WHEN TRUST MATTERS

Carbon Regulations and Consequences

Maritime Day Åland

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23 May 2024

Content

- Introduction
- IMO/EU general status on GHG emissions
- EU ETS
- Fuel EU Maritime
- IMO CII
- Solutions

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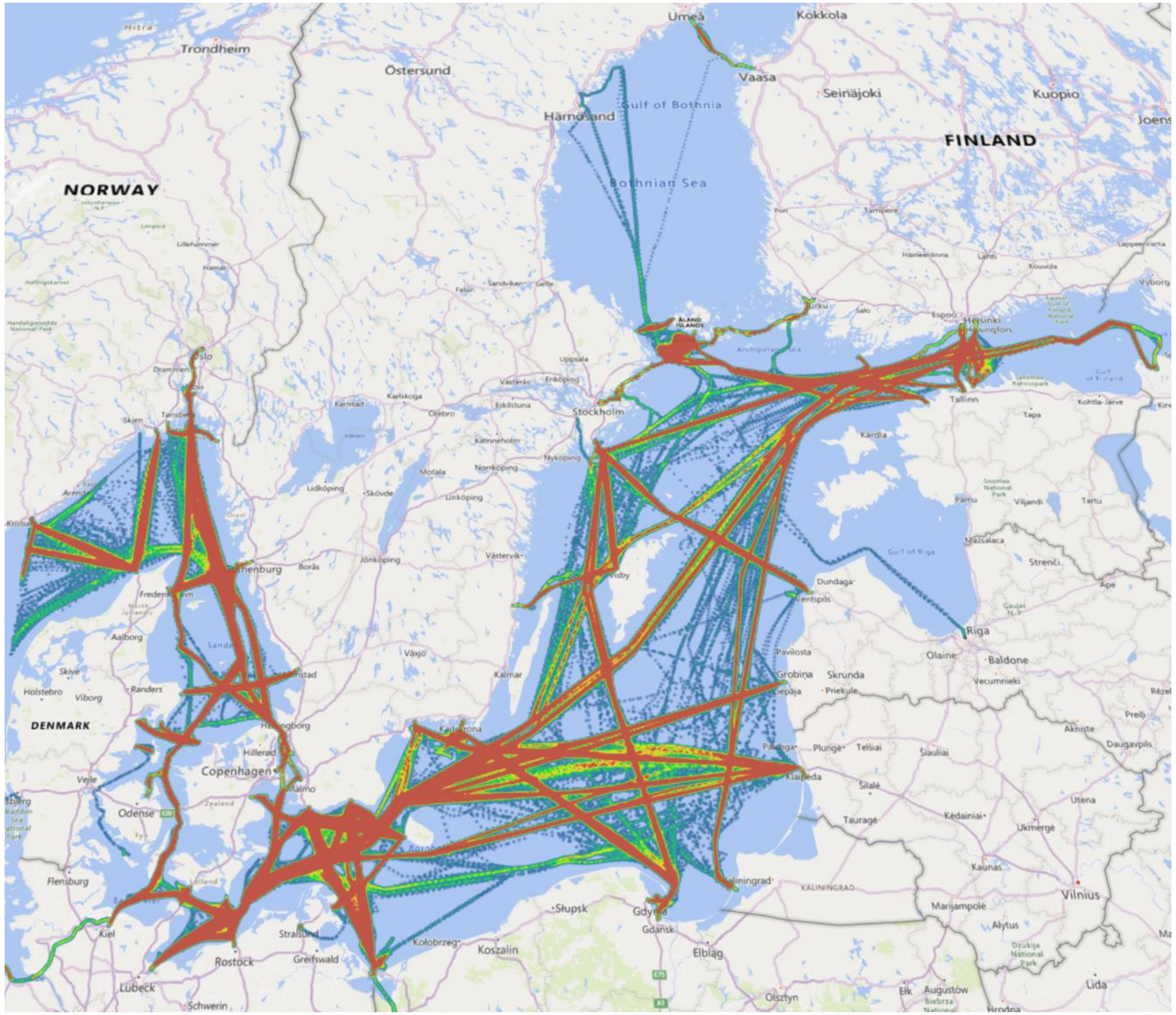
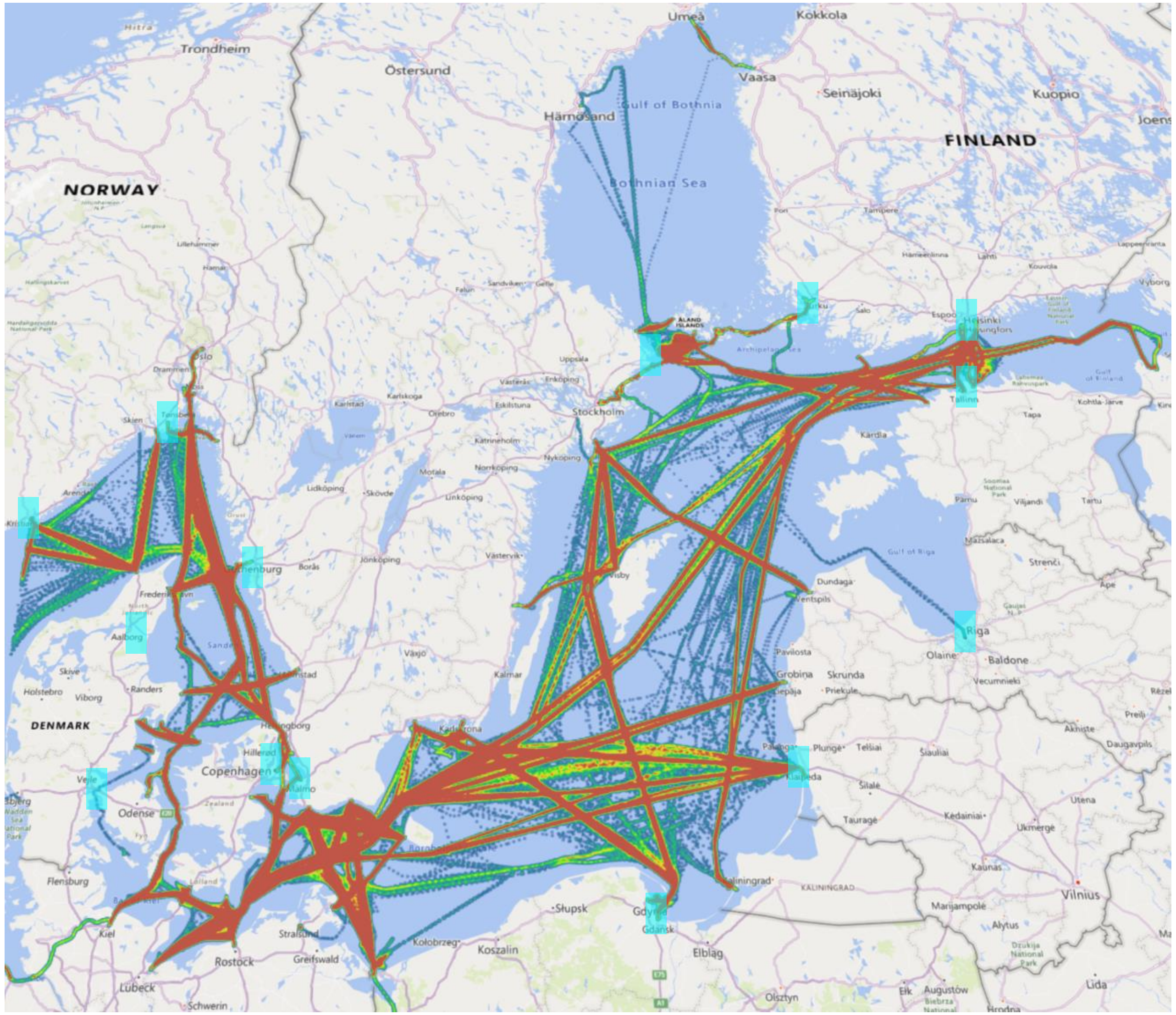
Trading pattern ro-pax in the Baltic region

- 2023 traffic patterns for Passenger/Ro-Ro ships operating in the Baltic Sea and west of Sweden
- 140 unique vessels > 5000 gross ton



DNV in the Baltic+ Region

- High coverage of DNV surveyors in the Baltic+ region
- RoRo/RoPax hubs
- 400+ surveys/year on RoRo/RoPax vessels



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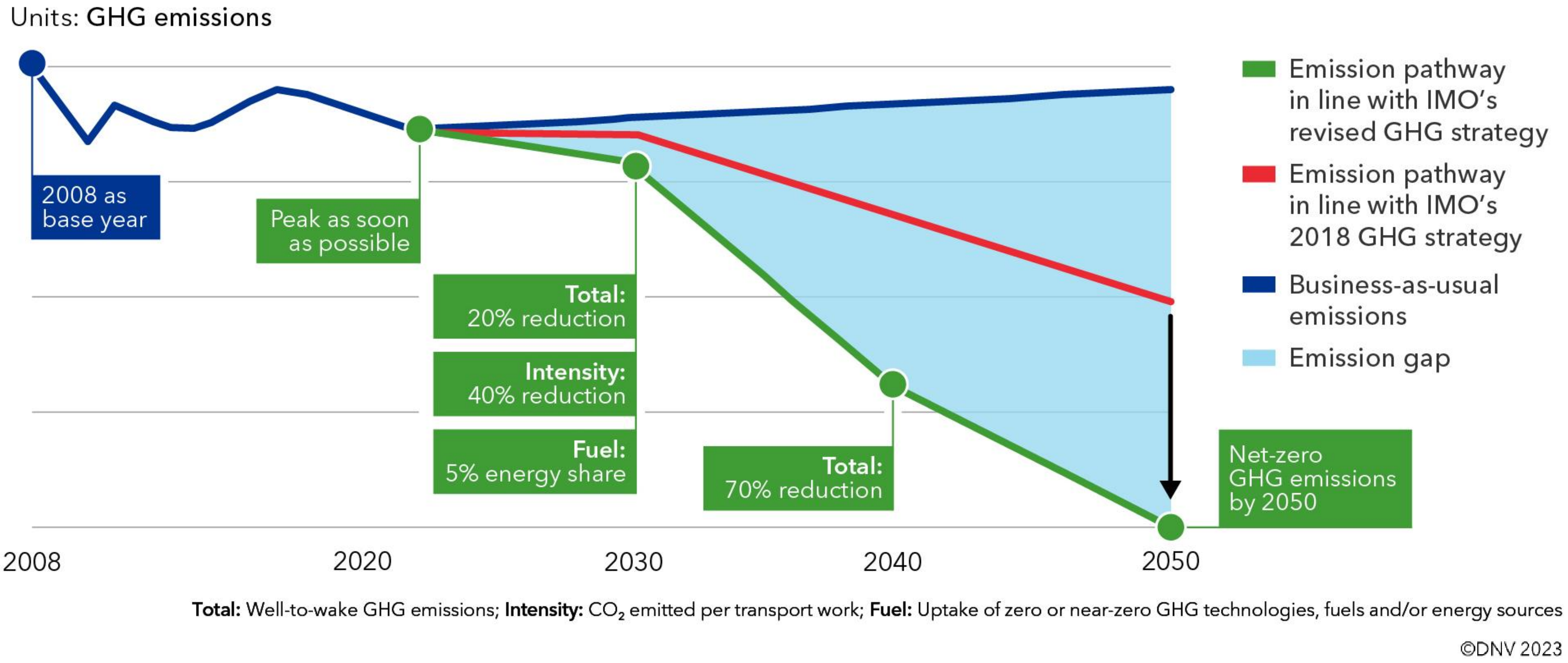
Strengthened IMO strategy on GHG reductions (MEPC 80)



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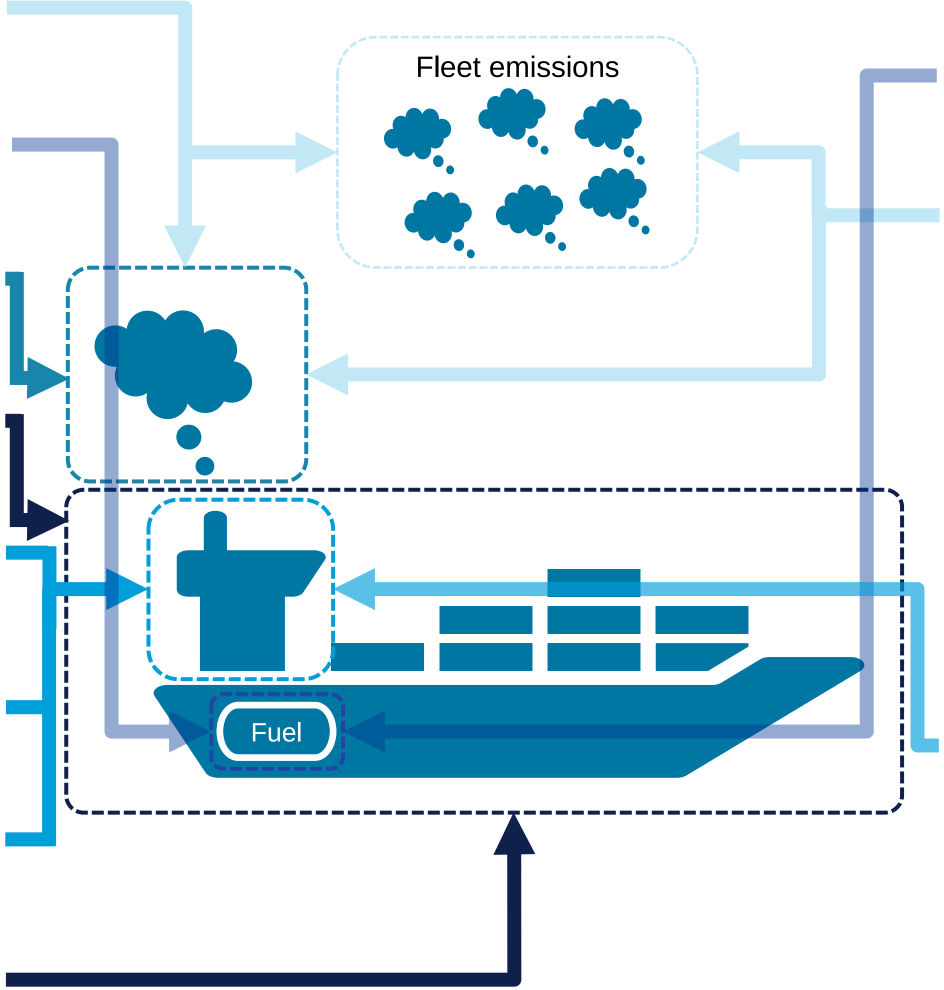
The regulatory framework to reduce GHG emissions

CO_2 price	Market-based measure Sets a price on CO_2 emissions	2027
GHG Fuel Standard	Operational requirement Well-to-wake fuel GHG intensity	2027
CII	Operational requirement Actual carbon intensity	2023
EEXI	Design requirement for existing ships Ideal carbon intensity	2023
SEEMP III	Management requirement Continuous carbon intensity improvement	2023
DCS SEEMP II	Reporting of actual fuel consumption and CO2 emissions	2019
SEEMP I	Management requirement Continuous energy efficiency improvement	2013
EEDI	Design requirements for new ships Ideal carbon intensity	2013



2025	Operational requirement Well-to-wake fuel GHG intensity	FuelEU Maritime
2024	Emission cap-and-trade Sets a price on CO_2 emissions	EU ETS
2018	Reporting of actual fuel consumption and CO2 emissions	EU MRV

EU regulations

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Shipping to be included in the EU Emissions Trading System from 2024

Ship sizes and type

Cargo/passenger ships (5000+ GT)

Offshore ships (5000+ GT)

Offshore and general cargo ships (400-5000 GT)

Other cargo/passenger ships (400-5000 GT)

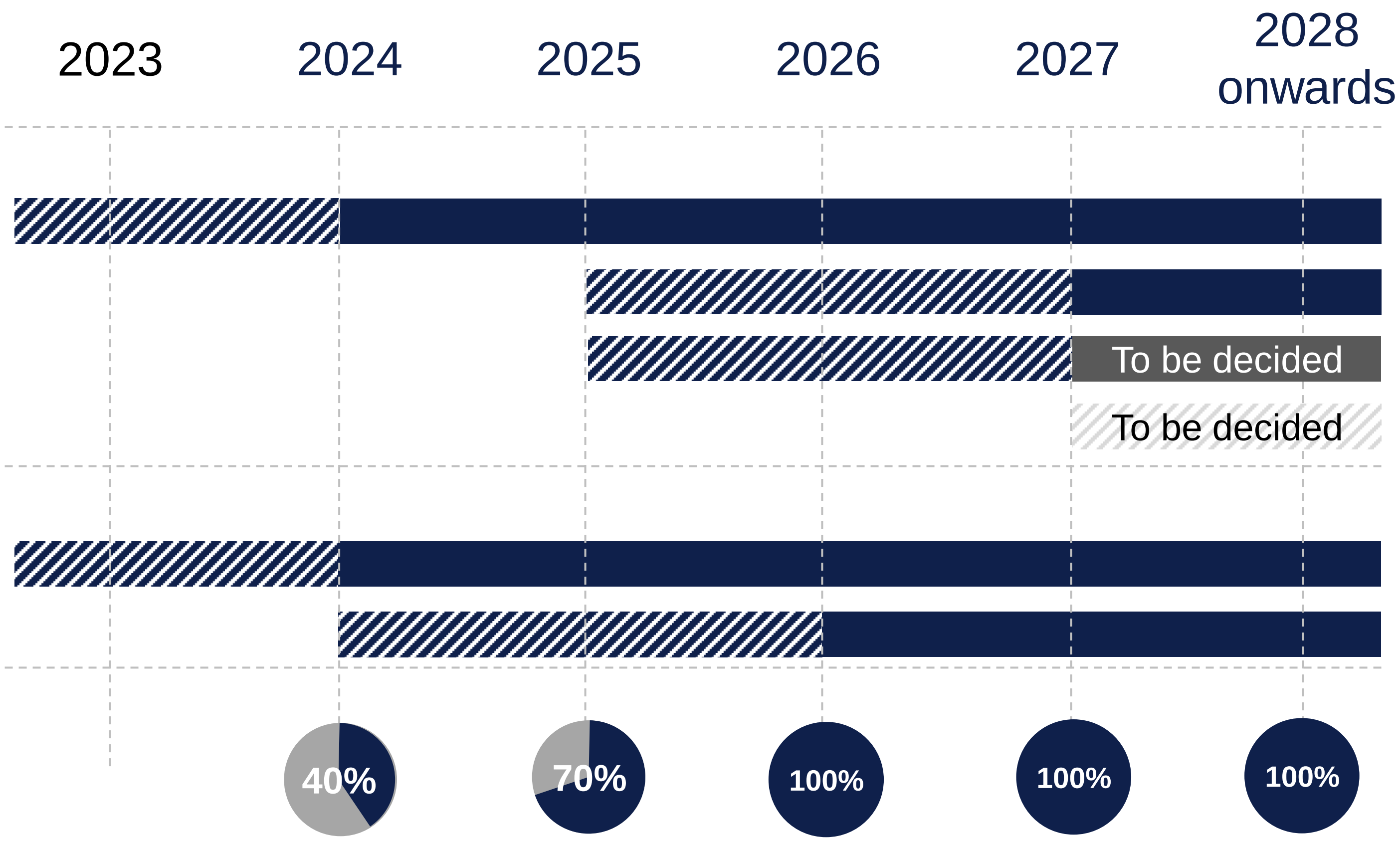
Greenhouse gases

Carbon dioxide (CO_2)

Methane (CH_4) and Nitrous oxide (N_2O)

Phase-in

% of emissions included in ETS scope

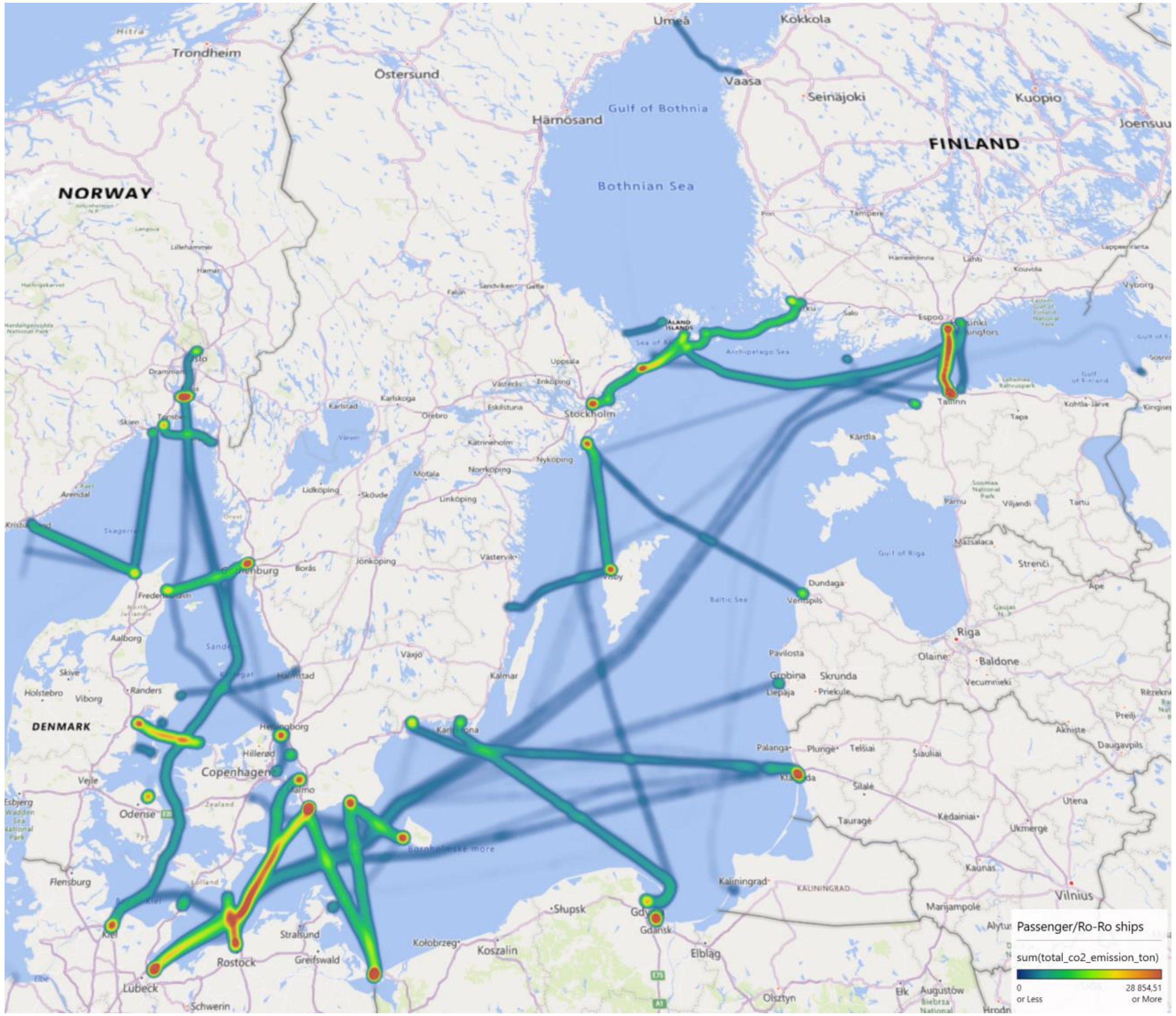


Reporting only (MRV)

Included in ETS scope

Emissions in the Baltic region

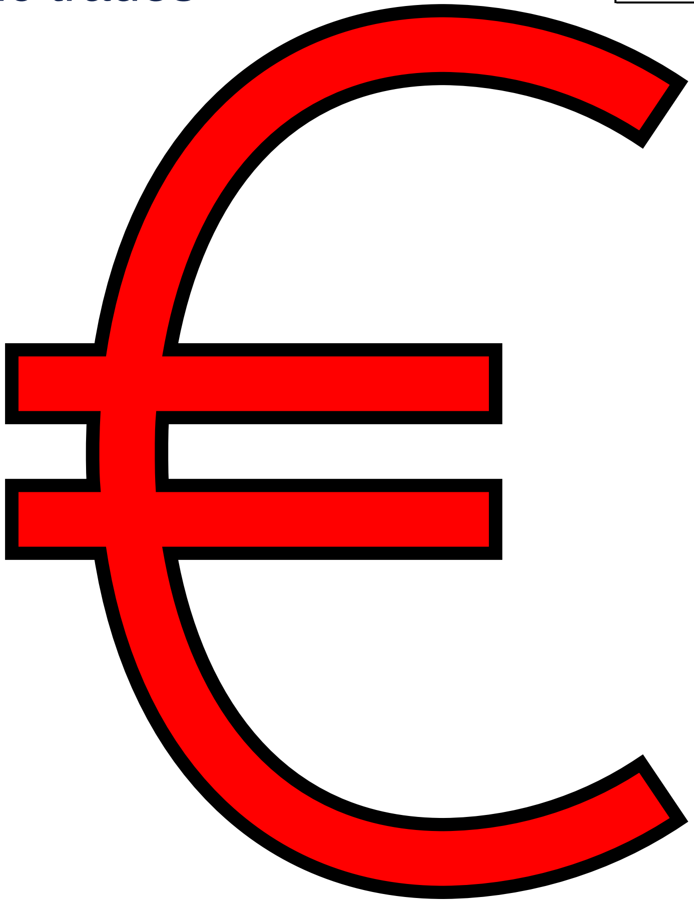
- Geographical distribution of fuel consumption for Passenger/Ro-Ro ships operating in the Baltic Sea and west of Sweden
- 140 unique vessels > 5000 gross ton
- Total fuel estimate of ~1.6 million toe
- CO_2 emission ~ 4.9 million ton



What does this mean for the industry?

- EU ETS will increase the cost of ROPAX significantly for the baltic trades

	2024	2025	2026
ROPAX additional cost EUA@70	122 372 675	214 152 181	305 931 687
ROPAX additional cost EUA@90	157 336 296	275 338 518	393 340 740



Content

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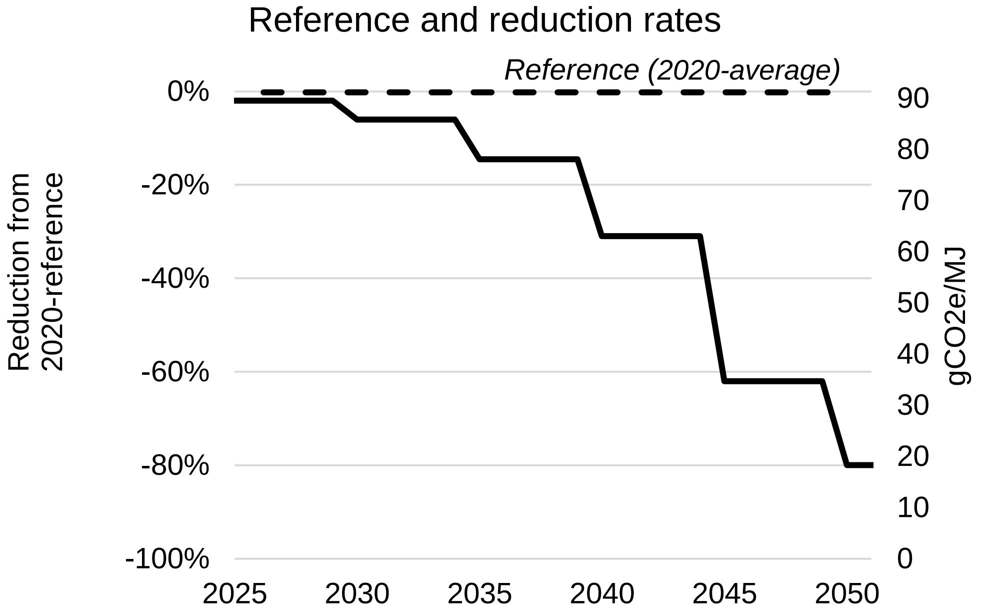
FuelEU Maritime – requirements to lifecycle GHG intensity of energy

- Requirement to the yearly **average well-to-wake GHG intensity of energy** used on-board:
  - All ships above 5000 GT transporting passengers or cargo
  - 50% of energy used on voyages between EU and non-EU ports, 100% of energy used on intra-EU voyages and when at berth
  - Includes CH_4 and N_2O and electricity received, rewards for using wind power
  - **Compliance can be banked and pooled**, with some limitations across periods, ships and companies
  - Mandatory 2% RFNBO use from 2034, if use in 2031 is less than 1%. Equivalent fuels with a similar or higher decarbonisation potential can be accepted.

- Requirement to the **use of shore power**:
  - From 1 January 2030 for **container and passenger ships** not using zero-emission technologies: **connect to shore power while at berth in TEN-T ports** for more than 2 hours

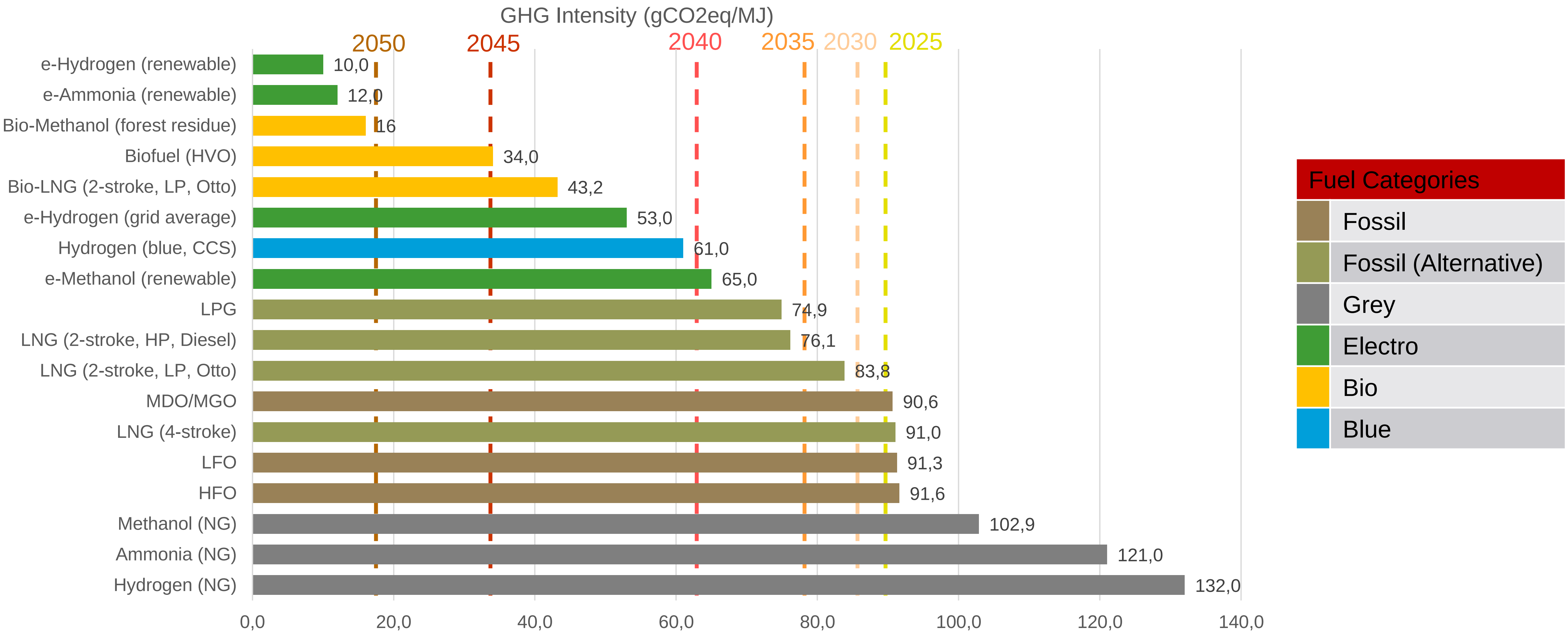
$$Well\ to\ Wake\ GHG\ intensity = \frac{gCO_{2eq}}{MJ}$$



Reduction	2025	2030	2035	2040	2045	2050
Reduction (%)	2%	6%	14.5%	31%	62%	80%
Required GHG intensity (gCO_2e/MJ)	89.3	85.7	77.9	62.9	34.6	18.2

Note: the above is subject to final adoption by the Parliament and Council

GHG Intensity limit



- *Values are based on assumption and may vary once LCA is finalized.*
- *LNG (with high pressure 2-stroke engine) and LPG are the two fossil fuels compliant options until 2040.*
- *Sources: FuelEU regulation, MEPC documents, JRC default values for transport fuels*

EU ETS and FuelEU Maritime compliance options

Option	EU ETS	FuelEU Maritime
Fossil LNG/LPG	+	+
Sustainable biofuels	++	++
Renewable fuels of non-biological origin (RFNBO), recycled carbon fuels (RCF) (e.g. e-methanol)	++	++
Shore power	++	++
Wind assisted propulsion	++	+
Energy efficiency	++	N/A
Onboard carbon capture and storage	++	?
Compliance balance (borrow, bank, pool)	N/A	+
Pay penalty	N/A	O

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CII - Carbon Intensity Indicator rating

Scope:

- Cargo, ro-pax and cruise ships above 5000 GT
- GT-based for vehicle carriers

Requirements:

- Every year from 2023: Annually calculate and report Carbon Intensity Indicator and rating A to E.
- Each ship needs to achieve rating C or better

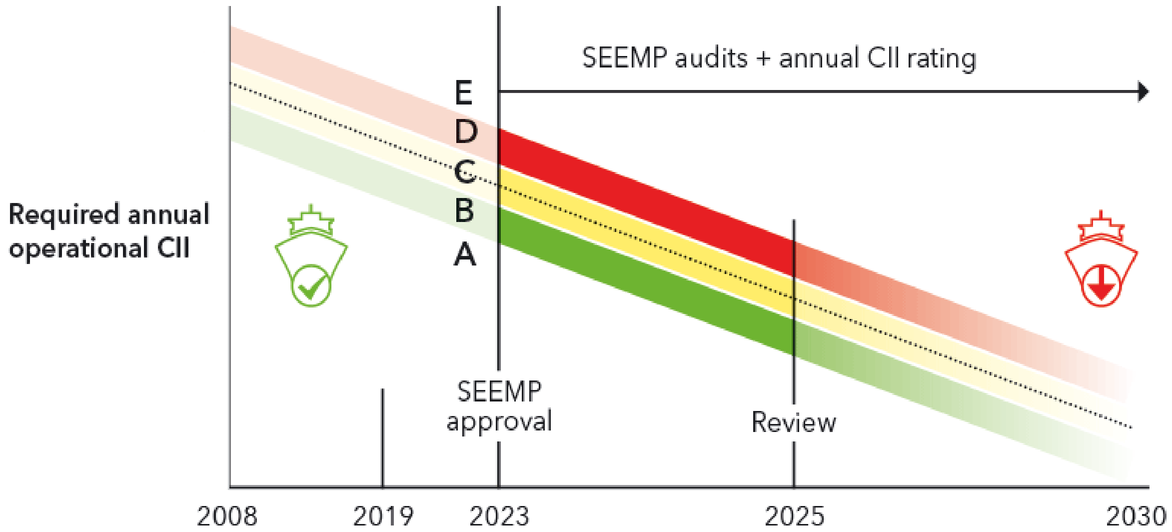
Enforcement:

- If rating D for 3 consecutive years or rating E: develop and implement an approved corrective action plan as part of SEEMP III to achieve rating C or better
- Annual Statement of Compliance issued

Review to be conducted by 1 January 2026, e.g.:

- Reduction factors for 2027-2030
- Strengthened corrective actions
- Need for enhancement of the enforcement mechanism

$$\text{CII} = \frac{\text{Annual fuel consumption} \cdot CO_2 \text{ factor}}{\text{Annual distance travelled} \cdot \text{Capacity (DWT or GT)}} \cdot \text{Correction factors}$$



Year	Reduction from 2019 ref. (mid-point of C-rating band)
2023	5 %
2024	7 %
2025	9 %
2026	11 %
2027-2030	To be decided

Carbon Intensity Indicator (CII) review

- **Phased approach** agreed
  - **Data-gathering** phase until MEPC 82, autumn 2024
  - **Data analysis and potential amendments** to the CII by MEPC 83, summer 2025
- **No immediate changes to the CII framework**
  - This includes correction factors and voyage adjustments
  - Potential **amendments in 2025** include:
    - CII **reduction requirements** from 2026 to 2030 to be aligned with the revised GHG Strategy ambitions
    - **Correction factors** and/or additional metrics
    - Revised **enforcement** mechanism
    - Application of **LCA guidelines**

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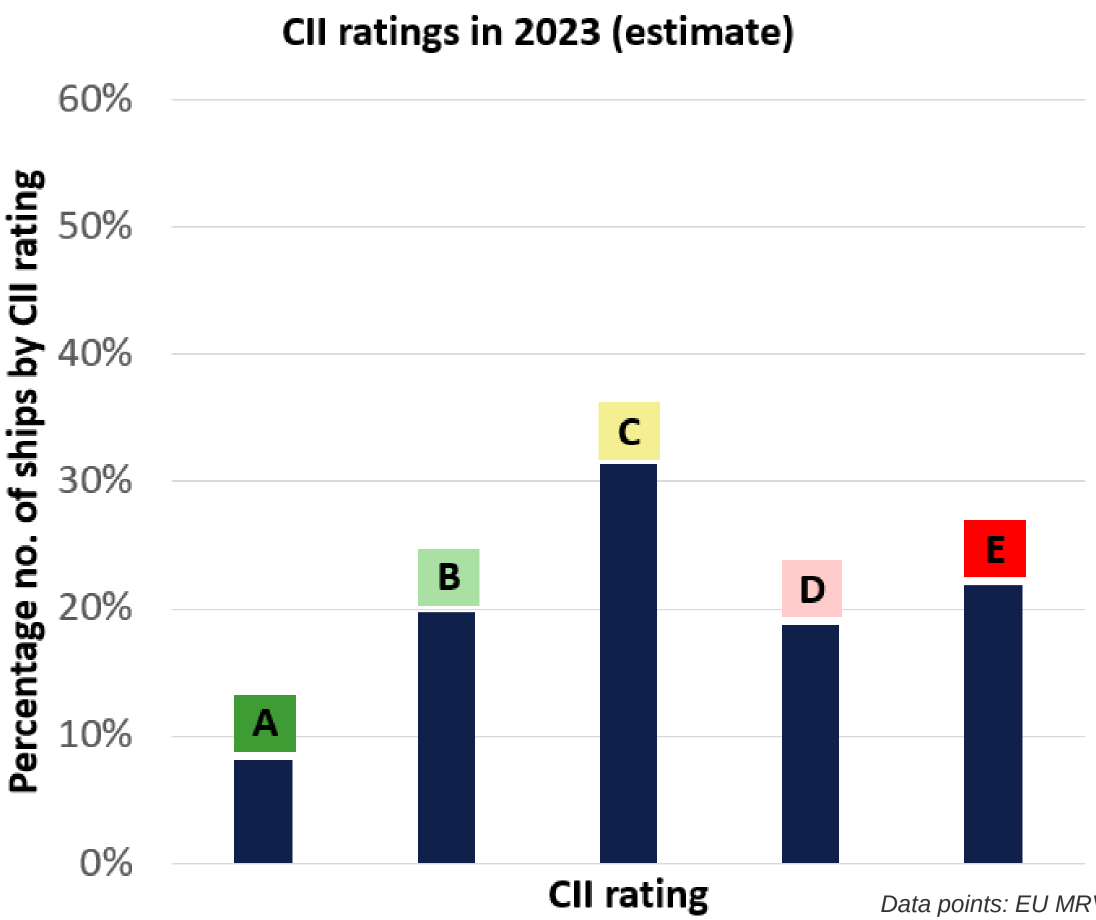
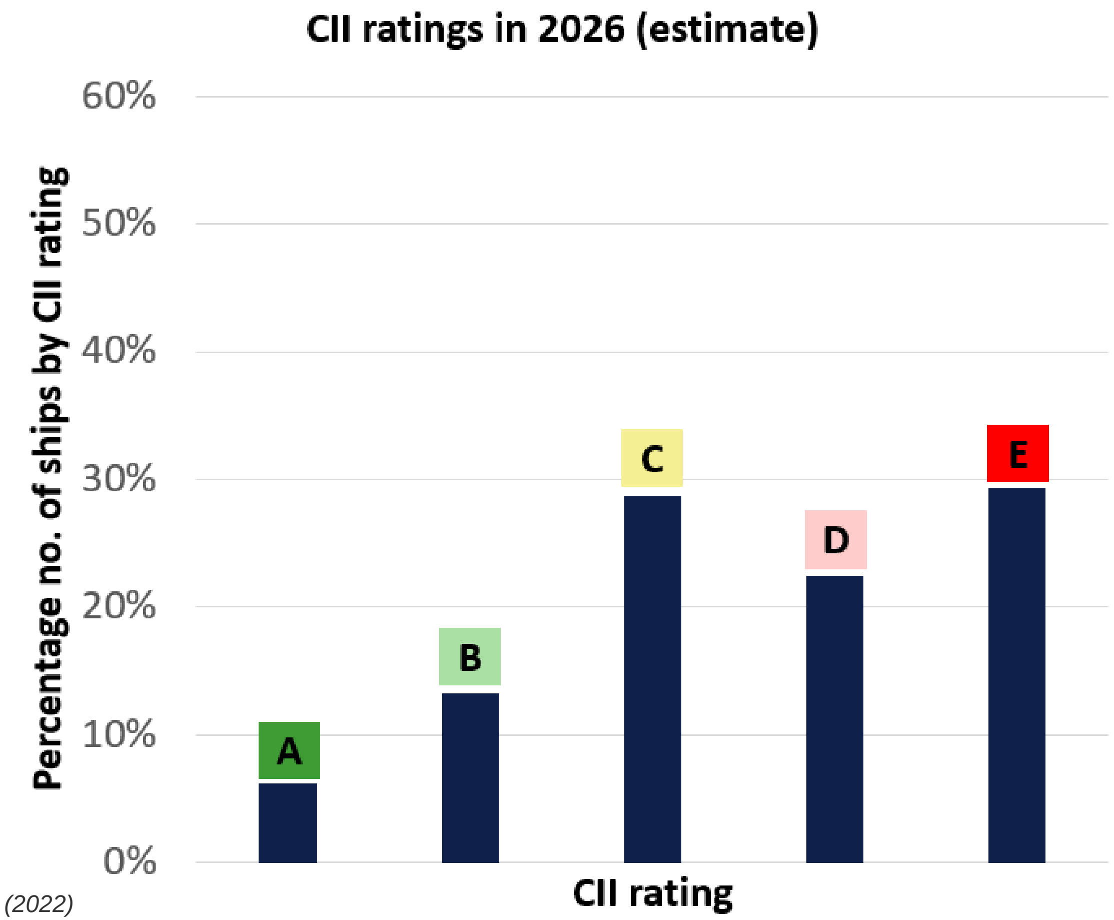
Percentage of ships in different categories based on 2022 data.





Data points: EU MRV data (2022)

Reference line and rating boundaries: MEPC.353(78)

Reduction factors: MEPC 76/WP.4

Note: The above estimates are based on 2022 EU-MRV data. EU-MRV data only cover operational data for voyages from, to and between EU ports and in EU ports.

Content

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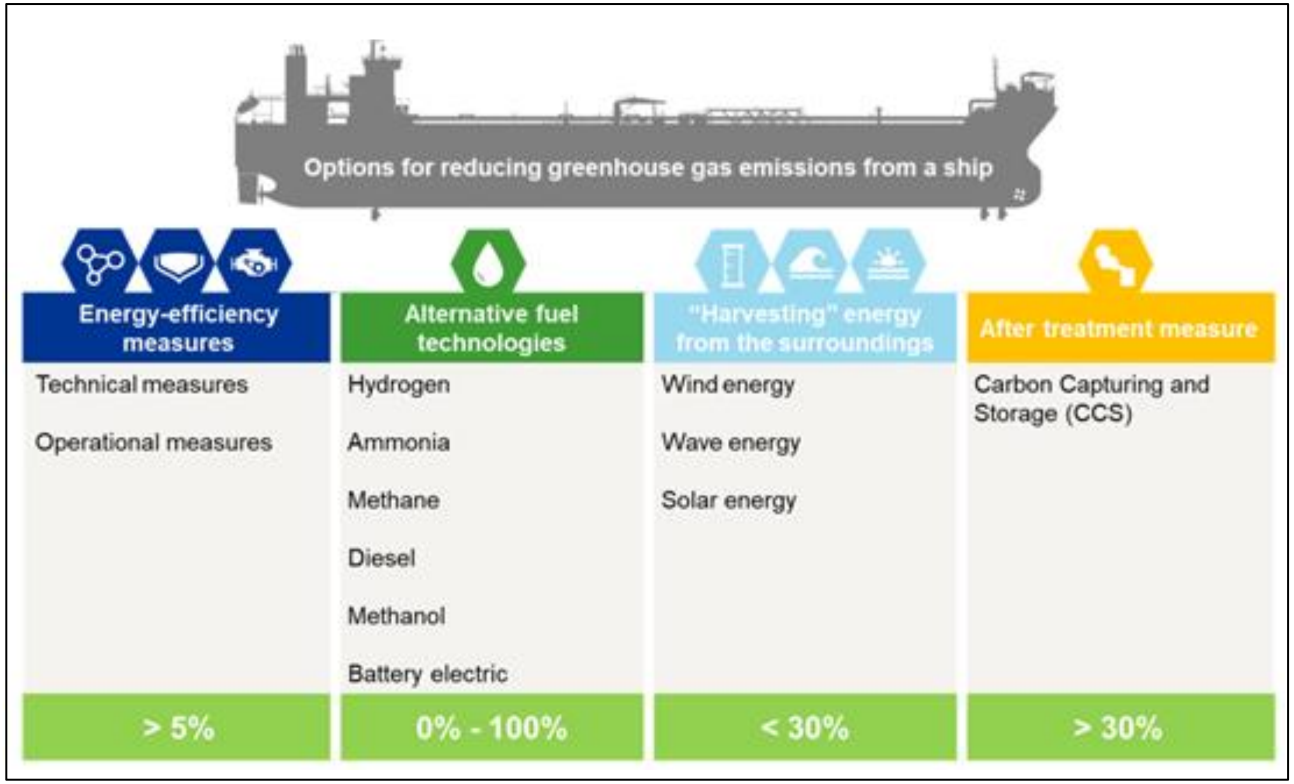
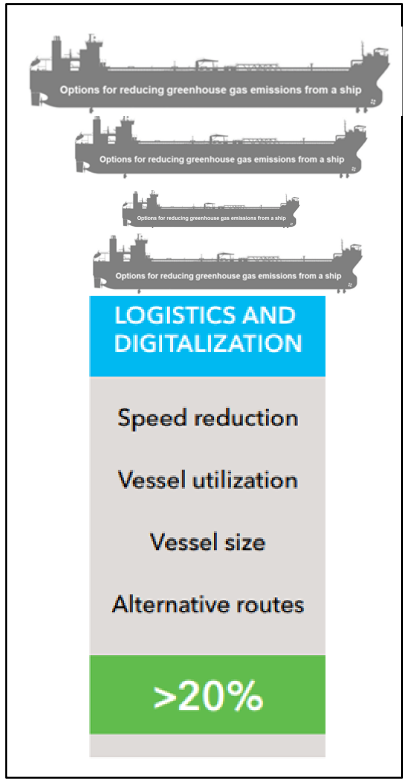
Decarbonization options for shipping

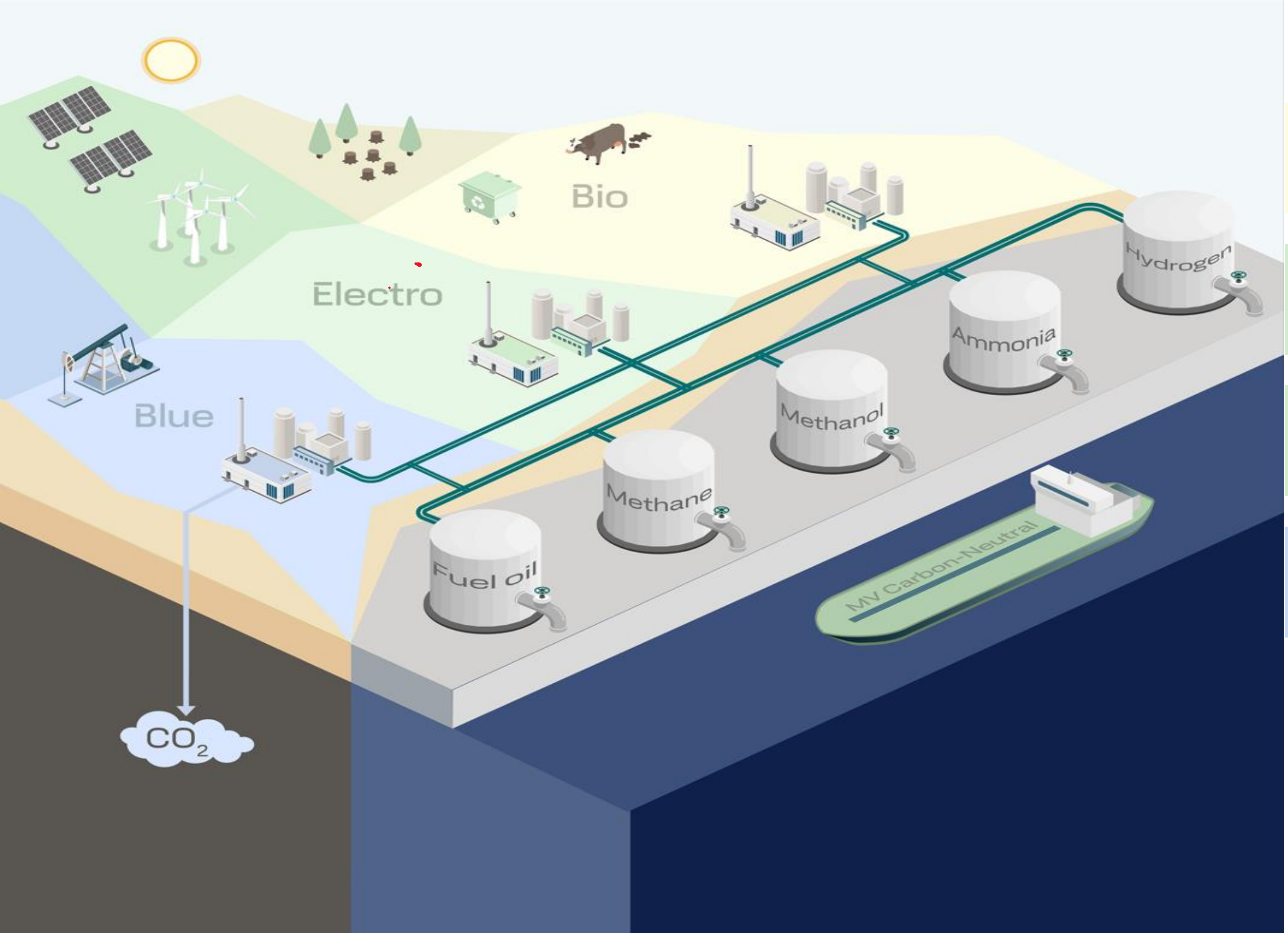
Significant **GHG reduction** can be achieved by technical and operational measures. **Up to 100%** GHG reduction can only be achieved with Alternative fuels. Barriers to implementation includes:

- Cost
- Availability and infrastructure
- Onboard storage





Shipping needs to switch to carbon-neutral energy supply chains



Sustainable biomass for biofuels

Renewable electricity for electrofuels

Sustainable carbon for carbon-based electrofuels

Large scale CCS

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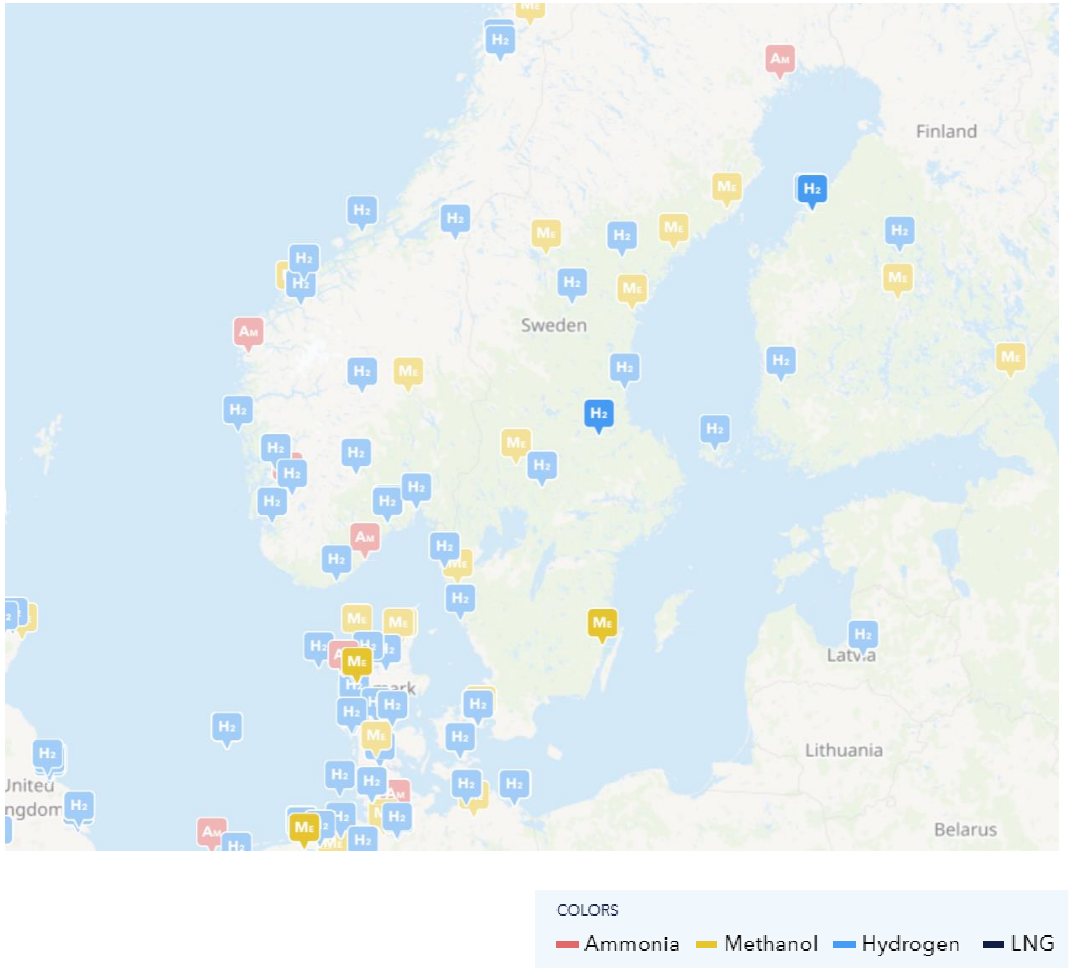
DNV AFI platform: [Alternative Fuels Insight (dnv.com)]

Fuel production

Status: In operation, Decided, Under discussion



Fuel bunkering

Status: In operation, Decided, Under discussion

Note that the majority of the projects presented are «under discussion». There are uncertainty regarding their realization.

DNV AFI platform: [Alternative Fuels Insight (dnv.com)]

Fuel production

Status: In operation

COLORS
Ammonia Methanol Hydrogen LNG

Fuel bunkering

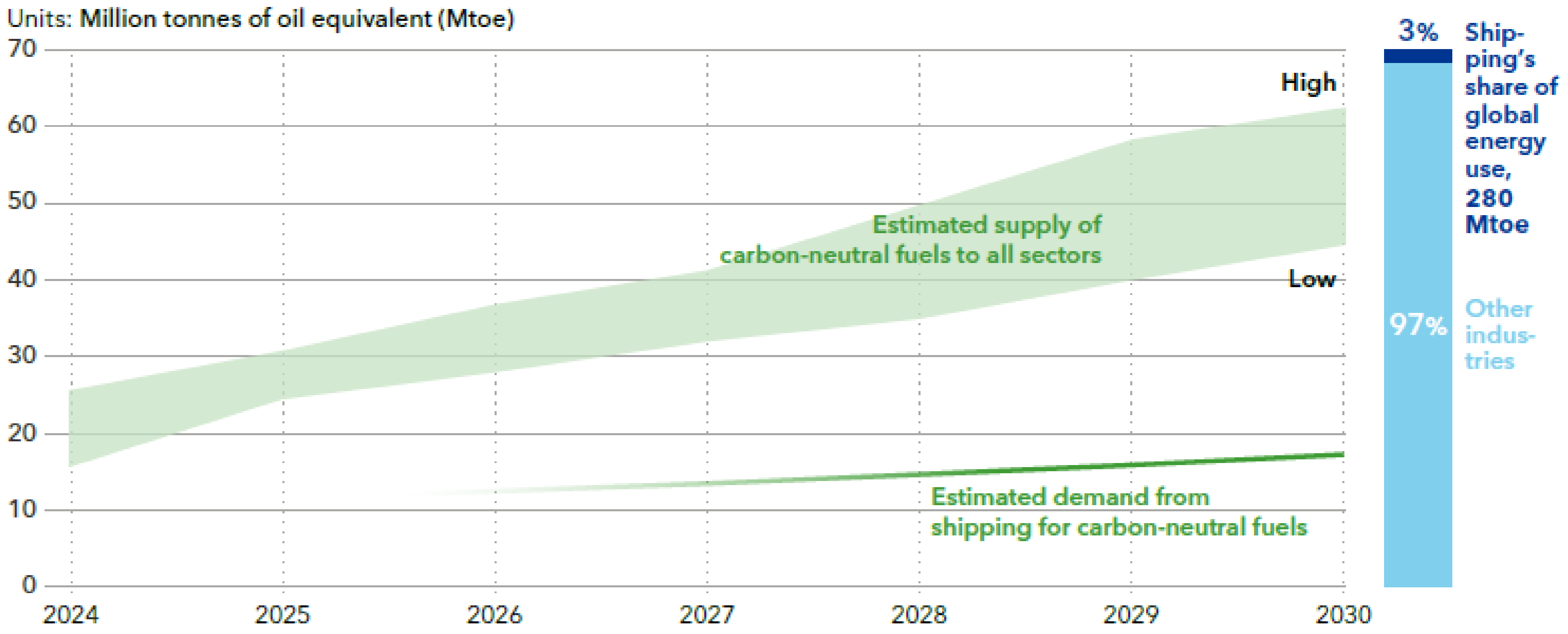
Status: In operation

COLORS
Ammonia Methanol Hydrogen LNG

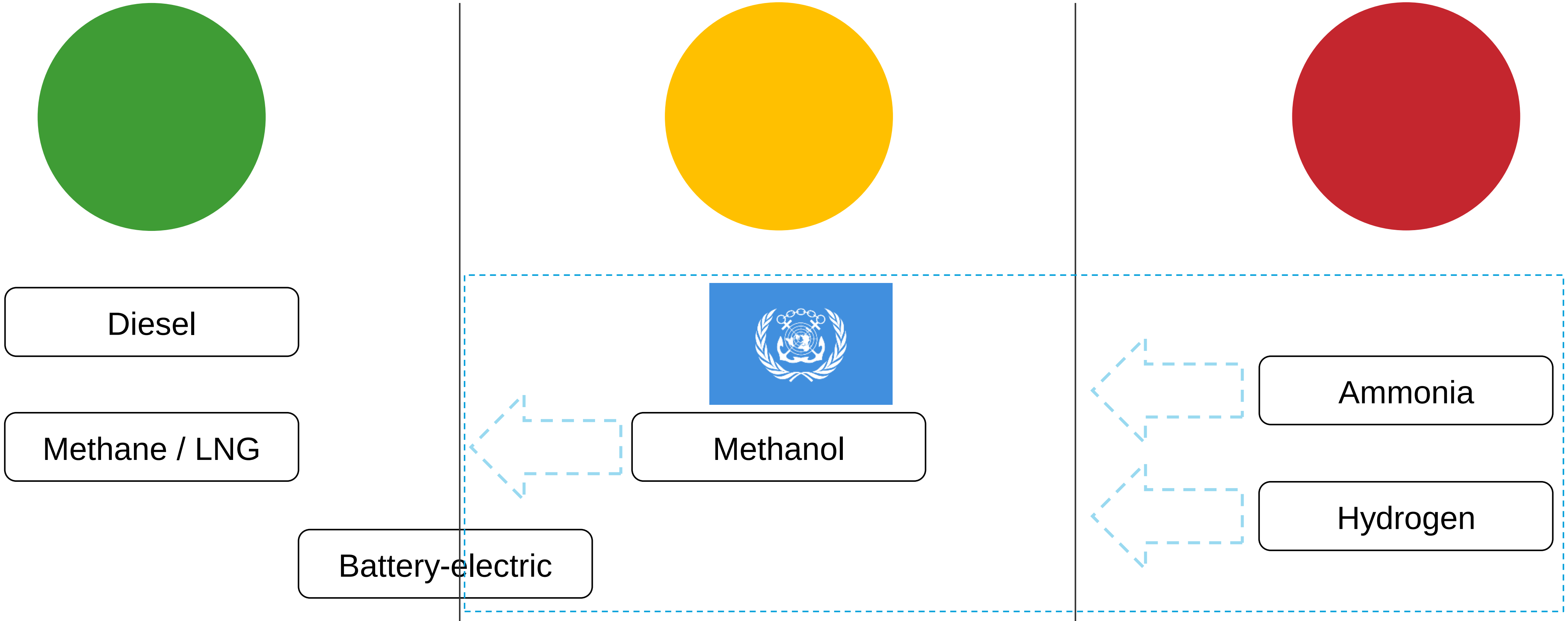
DNV Maritime Forecast 2023

FIGURE 1-4

Estimated supply of carbon-neutral fuel



Regulatory status of marine fuels



Covered by maritime regulations (SOLAS, IGC code, IGF code)

Class rules in place

Interim guidelines approved by IMO, but still Alternative Design Approach may be needed

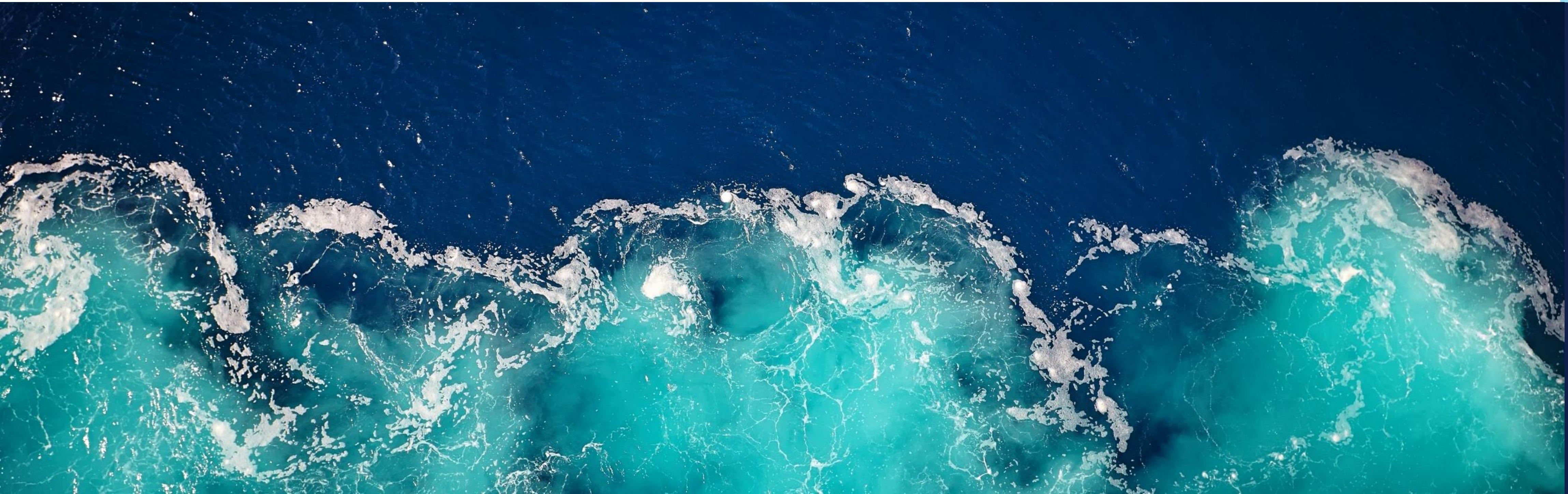
Class rules in place

Alternative Design Approach needed

DNV class rules for ammonia released in 2021

WHEN TRUST MATTERS

Economic Feasibility Study for RoPax



What we did

- This study has investigated the economic feasibility of different fuel and technology strategies for a 25 000 GT RoPax vessel in operation.
- We investigated the economic potential of three different fuel pathways (Fuel oil – baseline vessel, DF LNG and DF Methanol), and compared it to two onboard carbon capture scenarios, where the capture unit had the capacity to **capture 70% CO2 annually.**

Baseline vessel definition

Newbuild/in operation	In operation
Vessel capacity	25 000 GT
Vessel type	RoPax
Year of build	2005
Start year of cost analysis	2026
Remaining lifetime	25 years

Fuel Pathways

Fuel pathway 1: MF fuel oil

Fuel oil → *No conversion* → Bio-MGO / e-MGO

Fuel pathway 2: DF LNG

Fuel oil → *Retrofit* →
- LNG
- Bio-LNG / e-LNG
- Bio-MGO / e-MGO

Fuel pathway 3: DF Methanol*

Fuel oil → *Retrofit* →
- Fuel oil
- Methanol

Fuel pathway 4&5: Onboard carbon capture

Fuel oil → *Retrofit* →
- Low cost OCCS
- High cost OCCS
- Fuel oil
- Bio-MGO / e-MGO

Low-cost onboard CCS

Capture rate – 70%

Fuel penalty – 15%

Offloading cost – 40 USD/ton CO2

High-cost onboard CCS

Capture rate – 70%

Fuel penalty – 30%

Offloading cost – 80 USD/ton CO2

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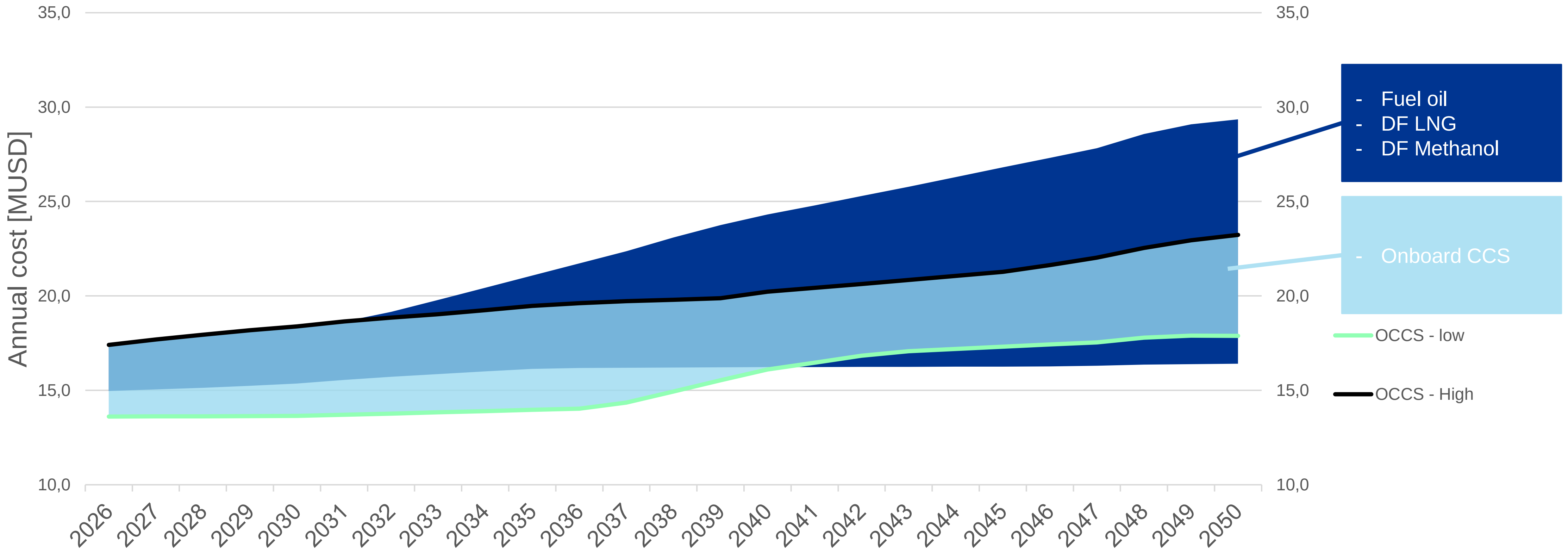
Range of Annual cost



The range of annual cost show that the low-cost onboard CCS scenario is competitive compared to the three other fuel pathways analysed in this study.

Discharge of the captured carbon and storage capacity

- For both onboard carbon capture scenarios where 70% of the carbon dioxide was captured annually, the amount of carbon dioxide captured is between 35 000 - 40 000 tonnes CO_2
- Due to fixed routes, the captured carbon can be frequently discharged to shore, less volume is needed for onboard storage.
- We have assumed that the captured carbon will be discharged once per day
  - Between 95 – 110 tons CO_2 per day
  - CO_2 storage tank capacity: 85 -100 m3 (liquid CO_2)

Thank you very much for you attention!

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