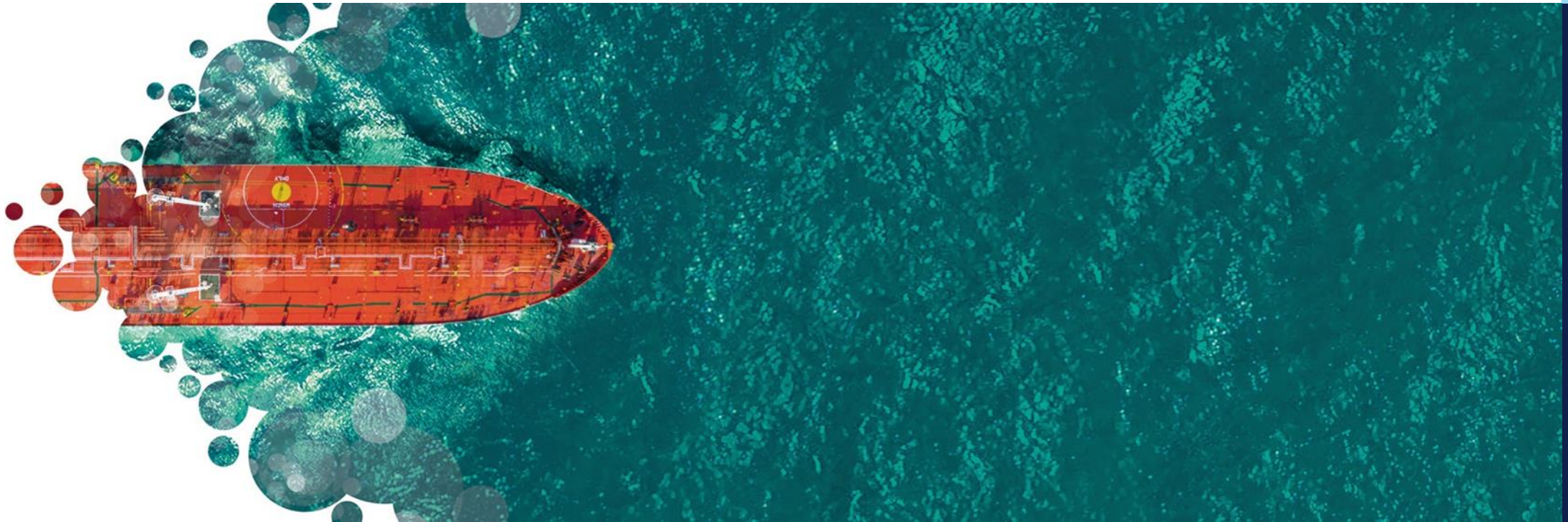
WHEN TRUST MATTERS

EKC 2022
Future compliance with decarbonization requirements

Jaeouk Sun

21 July 2022



Agenda

- **Decarbonization regulations and stakeholder outlook**
- **Road to IMO compliance**
- **Project examples regarding estimated impact of CII requirements on the bulk, tank and container fleet**



Regulatory and stakeholder outlook

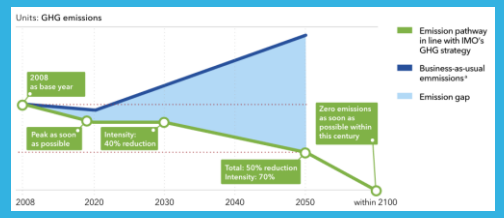
IMO has set their ambitions...

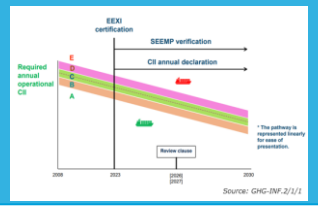
...however Financial Institutions, Cargo owners and Charters are increasing their influence...

Regulations

INTERNATIONAL MARITIME ORGANIZATION

Carbon ratings and design index







Banks assessments

POSEIDON PRINCIPLES

Some of the Signatories

BNP PARIBAS
The bank for a changing world

CRÉDIT AGRICOLE CORPORATE & INVESTMENT BANK

citi

CREDIT SUISSE

ING

SuMi TRUST
SUMITOMO MITSUI TRUST BANK

Nordea

DNB

Danske Bank

Charterers

SEA CARGO CHARTER

Some of the Signatories

TRAFIGURA

DOW

TOTAL

equinor

GUNVOR

LDC
Louis Dreyfus Company

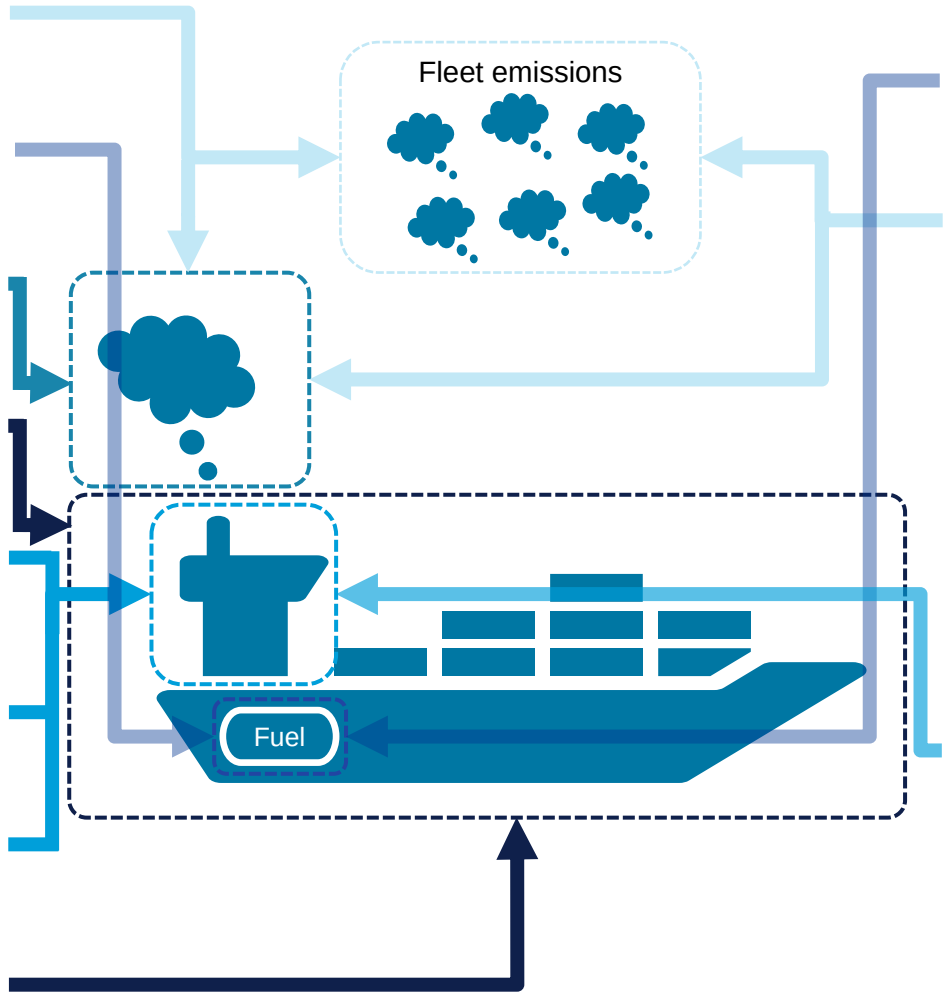
Cargill

AngloAmerican

DNV

The regulatory framework to reduce GHG emissions

CO_2 price	Market-based measure Sets a price on CO_2 emissions	TBD
GHG Fuel Standard	Operational requirement Well-to-wake fuel GHG intensity	TBD
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

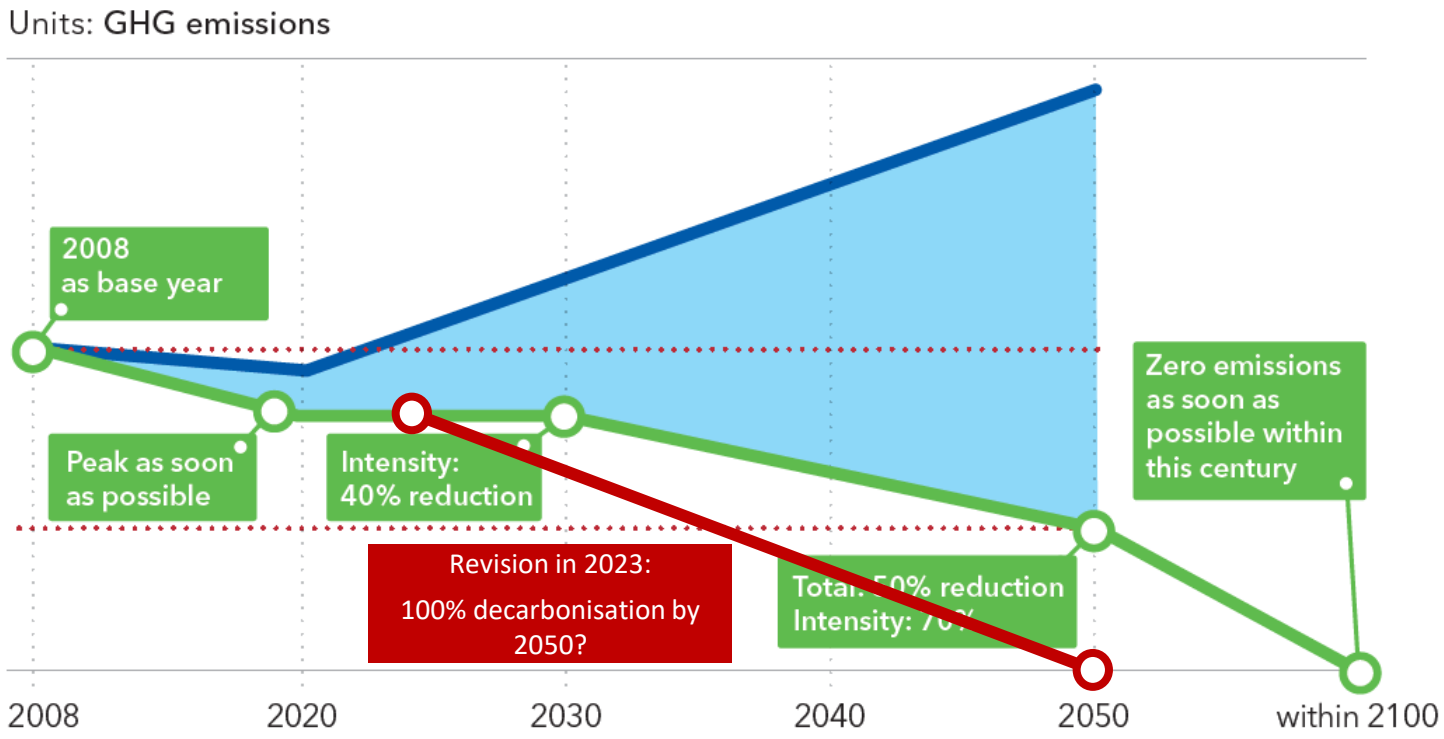


2025?	Operational requirement Well-to-wake fuel GHG intensity	**FuelEU Maritime**
2024?	Emission cap-and-trade Sets a price on CO_2 emissions	**EU ETS**
2018	Reporting of actual fuel consumption and CO2 emissions	**EU MRV**

EU regulations

DNV

IMO – Strategy on GHG reductions



Total: Refers to the absolute amount of GHG emissions from international shipping.
Intensity: Carbon dioxide (CO_2) emitted per tonne-mile.

Emission pathway in line with IMO's GHG strategy

Business-as-usual emissions[a]

Emission gap

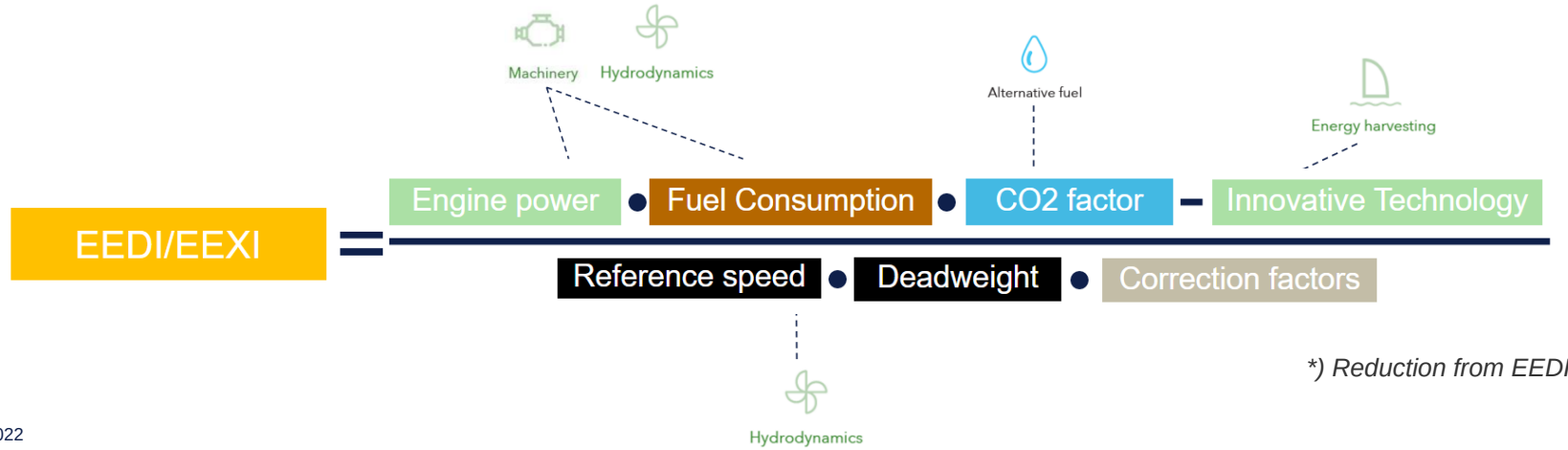
MEPC 78 outcome:

- Extensive exchange of views on the scheduled revision
- Decision point MEPC 80 (July 2023)

EEXI

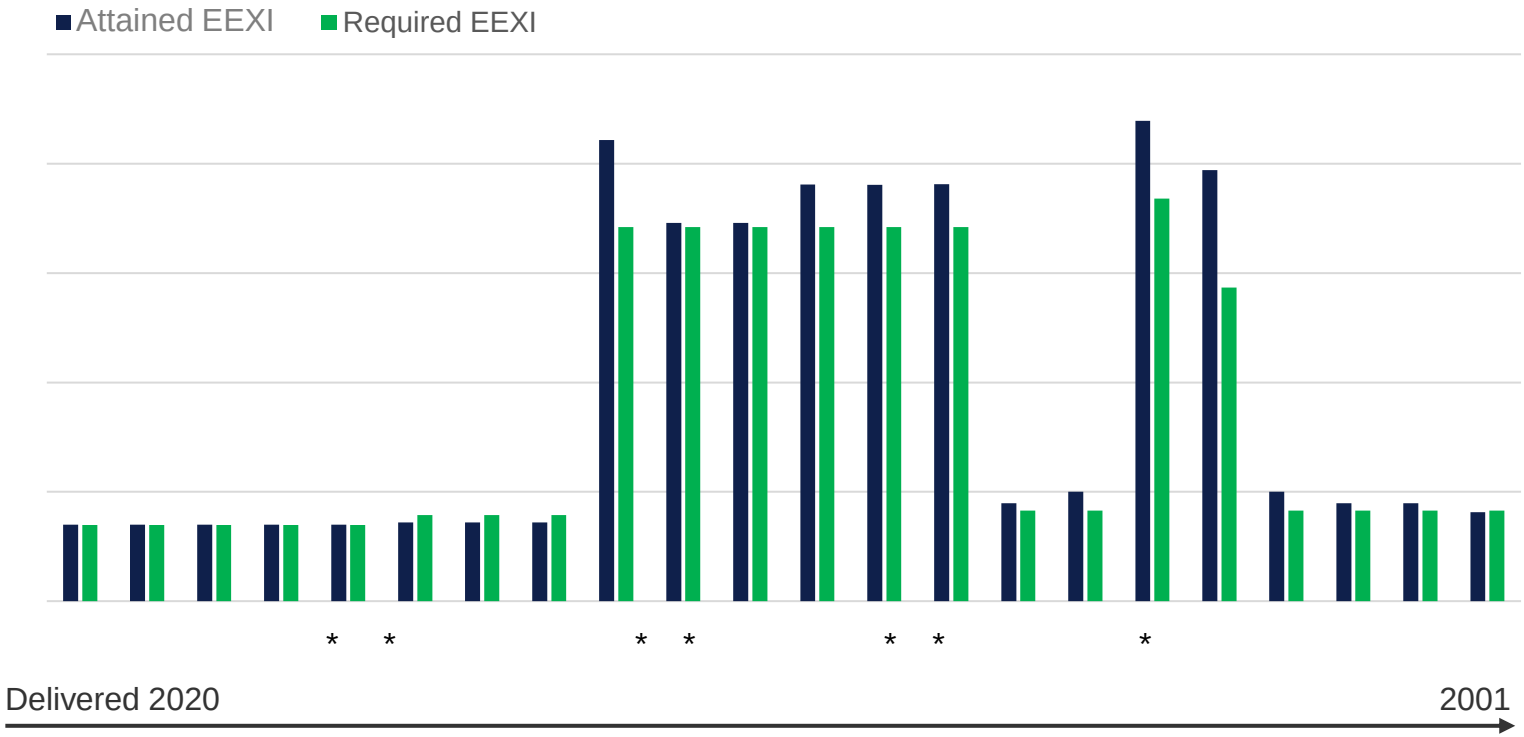
Energy Efficiency Existing Ship Index (EEXI)

- **Requirements:**
  - Attained EEXI to be calculated for ships above 400 GT
  - **Attained EEXI ≤ Required EEXI** for ships above segment specific size thresholds. Requirements similar to EEDI Phase 2/3, with some relief for a few ship types
  - Operators decide how to comply (Engine Power Limitation, fuel change, energy saving devices, retrofitting etc.)
- **Application:**
  - On first annual, intermediate or renewal IAPP survey or the initial IEE survey on or after 1 January 2023



*) Reduction from EEDI reference line

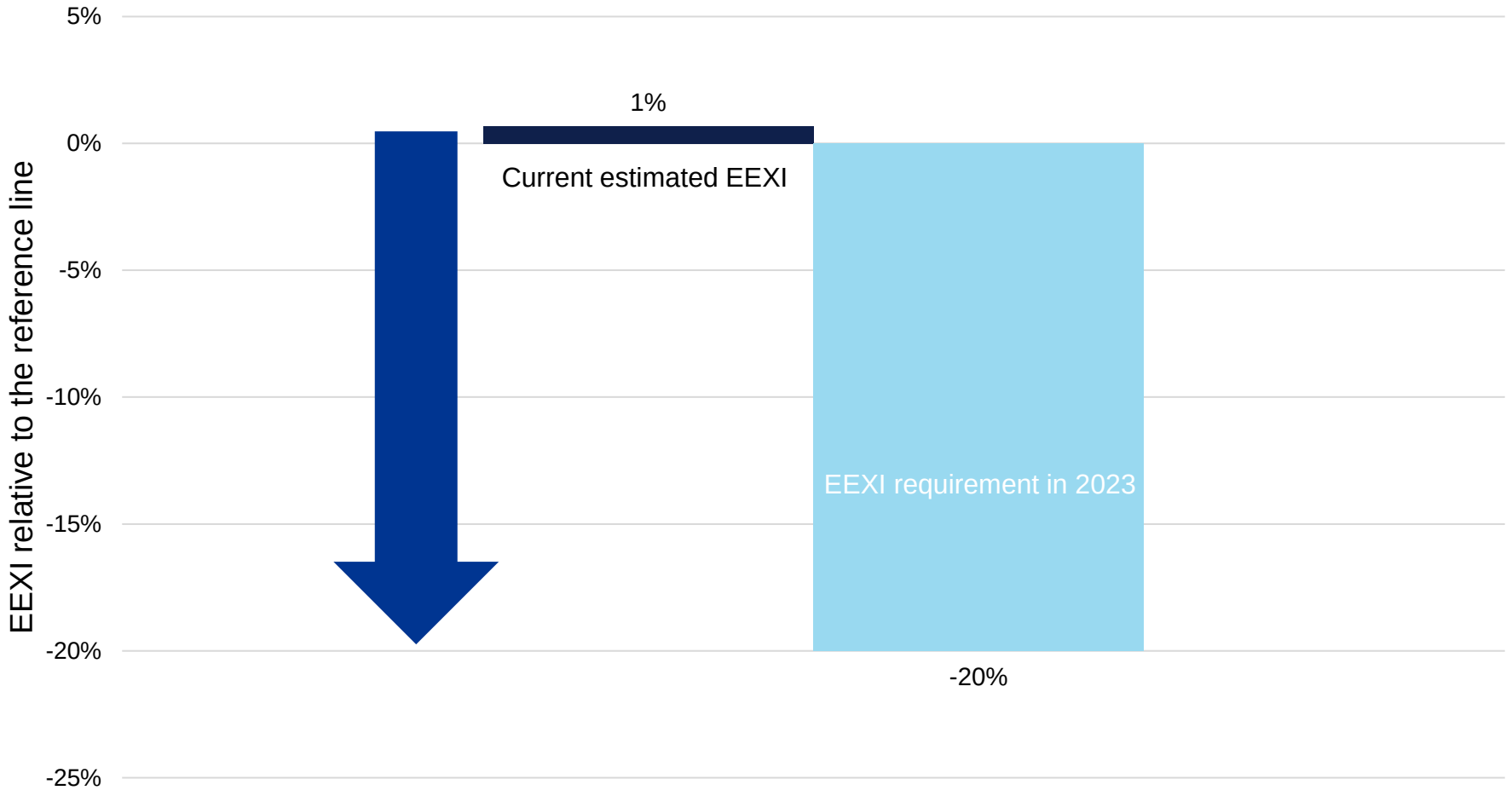
Estimated versus required EEXI values in 2023
Sample vessels from a GC and chemical tanker fleet



*) Ships scheduled for dry-dock in 2021/2022

DNV ©

EEXI – Single ship case - Example bulk carrier, built 2011

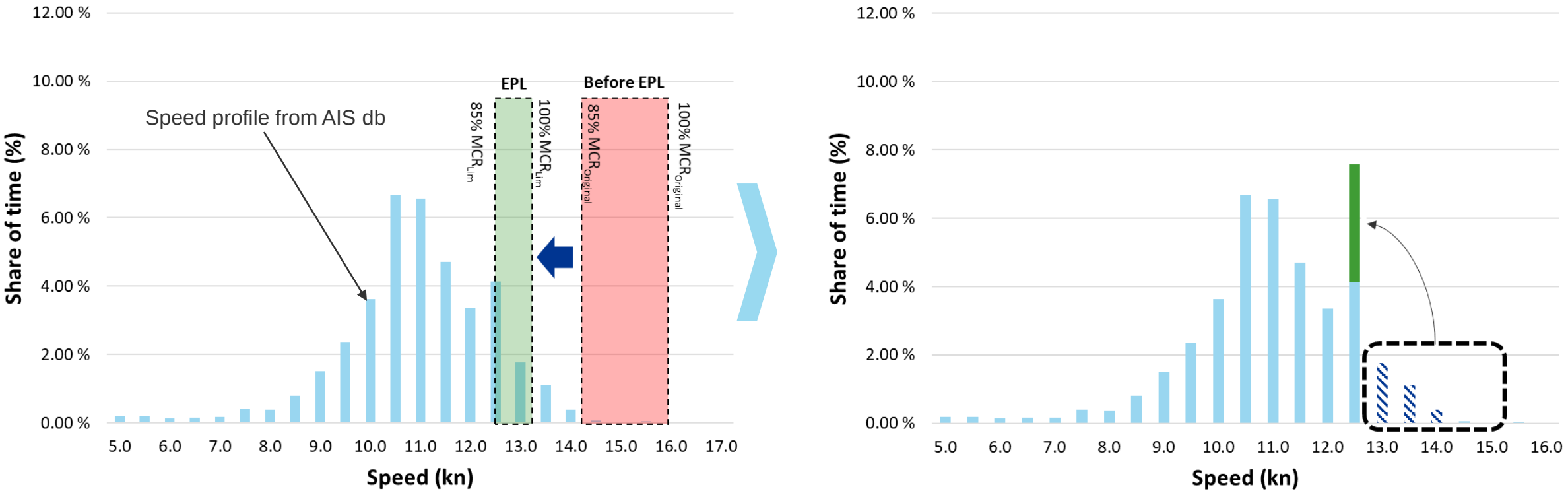


Initial MCR:
9,480 kW

EPL:
Approx.6,000 kW

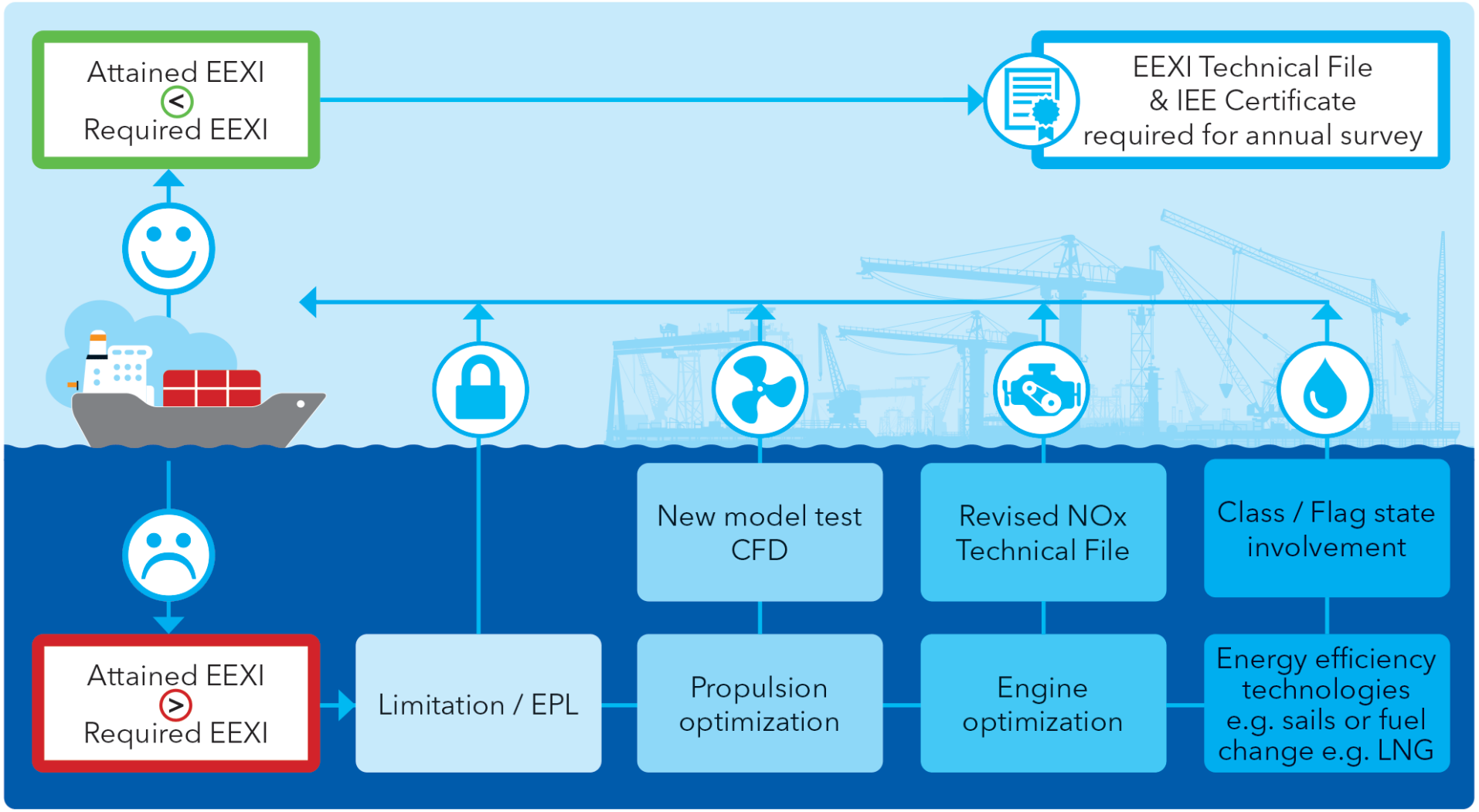
DNV ©

EEXI – Single ship case - Example bulk carrier, built 2011



Note: The presented results are based on high-level calculations. More detailed analysis is required to fully assess impact of EPL on commercial operations, including transit speed.

EEXI - Typical options and pathways to compliance



Key criteria

- **Cost of implementation**
- **Vessel age**
- **Docking schedule**
- **Speed loss**

DNV ©

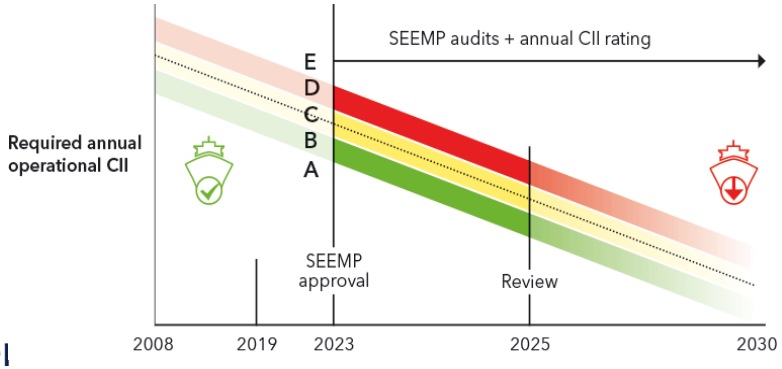
CII and enhanced SEEMP requirements

Carbon Intensity Indicator rating

- **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 to achieve rating C or better
  - Annual Statement of Compliance issued.

- **Other elements:**
  - **Review to be conducted by 1 January 2026 – particularly**:
    - Reduction factors for 2027-2030
    - Strengthened corrective actions
    - Need for enhancement of the enforcement mechanism
  - Carbon Intensity Code to be developed to ensure mandatory application



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 rating in a nutshell

IMO Status

Step 1: Calculate attained CII

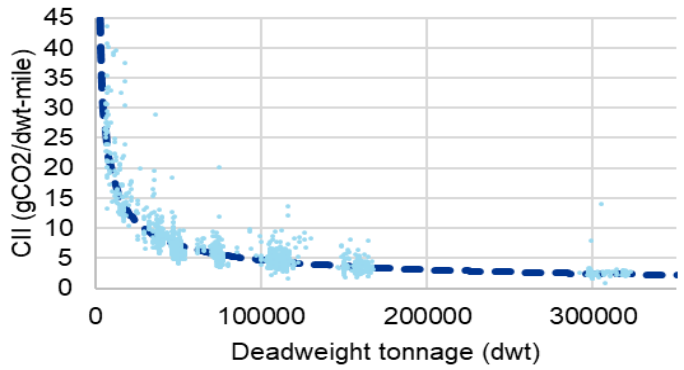
Calculation of annual CII:

$$\text{CII} = \frac{\text{Annual fuel consumption} \bullet \text{CO}_2\text{ factor}}{\text{Annual distance travelled} \bullet \text{Capacity}} \bullet \text{Correction factors}$$

To be developed

IMO Status

Step 2: Find reference CII based on ship type and size



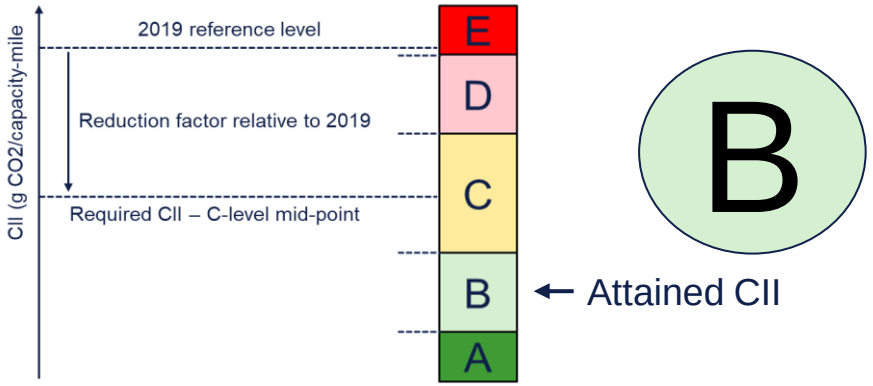
IMO Status

Step 3: Find required CII using reduction 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

IMO Status

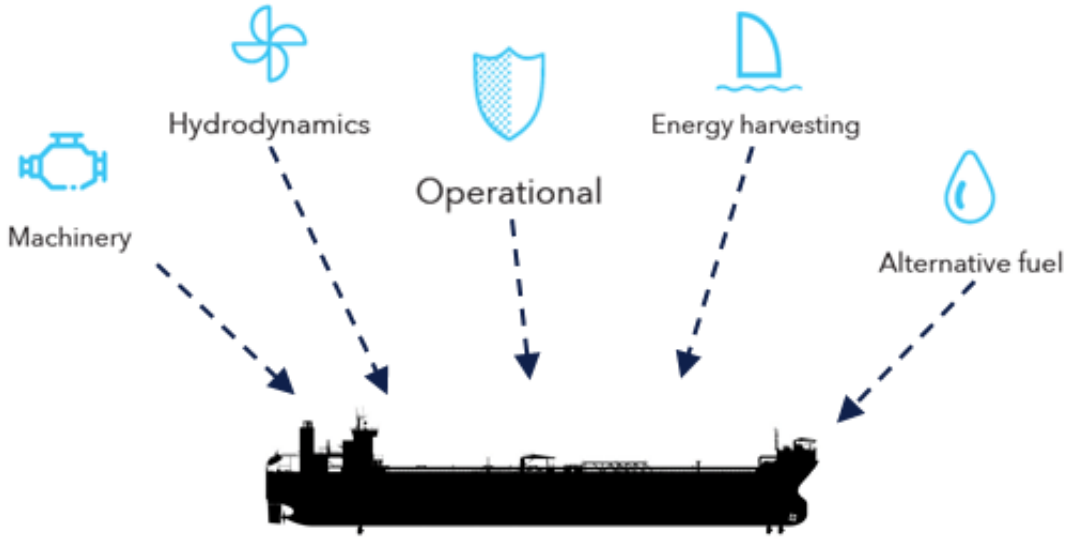
Step 4: Identify rating band width



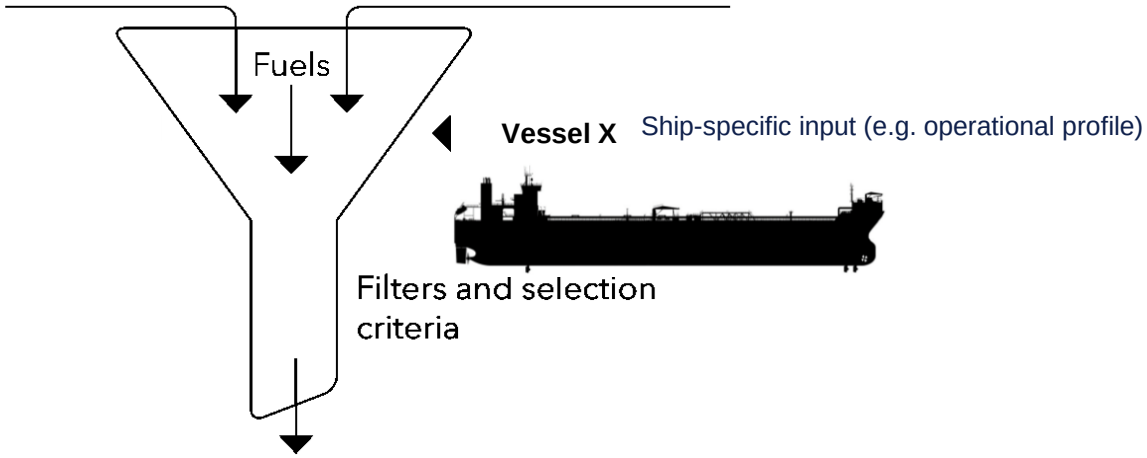
Scope: Cargo, ro-pax and cruise ships above 5000 GT

CII Improvement screening

Making a list of measures to improve CII



Screening of measures

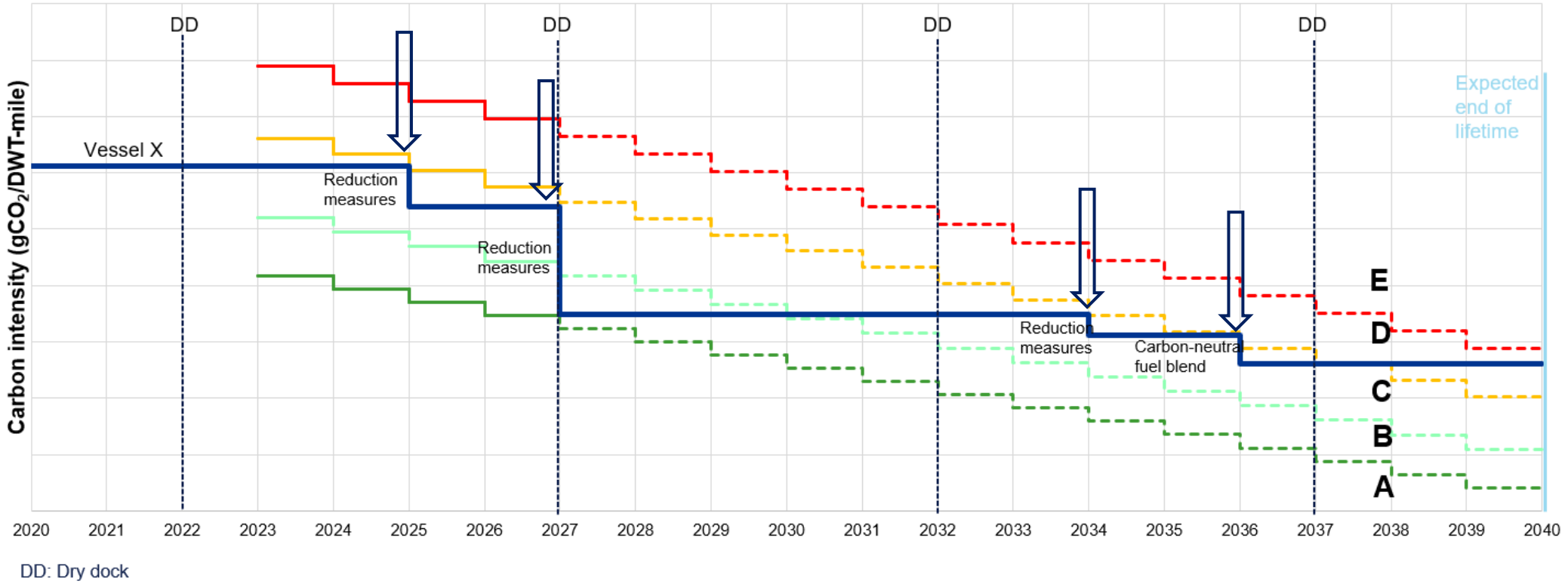


Cost-efficient measures for CO_2 reduction

Preparing and reviewing roadmap

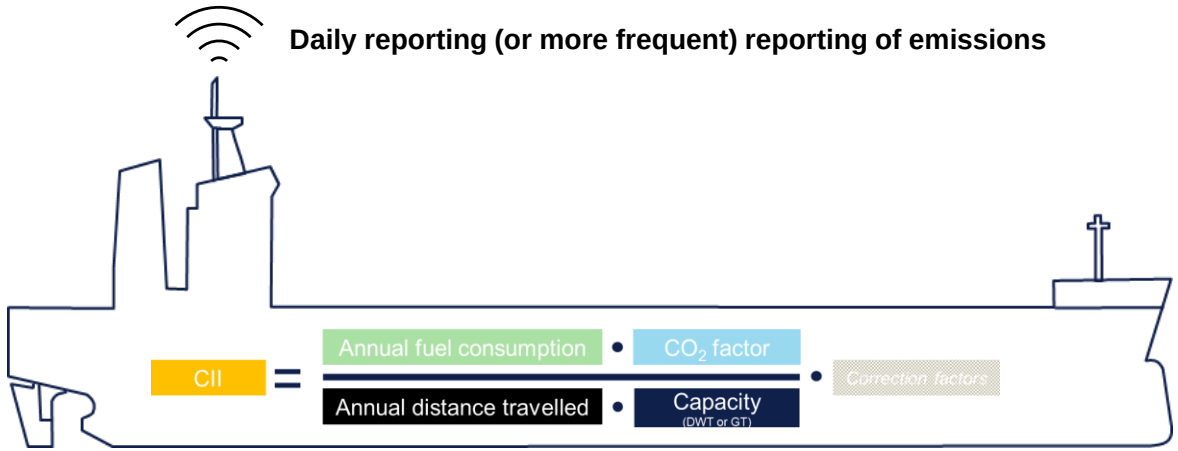
Ship-specific roadmaps is created containing measures and time of implementation needed to stay compliant with CII rating requirements.

Carbon intensity for example ship following a roadmap

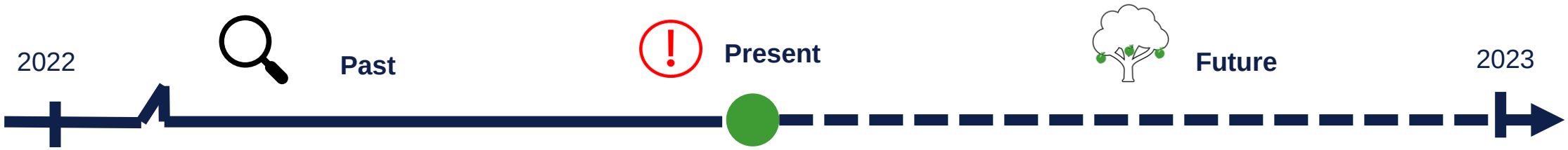


DD: Dry dock

Step 4 – Continuous monitoring and simulation of CII performance



Key operational and technical characteristics of the ship varies in time (e.g. Time in port, speed profile, hull condition, etc.)



Understanding and learning from the past

- ✓ Analytics, providing input to present and future

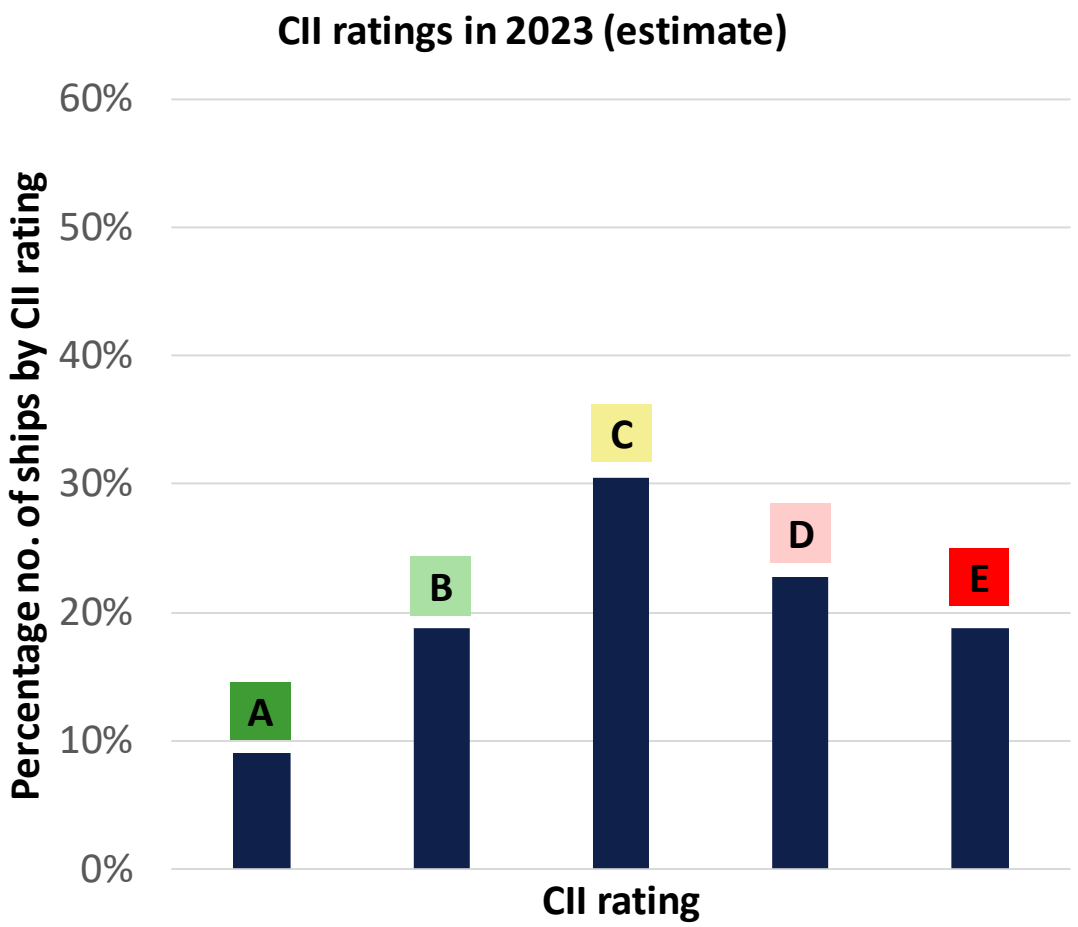
Provide early warnings

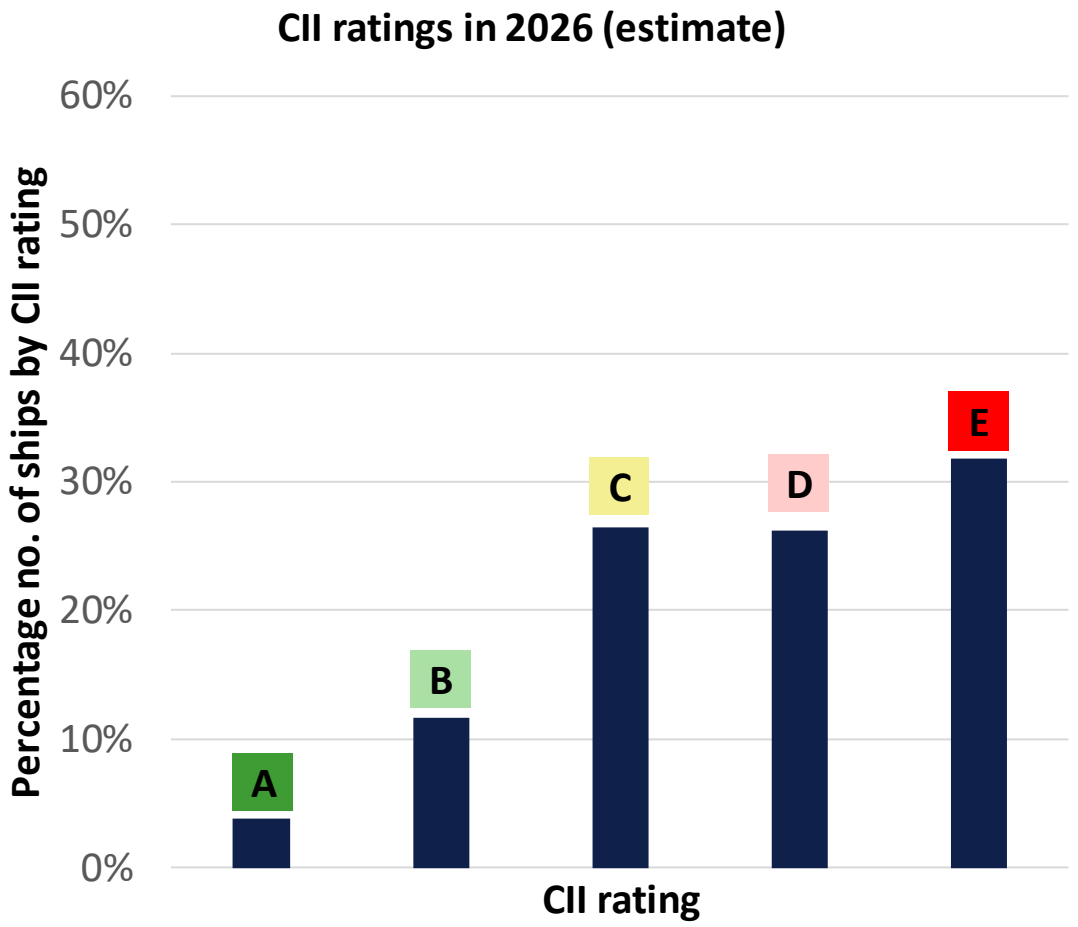
- ✓ Introducing corrective actions

Simulating future CII

- ✓ Business as usual (no actions)
- ✓ How to meet target CII (actions)
- ✓ Potential CII score (all actions)

Impact on the bulk carrier fleet





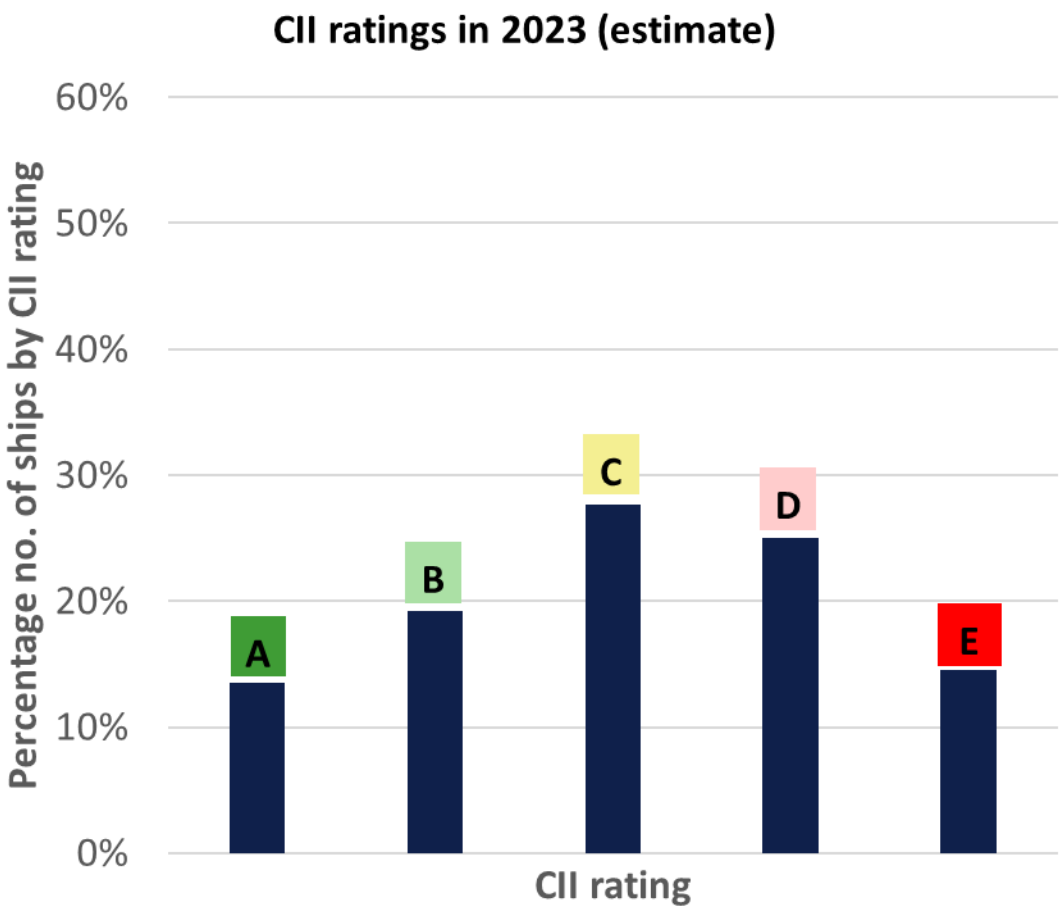
Data points: EU MRV data (2019)

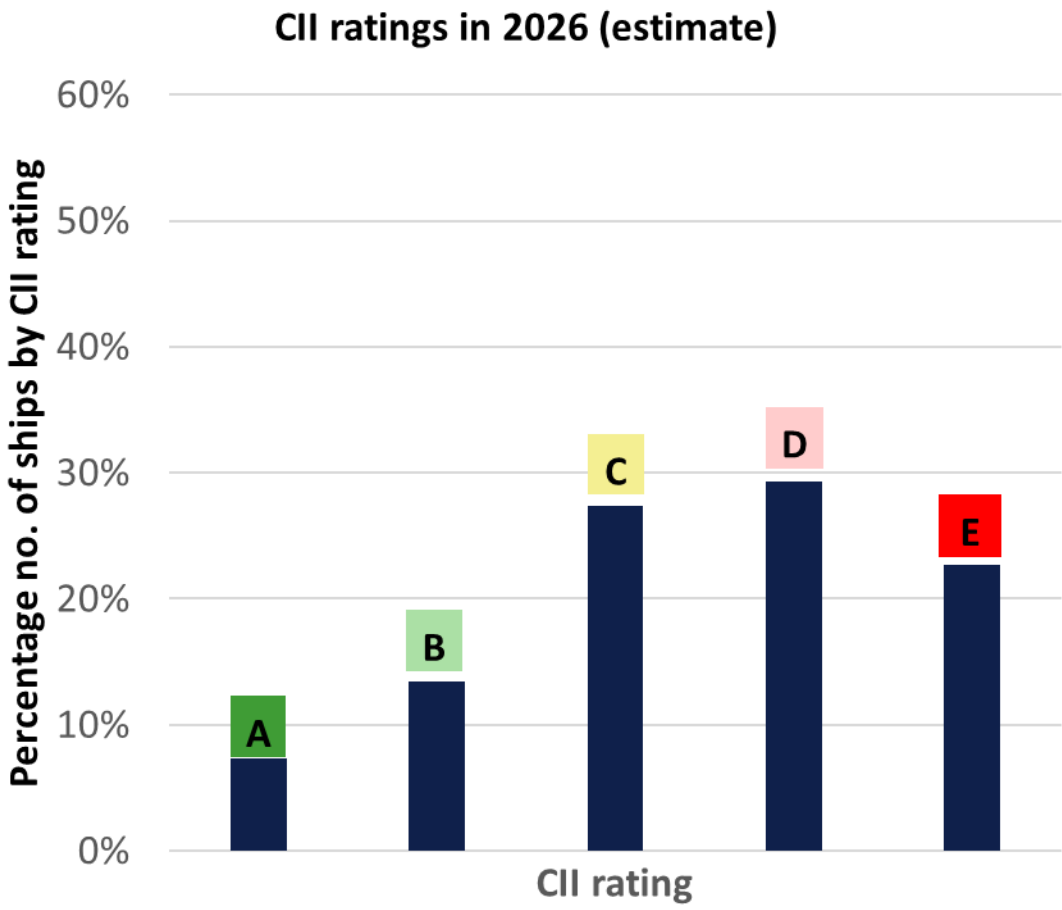
Reference line and rating boundaries: ISWG GHG 8/WP.1/Rev.1/Add.1

Reduction factors: MEPC 76/WP.4

Note: The above estimates are based on 2019 EU-MRV data. EU-MRV data only cover operational data for voyages from, to and between EU ports and in EU ports.

Impact on the tanker fleet





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Recent project examples

DNV

WHEN TRUST MATTERS



Green tankers towards 2050

HMD – HGS – DNV

HYUNDAI MIPO DOCKYARD

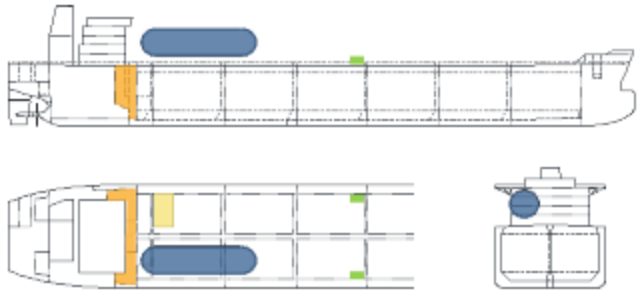
HYUNDAI GLOBAL SERVICE

Alternative designs

Baseline : 7th Generation of MR tanker

3. Alternative fuel (LNG D/F)

HYUNDAI MIPO DOCKYARD



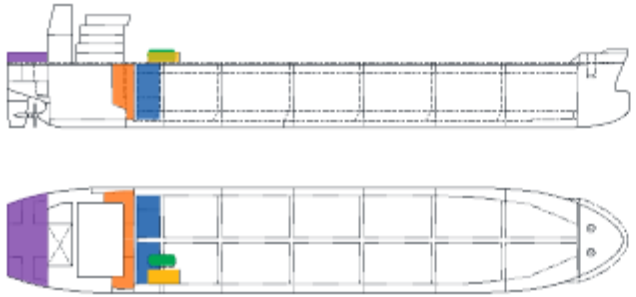
- **IMO Type C LNG fuel tank** (One(1) tank on deck, abt. 1,500 m³)
- **LNG bunker station**
- **F.G.S.S. room** (In front of Accomm. D/H)
- **Light fuel oil tanks**

ITEMS		UNIT	DUAL FUELED MR TANKER
Main Engine	Type	-	MAN B&W 6G50ME-C9.6-GI-HPSCR
	NMCR	(kW x rpm)	10,320 x 100.0
	MCR	(kW x rpm)	7,080 x 83.0
	NCR	(kW x rpm)	4,900 x 73.4
Speed (design draught, NCR, 15% S.M.)		(knots)	14.5
LNG capacity		(m³)	1,500
Cruising range (LNG/Diesel)		N.M.	13,900 / 23,300

6/ 16

3. Alternative fuel (Methanol D/F)

HYUNDAI MIPO DOCKYARD



- **Methanol fuel tanks** (Two (2) tanks in hold, abt. 2,360 m³)
- **Methanol fuel supply room** (In front of Accomm. D/H)
- **Methanol service tank** (In front of Accomm. D/H)
- **Light fuel oil tanks**
- **N_2 generator room** (on Aft.upper deck)
- **Cofferdam** (Between Slop tank and L.F.O.T)

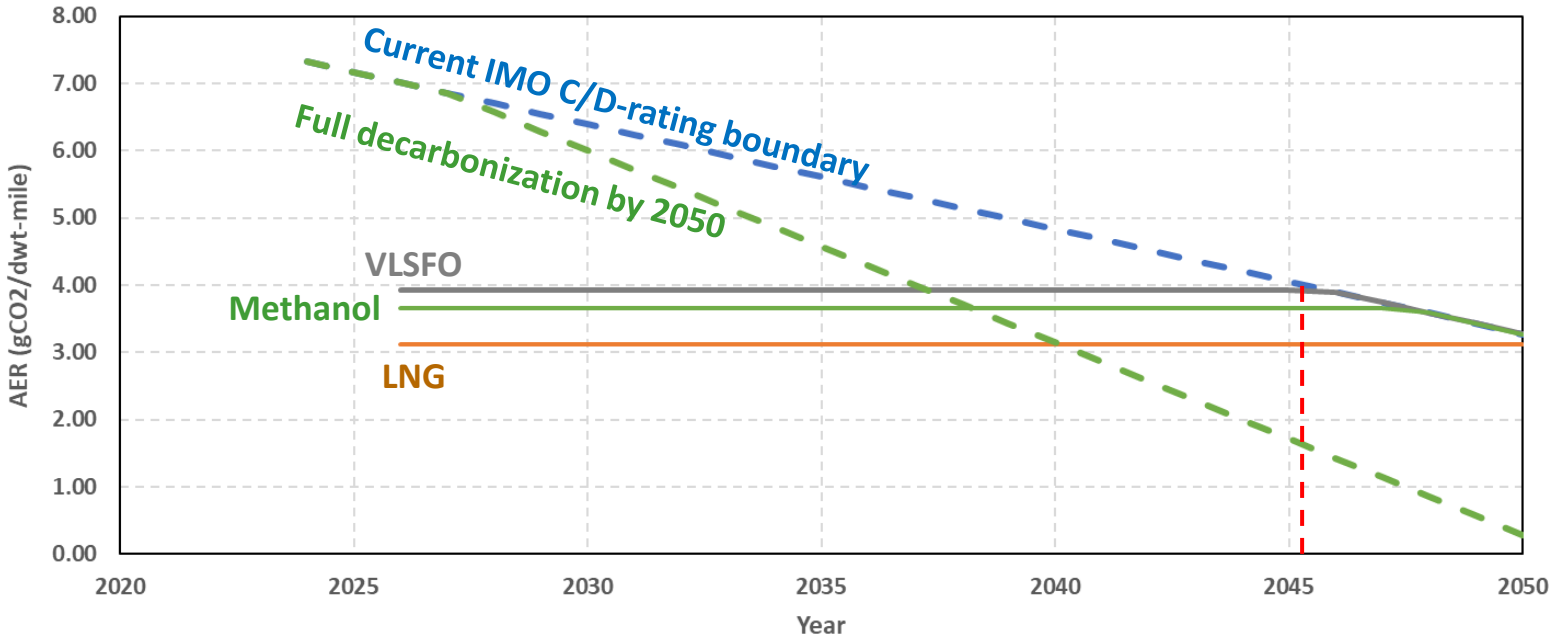
ITEMS		UNIT	DUAL FUELED MR TANKER
Main Engine	Type	-	MAN B&W 6G50ME-C9.6-LGIM-EGRBP
	NMCR	(kW x rpm)	10,320 x 100.0
	MCR	(kW x rpm)	7,080 x 83.0
	NCR	(kW x rpm)	4,900 x 73.4
Speed (design draught, NCR, 15% S.M.)		(knots)	14.5
Methanol capacity		(m³)	2,360
Cruising range (MeOH/Diesel)		N.M.	16,700 / 22,200

7/ 16

DNV

Greenhouse gas reduction trajectories

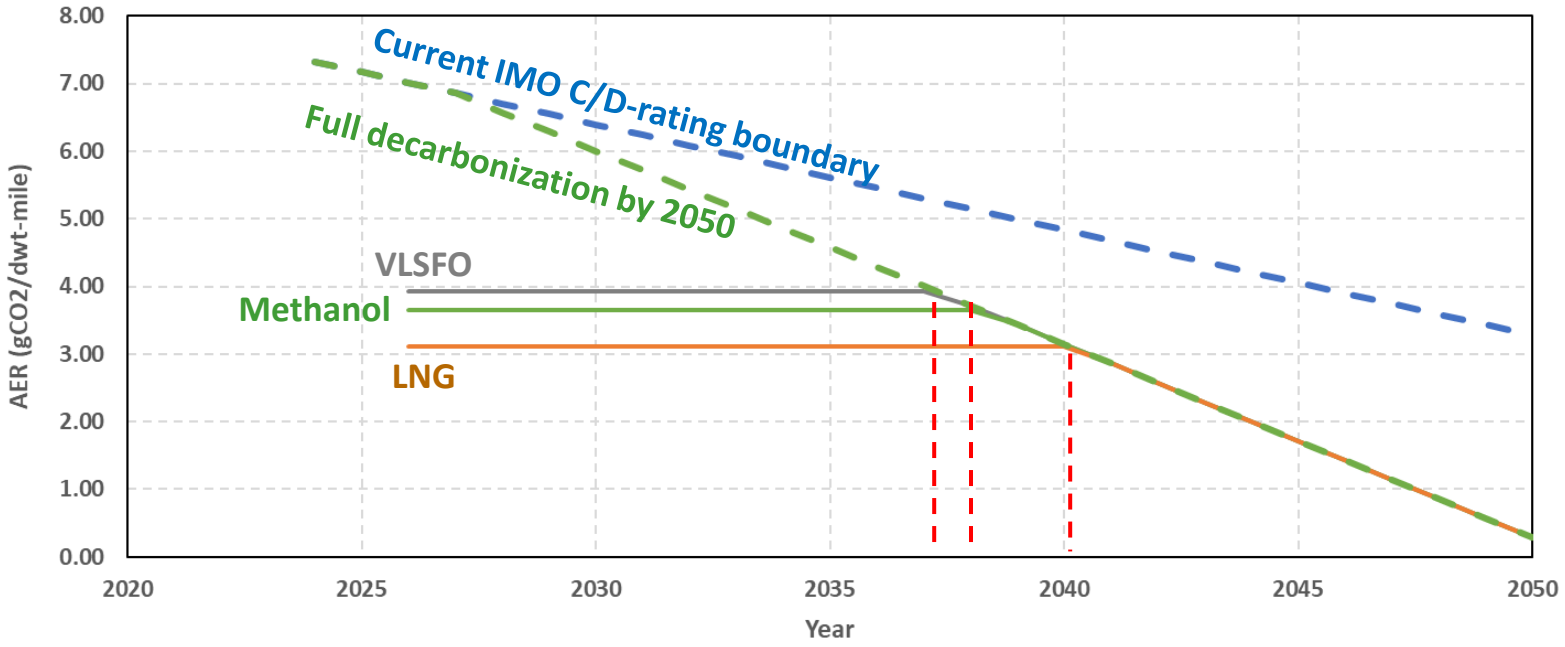
7th Generation HMD 50,000 DWT Tanker design



- Very efficient vessel design
- Under current IMO ambitions it can operate with:
  - VLSFO until 2045
  - LNG until 2050

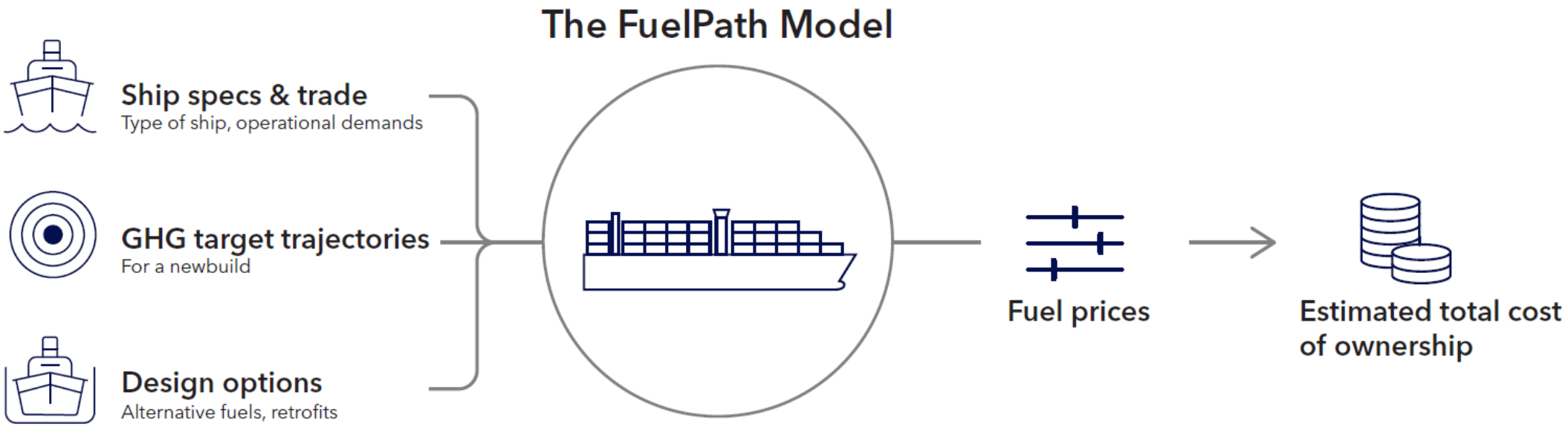
Greenhouse gas reduction trajectories

7th Generation HMD 50,000 DWT Tanker design



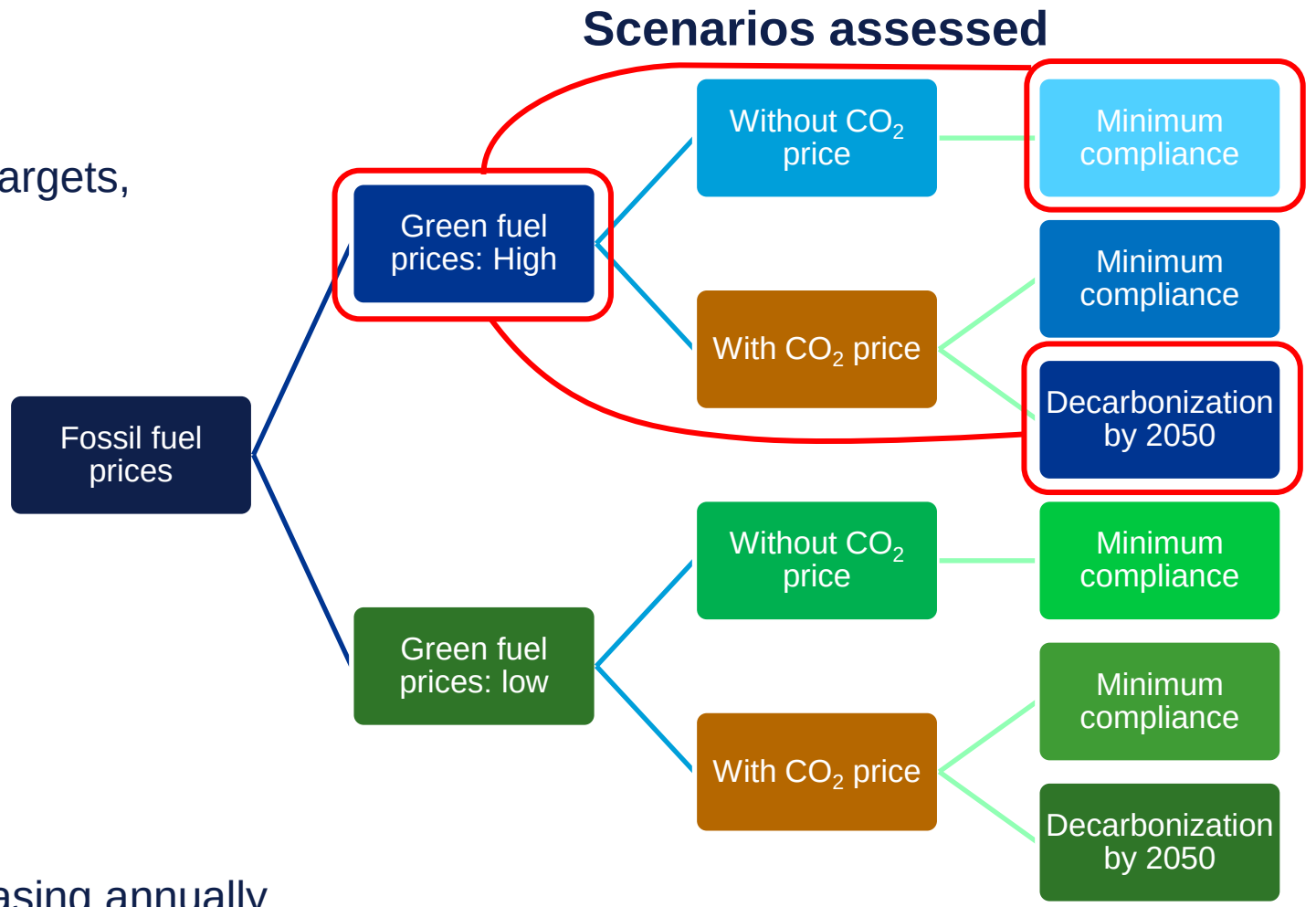
- Very efficient vessel design
- Under current IMO ambitions it can operate with:
  - VLSFO until 2045
  - LNG until 2050
- In a stricter, full decarbonization by 2050 scenario:
  - VLSFO until 2037
  - Methanol until 2038
  - LNG until 2040

Assessment of economic potential of fuel strategies

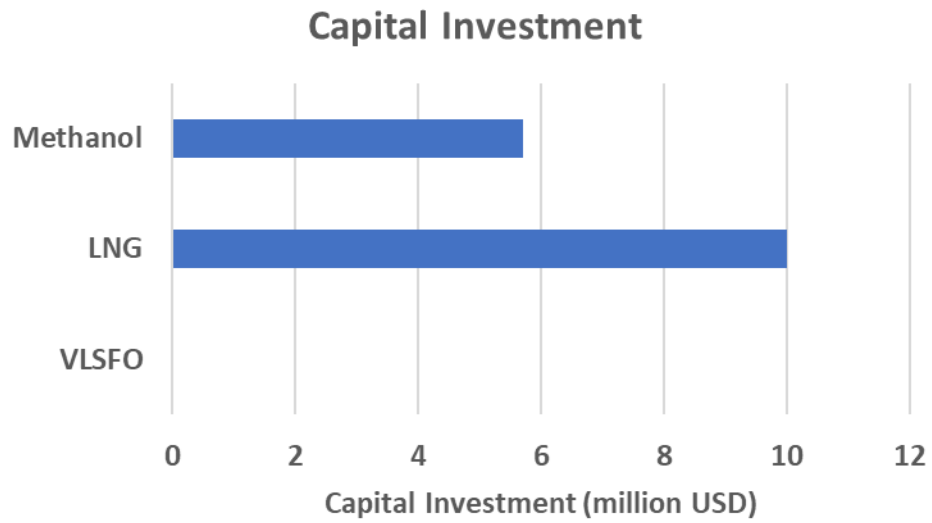


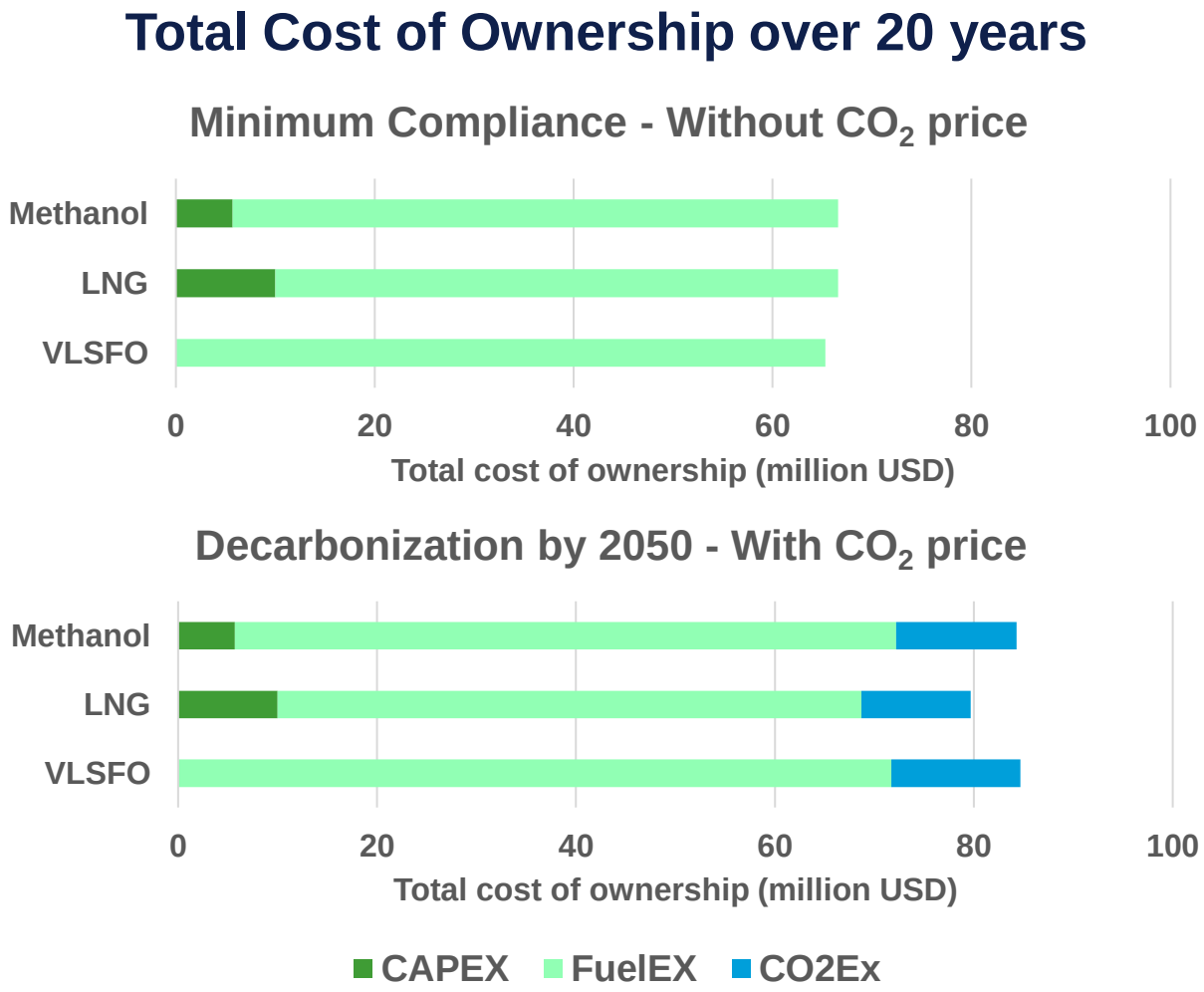
Fuel price and regulatory scenarios

- **Regulatory scenarios:**
  - Minimum compliance: Current IMO targets, transition from rating C to D
  - Full decarbonization by 2050
- **Fuel price scenarios**
  - High green fuel prices
  - Low green fuel prices
- **CO_2 prices**
  - Without CO_2 prices
  - With CO_2 price: 50 USD/tCO_2, increasing annually



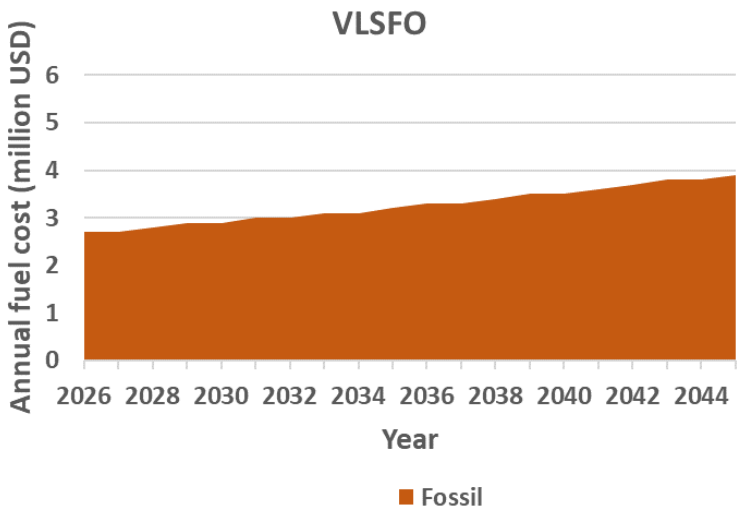
Cost of ownership

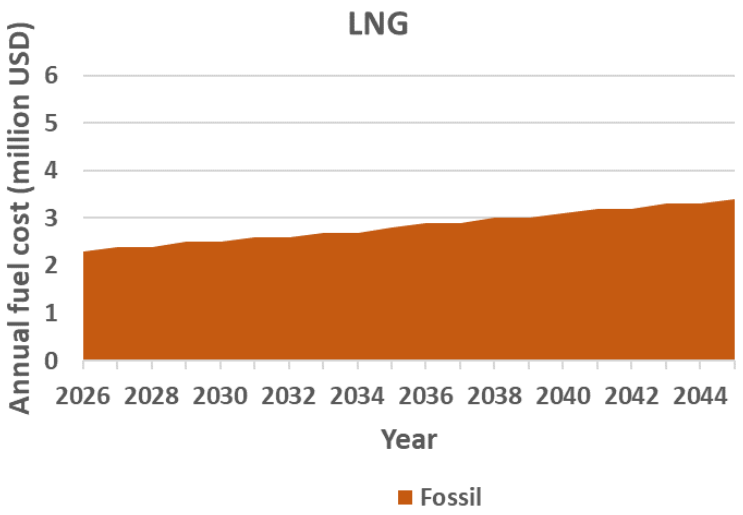


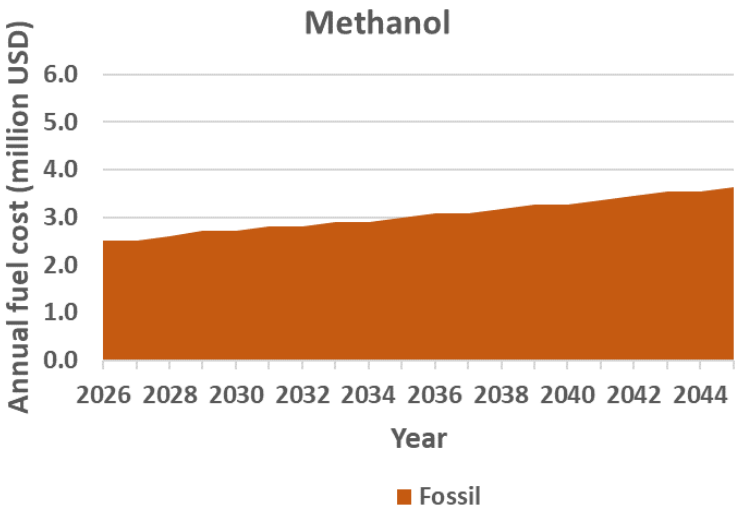


Impact of regulatory scenario on fuel selection & cost

Current IMO targets – Minimum requirements

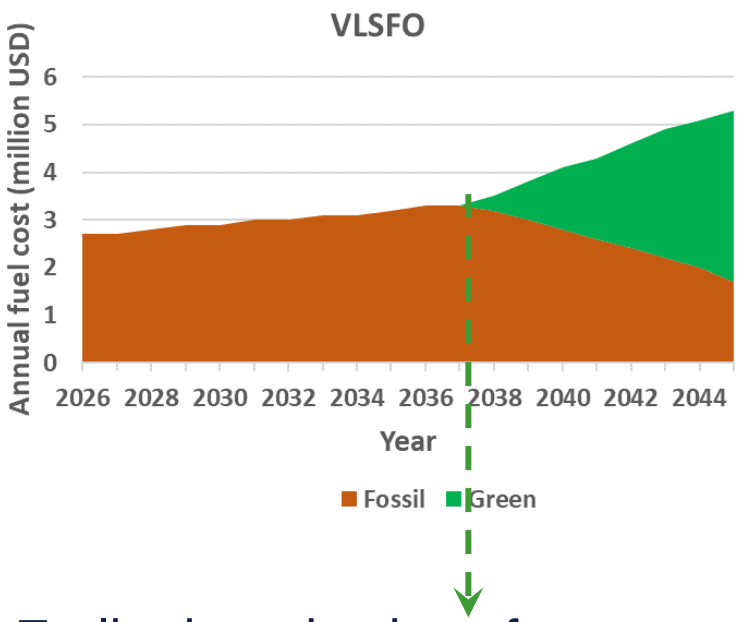


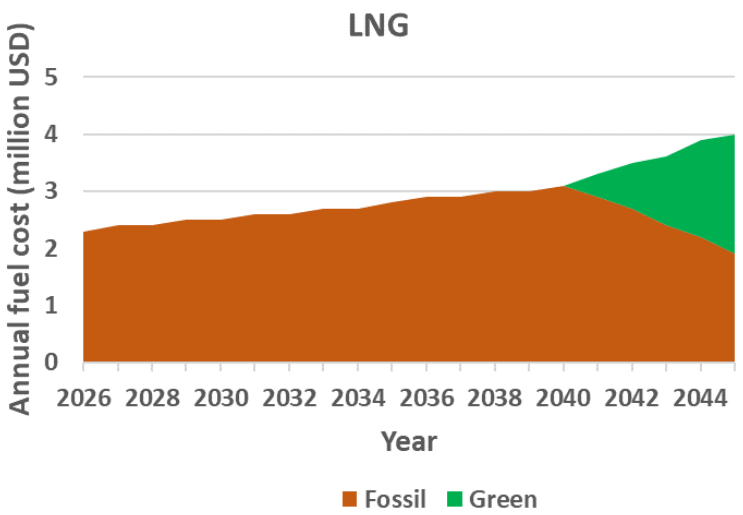


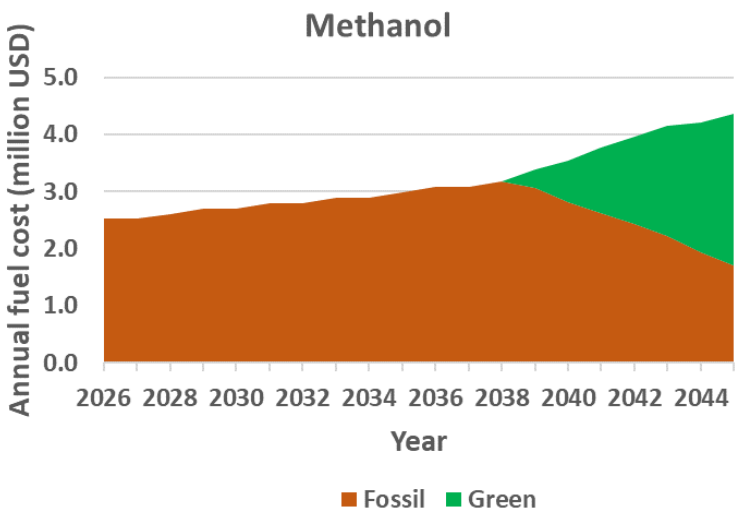


Impact of regulatory scenario on fuel selection & cost

Decarbonization by 2050







Earlier introduction of green fuels in conventional design

Key takeaways – Green MR Tanker design



Very efficient vessel design

- Can operate on VLSFO until early 2040s under current IMO ambitions
- LNG & Methanol offer flexibility in reducing annual fuel costs

Significant expected impact of Carbon Prices on fuel costs

IMO requirements can become stricter – LNG and methanol offer more options for compliance

Optimum solution will depend on area of operation, fuel availability and expected costs

감사합니다. Thank you

Jaeouk Sun

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