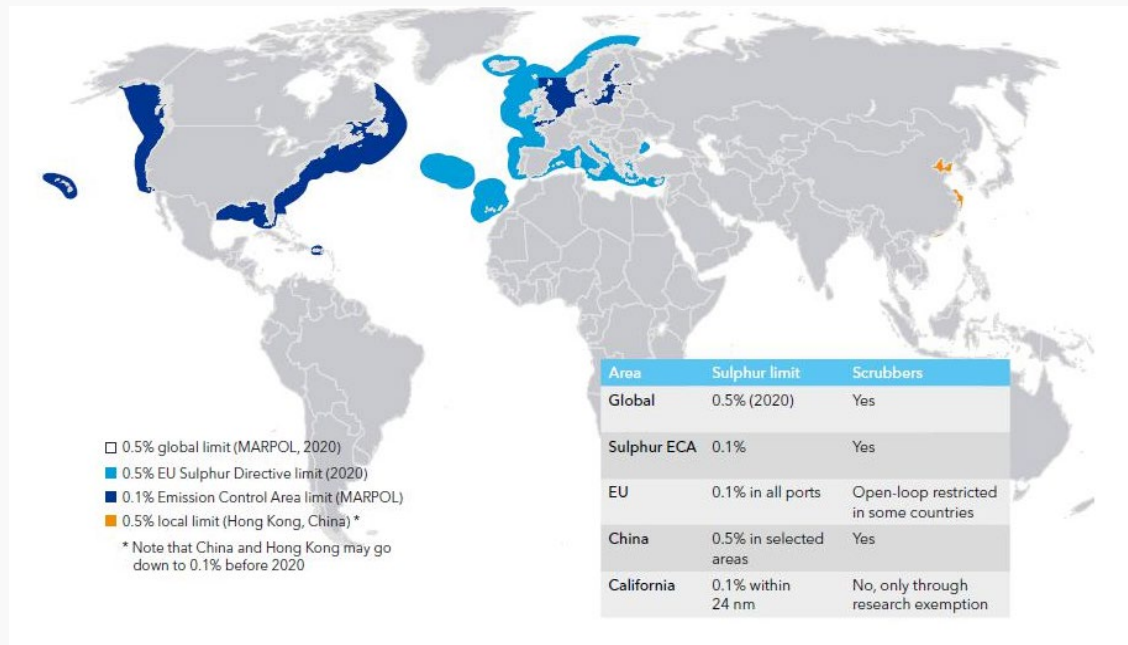
Is it enough?



Source: Forbes

A focus on Annex VI (Air pollution)

- Initial aim was on limiting the effects of air pollutants, not GHG, such as Sulphur oxides (SOx) and Nitrous Oxides (NOx)
- Also prohibits deliberate ozone depleting substances, regulates shipboard and deliberate emissions of Volatile Organic Compounds



Source: Yu Yunfei

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A focus on Annex VI (Air pollution GHG)

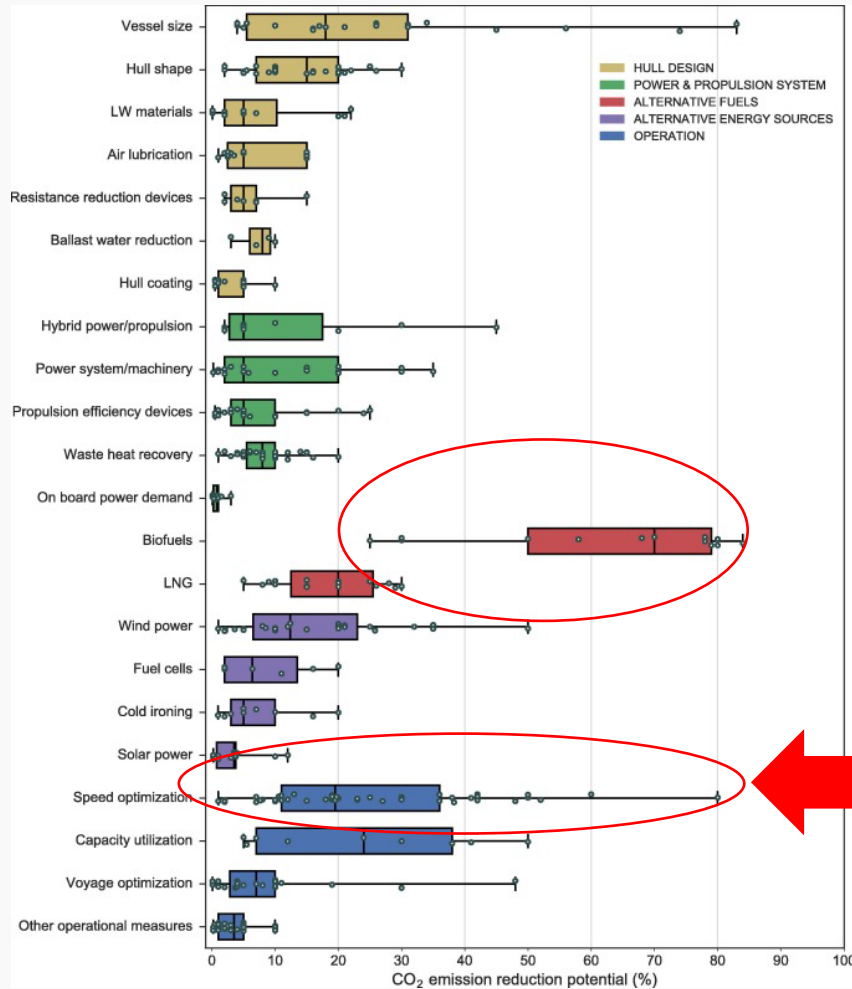
- First GHG related measure introduced as amendment via MEPC 62 in 2011
 - **Technical** requirements for the Energy Efficiency Design Index (EEDI) – only for new build ships
 - Introduction of the **operational** Ship Energy Efficiency Management Plan (SEEMP) – for all vessels from January 1st, 2013
 - Voluntary use of Energy Efficiency Operational Index (EEOI) – CO₂/tonne miles
- Paris Climate Agreement was signed in 2016 under COP 21
 - UN Framework Convention on Climate Change (UNFCCC) stipulates that parties should meet regularly to address climate change at Conference of Parties (COP)
 - The goal is to keep the rise in mean global temperature to well below 2 °C above pre-industrial levels, and preferably limit the increase to 1.5 °C
 - To a 1.5 °C limit, emissions must be cutted by half by 2030
 - Shipping and aviation fall under the umbrella of IMO and ICAO respectively, therefore not considered part of the agreement

IMO GHG strategy

- Then the GHG strategy was presented at **MEPC 80th** in 2023 as an update to MEPC 72th (2018) Initial GHG strategy
- Levels of ambition:
 - Decrease of the CO2 emissions by 40% by 2030 compared to 2008 levels
 - Net zero GHG emissions by or around 2050
- How?
 - Carbon intensity reduction by introducing new phases to EEDI
 - Strengthening the SEEMP
 - No prescriptive measure, but open to innovation via operational and/ or technical measures. No mention of Market Based Measures (MBM). To be further discussed in 2027.



Emission reduction measures



Jia et al., 2017 empirical study showed that by removing port inefficiencies. VLCC could reduce up to 19% of emissions

Source: Bouman et al., 2017

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IMO GHG strategy...then what?

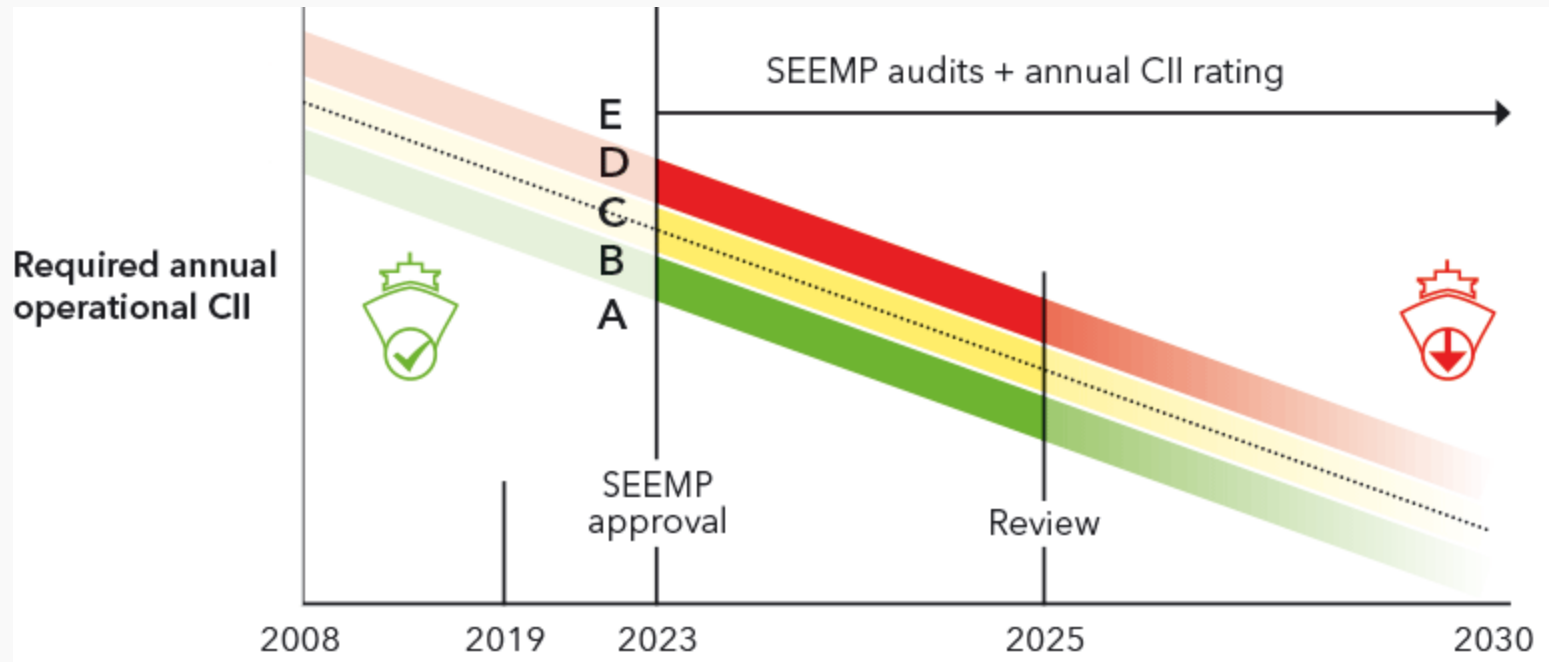
- From **MEPC 76th 2021** they introduced the Energy Efficiency Existing Ship Index (EEXI)... remember the EEDI? Too many «old» ships around. EEXI is applicable to all existing ships >400GT.
- Introduction of the first mandatory operational measure, the Carbon Intensity Indicator (CII)
 - CII mandatory to be reported **anually** from January 2024
 - CII is CO₂/cargo carrying capacity and nautical miles.
 - Provides a ranking from A to E, stating the vessels operational efficiency
 - Mandatory from 2023 for cargo, RoPax and cruise ships above 5,000GT
- **Examples and detailed explanation for calculating CII and ratings following this [link](#) slides 9 to 14**



IMO GHG strategy...then what?

- CII is annually calculated as AER (Annual Efficiency Ratio) or cgDist(Cargo Gross Ton distance), equivalent to EEOI (voluntary from 2013).
 - AER (emission per dwt-mile) and cgDist(emissions per gross ton-miles) $AER = \frac{\sum_i c_i}{\sum_i dwt D_i}$ $cgDist = \frac{\sum_i c_i}{\sum_i GT D_i}$
where
 c_i is the carbon emissions for a voyage i is computed using the fuel consumption and carbon factor for each type of fuel, dwt is the design deadweight of the vessel, and D_i is the distance travelled on a voyage i
 - EEOI main difference with AER is on the denominator. EEOI uses actual transported cargo, AER uses cargo capacity.
 - CII based on IMO DCS... no cargo is reported. So EEOI is disregarded when it is more accurate than AER.
- As per the last IMO GHG 4th report shipping contributed to ~1.1 billion tonnes in 2018. 2.89% of the total anthropogenic CO2 emissions

IMO GHG strategy...then what?



Source: DNV

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BREAK



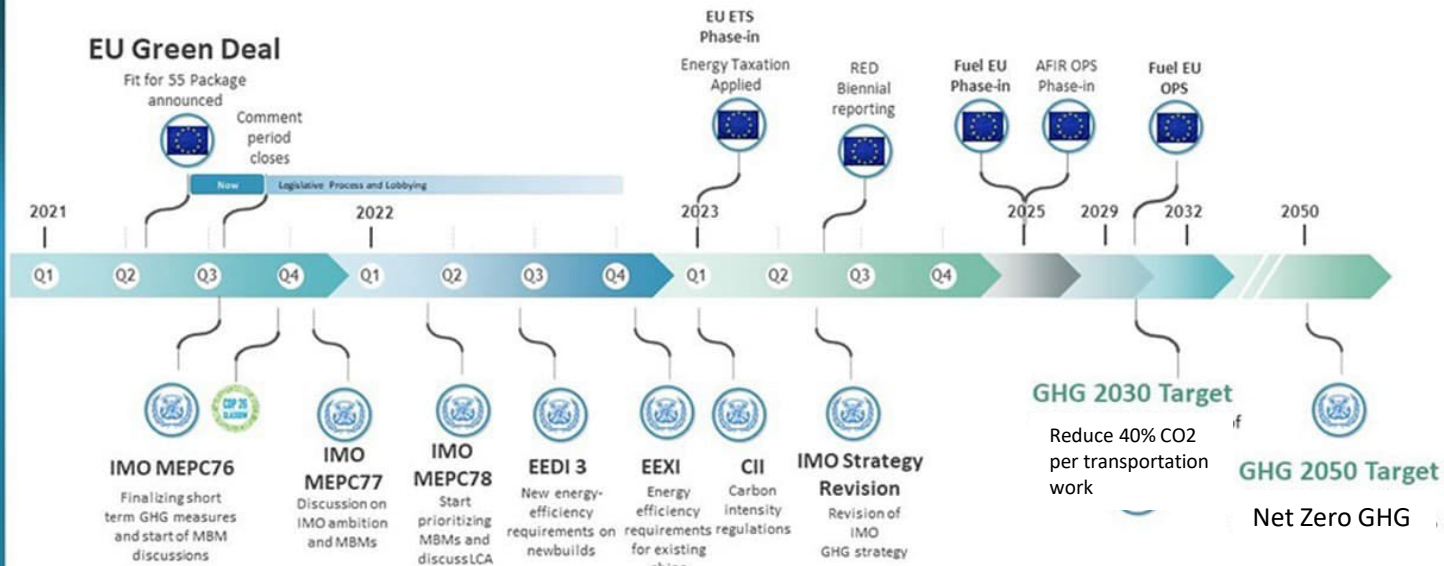
CII paradox

- CII would increase carbon emissions? Is it not meant to reduce them?
- The distance denominator in some scenarios (see Wang et al. 2021) suggest that a vessel would sail a more distant leg (without need) to increase the denominator value and reduce the overall CII value. More distance equal more emissions.
- What to do?
 - Obvious answer. Use zero carbon fuels (e.g., ammonia, hydrogen, etc.). CO₂ emissions = 0
 - Problem: underdeveloped infrastructure
 - Halfway solution: LNG – lower carbon content (passes CII rankings) High Methane (CH₄) content (a more powerful GHG 28x more powerful than CO₂ on a 100 years lifespan).
 - Not so obvious: speed reduction, but then you might need more vessels to compensate a trade route. So, more emissions.

IMO interplay with the EU



The regulatory timeline for EU and IMO overlap



European Trading System (EU ETS)

- EU goal to reduce emissions 55% by 2030
- Shipping introduced to the existing ETS (it exists from 2005) as part of a set of legislation package called «Fit for 55 package»
- Based on cap and trade system
 - A cap is set on the total amount of certain greenhouse gases a vessel would emit
 - Cap is reduced over time
 - Passing the cap, the installation can buy or sell emission allowances
 - At the end of the year a vessel must have remaining allowances, otherwise heavy fines
- The polluter pays principle. Whoever has the polluting decisions. Type of contract is important to allocate this cost.
- Emissions are counted as: 50% of emissions if start or ending in an EU port and 100% emissions for vessels trading between EU ports. + at-berth (100%)
 - Calculated per leg such as the voyage consumption in the voyage calculation
- Counted emissions to be surrendered(cap): 70% in 2025 up to 100% in 2026

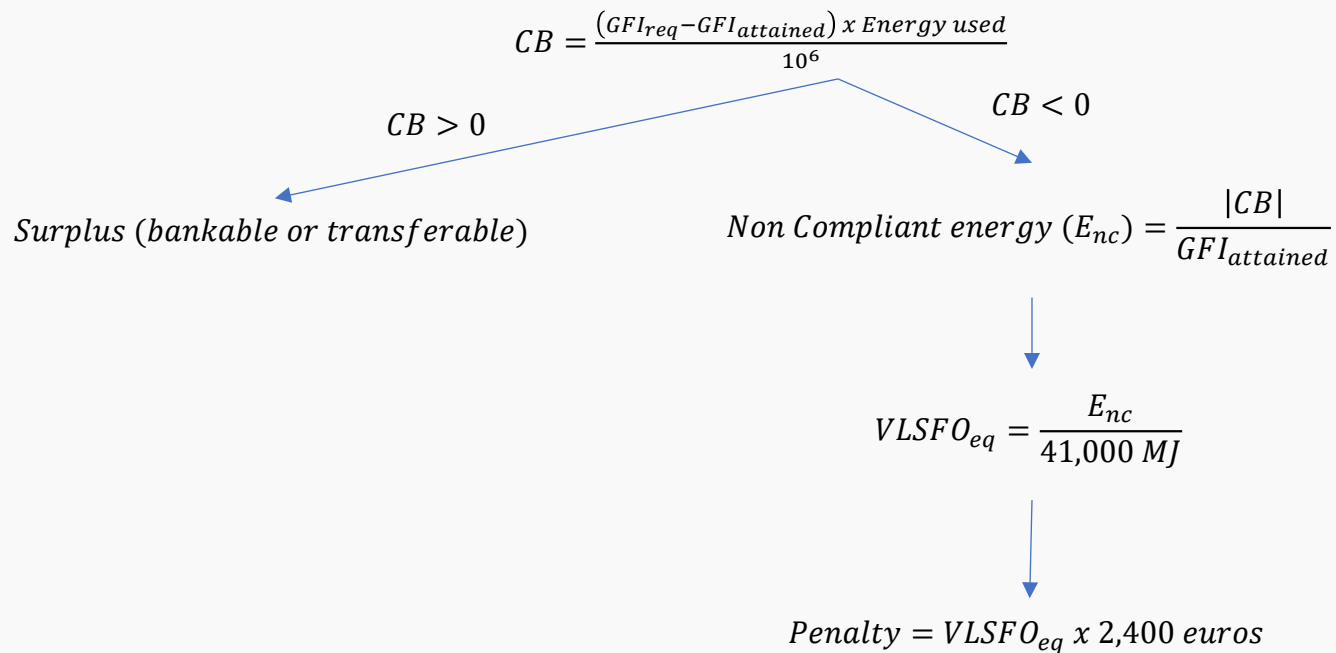
Fuel EU

- Applies from 2025 for ships $\geq 5,000$ GT on intra-EU voyages (100%) and extra-EU (50%) + at-berth (100%)
- Includes Well to Wake GHG intensity (gCO₂e/MJ)
 - Tank to Wake: Fuel used on board the vessel
 - Well to Wake: From oil out of the ground until its use on board the vessel
- Baseline target: 91.16 gCO₂e/MJ (VLSFO) and reducing from 2% in 2025 until 80% in 2050
- Compliance compares attained GHG Fuel Intensity (GFI) and required target, both in gCO₂e/MJ
 - Compliance Balance (CB) = (Required GFI-Attained GFI) x Energy (MJ)
 - Surplus can be borrowed, banked or transferred
 - Deficit pays a penalty

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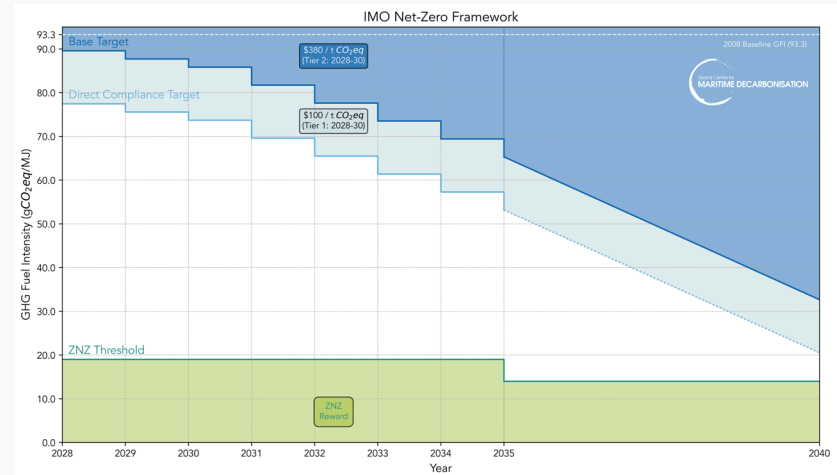


Fuel EU Penalty

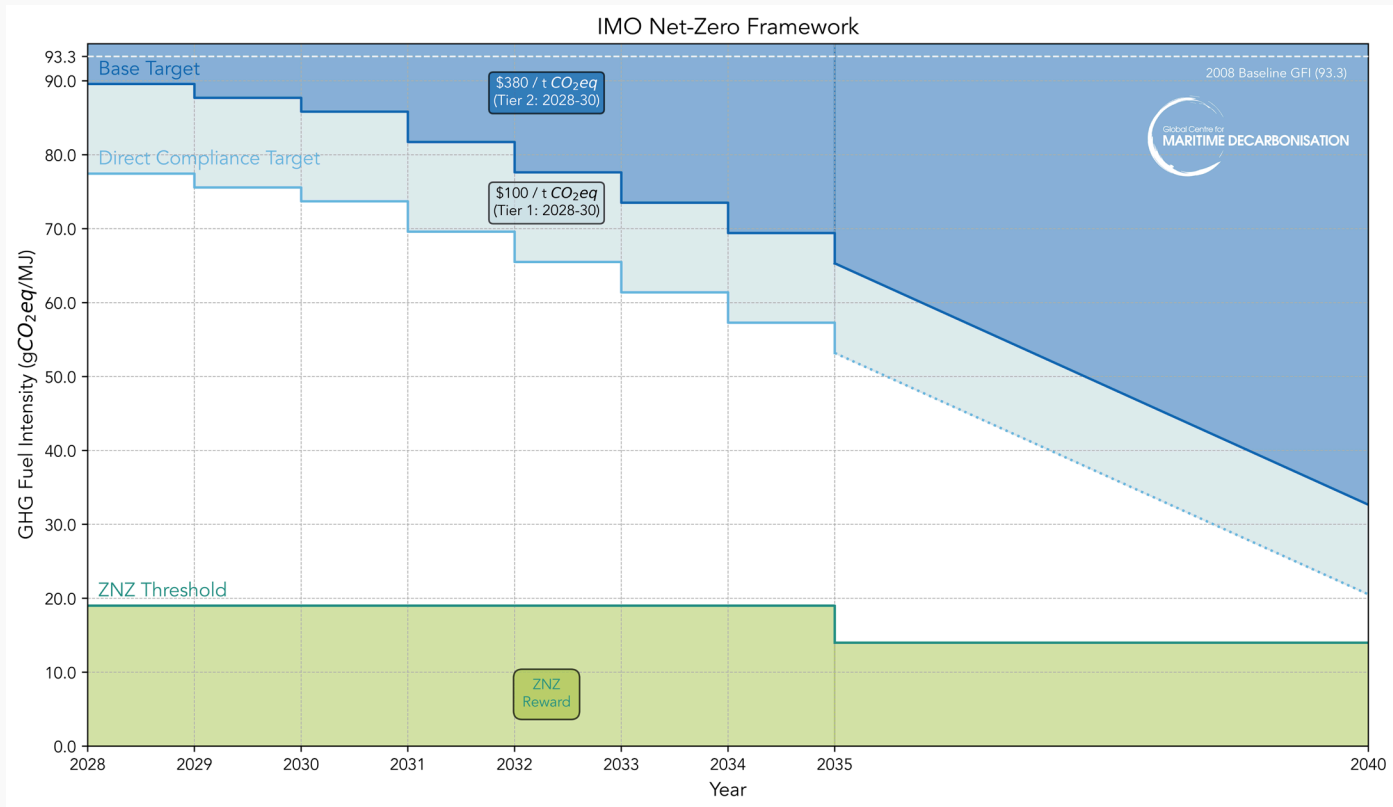


IMO Net Zero Framework

- Applies to ships $\geq 5,000$ GT
- Beginning in 2028
- Regulates attained GFI
- Two compliance levels Tier 1 (Direct compliance target) and Tier 2 (Base Target)
- Ships compare attained GFI vs targets
 - Below direct – Surplus Units
 - Above direct – Tier 1 deficit
 - Above base – Tier 2 deficitThey add up



IMO Net Zero Framework



IMO Net Zero Framework

- Tier 1 deficit → must buy Tier 1 RUs (US\$100/tCO₂eq for 2028–2030).
- Tier 2 deficit → must buy Tier 2 RUs (US\$380/tCO₂eq for 2028–2030).
- Prices set/revised periodically by IMO.
- Surplus units
 - Offset Tier 2 deficits (not Tier 1)
 - Banked in 2 years or transferred once

Example

Attained GFI (WtW) : 91 gCO₂e/MJ (VLSFO)

Direct target: 78 gCO₂e/MJ

Base target : 89 gCO₂e/MJ

Annual energy used= 5000 *ton VLSFO* –LHV = $40 \times 10^3 \frac{\text{MJ}}{\text{ton}}$

Step 1: Calculate Tier gaps

$$\textit{Tier 1} = \min(\textit{Attained}, \textit{Base}) - \textit{Direct}$$

$$= \min(91, 89) - 78 = 11 \text{ g/MJ}$$

$$\textit{Tier 2} = \max(0, \textit{Attained} - \textit{Base})$$

$$= \max(0, 91 - 89) = 2 \text{ g/MJ}$$

Example

Attained GFI (WtW) : 91 gCO₂e/MJ (VLSFO)

Direct target: 78 gCO₂e/MJ

Base target : 89 gCO₂e/MJ

Annual energy used= 5000 *ton VLSFO* –LHV = $40 \times 10^3 \frac{\text{MJ}}{\text{ton}}$

Step 2: Convert gaps to tCO₂e

Tier 1

$$5000 \text{tonHFO} \times 40,000 \frac{\text{MJ}}{\text{tonHFO}} \times 11 \frac{\text{gCO}_2\text{e}}{\text{MJ}} \times \frac{1 \text{ tonCO}_2\text{e}}{1 \times 10^6 \text{gCO}_2\text{e}}$$
$$= 2200 \text{ tonCO}_2\text{e}$$

Tier 2

$$5000 \text{tonHFO} \times 40,000 \frac{\text{MJ}}{\text{tonHFO}} \times 2 \frac{\text{gCO}_2\text{e}}{\text{MJ}} \times \frac{1 \text{ tonCO}_2\text{e}}{1 \times 10^6 \text{gCO}_2\text{e}}$$
$$= 400 \text{ tonCO}_2\text{e}$$

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Example

Attained GFI (WtW) : 91 gCO₂e/MJ (VLSFO)

Direct target: 78 gCO₂e/MJ

Base target : 89 gCO₂e/MJ

Annual energy used= 5000 *ton VLSFO* –LHV = $40 \times 10^3 \frac{\text{MJ}}{\text{ton}}$

Step 3: Estimate the penalty

Tier 1

$$2200 \text{ tonCO}_2\text{e} \times 100 \text{ \$/tonCO}_2\text{e}$$

Tier 2

$$400 \text{ tonCO}_2\text{e} \times 380 \text{ \$/tonCO}_2\text{e}$$

Total RUs

372,000 \$

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An investment decision

We are requested to make a very brief assesment of whether to invest in retrofiting to e-ammonia capable Internal Combustion Engine for an MR tanker or remain to operate with the current fuel HFO.

- E-ammonia has a LHV of 18,600MJ/t and HFO has LHV of 41,000MJ/t

- 1) Identify the cost sources for e-ammonia retrofit
- 2) Estimate the NPV for both options. (Excel attached)
 - Discount rate = 5%
 - HFO Price = 550 \$/t and E-ammonia=\$900\$/t
 - The energy demand for your vessel annual operation is approx. 270 million MJ
 - Remaining lifetime 10 years (2025-2035)

Which one is better. Why?

- 3) Rerun the NPV, now by adding the GFI carbon penalty using the calculator using <https://gcformd.org/calculator/>

Which alternatives makes the e-ammonia more competitive?

A small intro on fuel “colors”

GREEN HYDROGEN

PROCESS
ELECTROLYSIS

SOURCE
RENEWABLES



BLUE HYDROGEN

PROCESS
AUTO THERMAL
REFORMING OR
GASIFICATION

CARBON IS CAPTURED

SOURCE
NATURAL GAS
COAL



GREY HYDROGEN

PROCESS
STEAM METHANE
REFORMING OR
GASIFICATION

NO CARBON CAPTURE

SOURCE
NATURAL GAS
COAL



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