

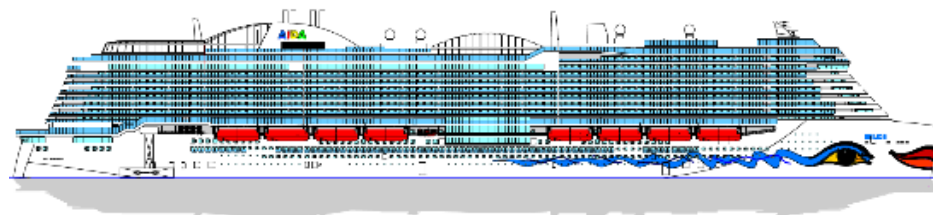
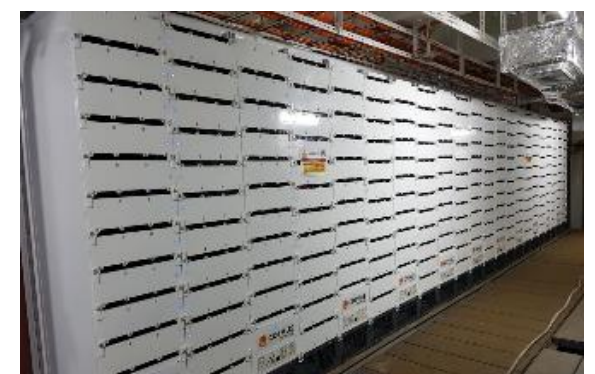


Andrea Cogliolo
Senior Director
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Innovazione tecnologica e
decarbonizzazione del settore
marittimo

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Where we are?



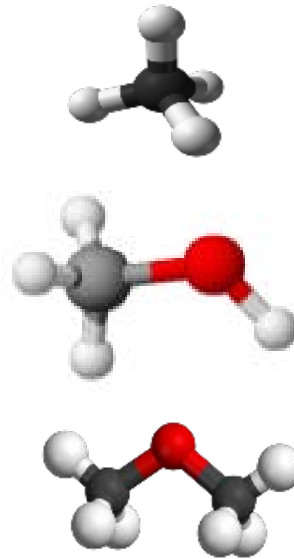
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Most Promising Fuels



Last decade 2010 - 20

- **LNG Liquefied Natural Gas**
- LPG Liquefied Petroleum Gas
- **Methanol**
- Ethanol
- DME Di-Methyl-Ether
- Synthetic Diesel (Gas To Liquid, Coal To Liquid)
- RME Raps-Methyl-Ether
- Bio oils



... in the future

- Low Flash Point Diesels
- **Bio Fuels**
- **Electric Stored Energy**
- **Diesel + H2**
- **LNG + H2**
- **NH3**
- **H2**
- **Nuclear**

Unconventional Fuels

Barriers to overcome



- Availability
- Safety
- Health Impact
- Environmental impact
- Technical issues
- Logistic chain
- Cost
- Rule requirement availability
- Social perception
- ...

The IMO approach

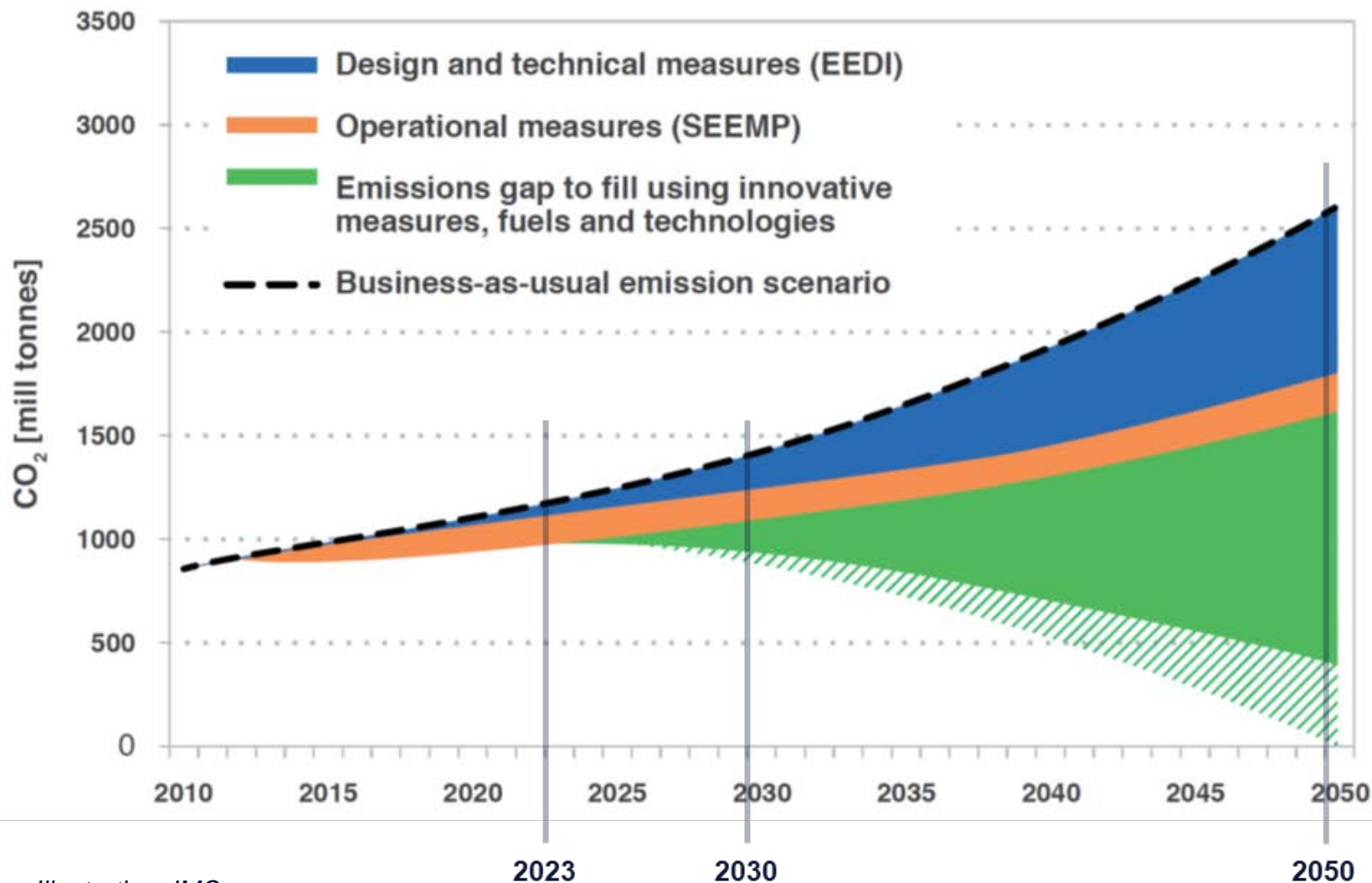
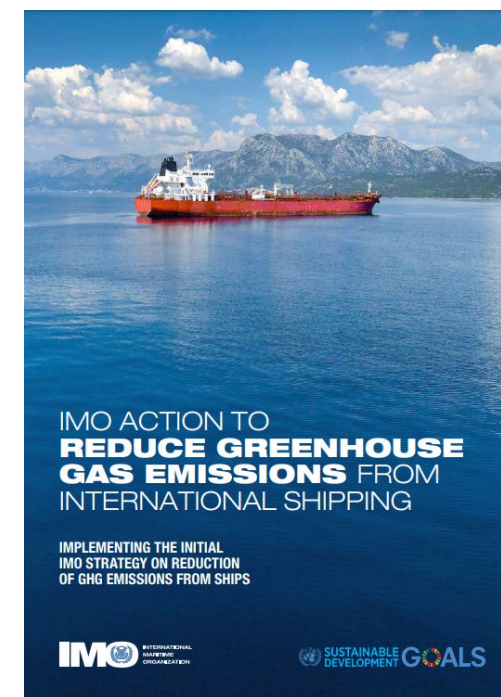


Illustration: IMO

Image: IMO



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The IMO approach



Nov. 2022 – Jan. 2023

Entry into force of MARPOL
Annex VI amendments

Technical Measures

Energy Efficiency Design Index (EEDI)
Energy Efficiency Existing Ship Index (EEXI)

Operational Measures

Carbon Intensity Indicator (CII)
New requirements for Ship Energy Efficiency Management Plan (SEEMP)

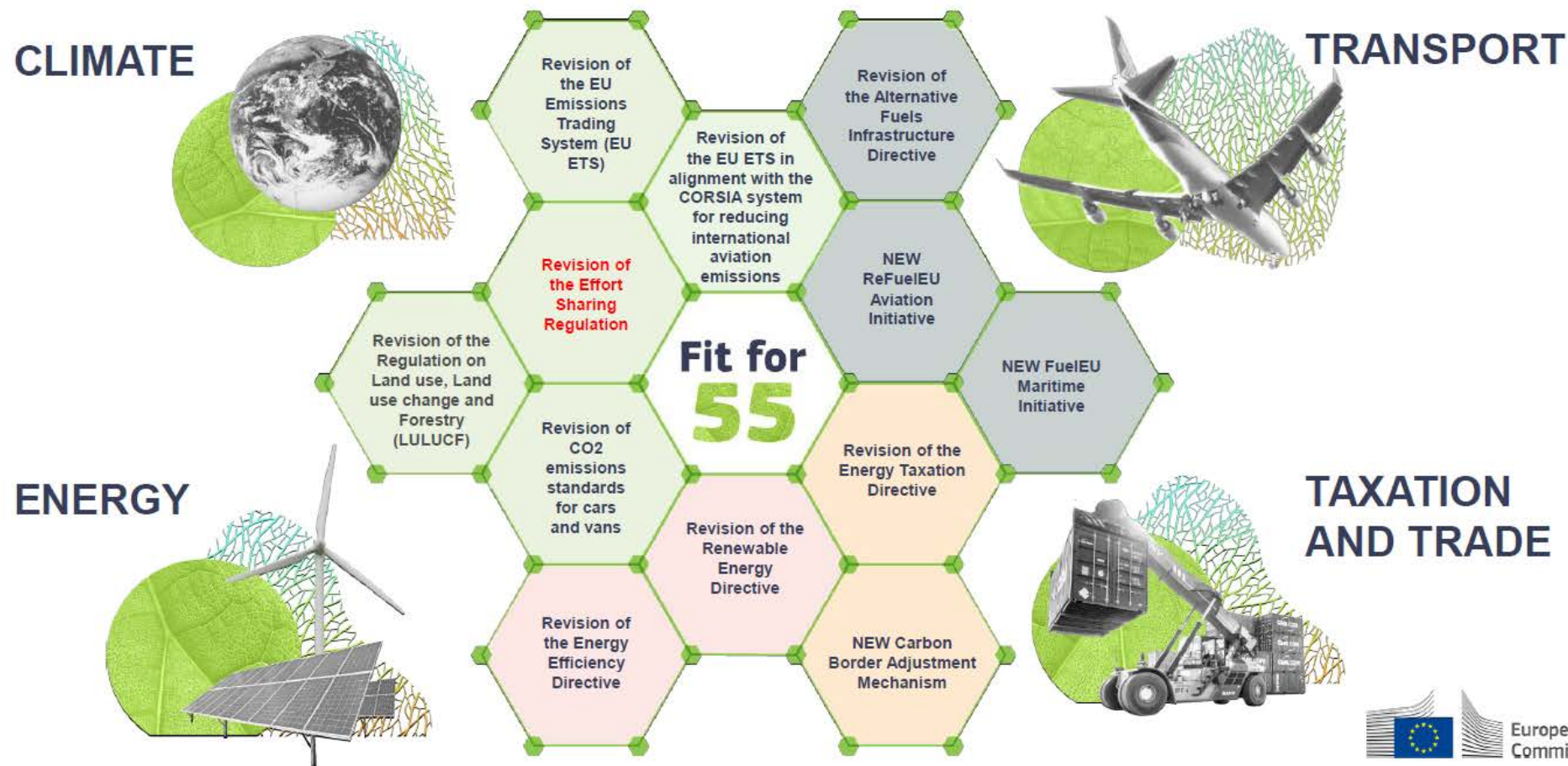


2030

40% carbon intensity reduction

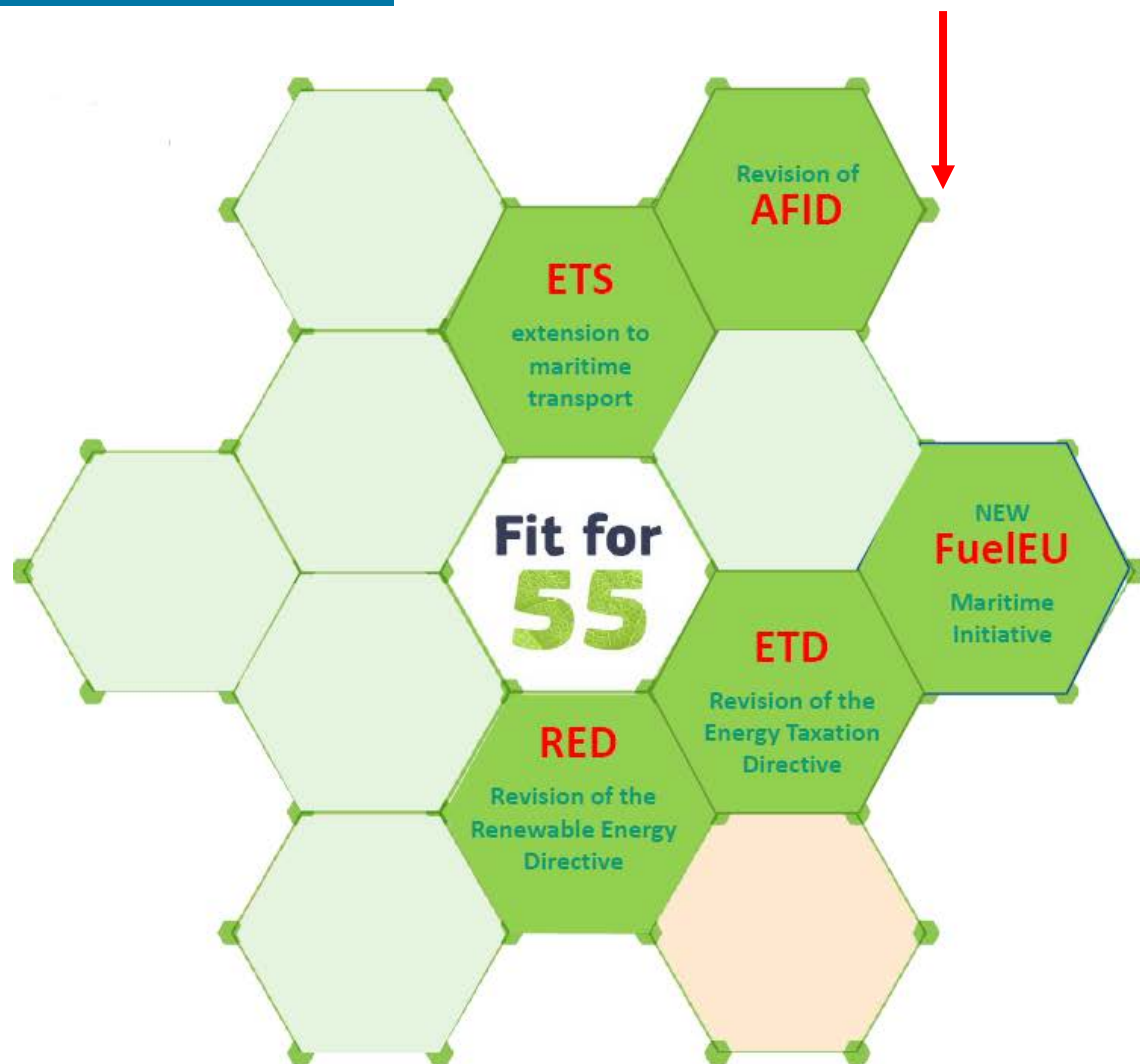
- EEDI framework for new ships in place since 2013.
- EEXI framework for existing ships in 2023.
- CII framework from 2023 onwards.

EU Fit for 55 Package



EU Fit for 55 Package

Maritime-related proposals



MARITIME

Draft ETS Directive



Requirements

- ❑ By 31 March of each year: Company shall submit to the responsible administering authority **the verified aggregated emissions data** (based on MRV Regulation) at Company level that covers the emissions in the reporting period
- ❑ By 30 April of each year: Company shall **surrender a number of allowances** equal to its total emissions
- ❑ **Phase-in period** of allowance surrendering
 - 20 % of verified emissions reported for 2023
 - 45 % of verified emissions reported for 2024
 - 70 % of verified emissions reported for 2025
 - 100 % of verified emissions reported for 2026 and after



Penalties

- ❑ Publication of the Companies names in breach of requirements to surrender sufficient allowances
- ❑ For each tonne of carbon dioxide equivalent emitted for which the Company has not surrendered allowances, the Company shall pay EUR 100.
- ❑ Expulsion orders can be issued against ships under the responsibility of a Company that has failed to surrender allowances for two or more consecutive reporting periods

Draft FUEL EU Maritime

Overview of EC Proposal



- ❑ Same scope as in ETS (ships above 5000 GT, intra-EU voyages, 50% extra-EU voyages, EU ports)
- ❑ **GHG intensity of the energy used on-board** – introduction of limits on the yearly average GHG intensity of energy used on-board (CO₂eq/MJ)



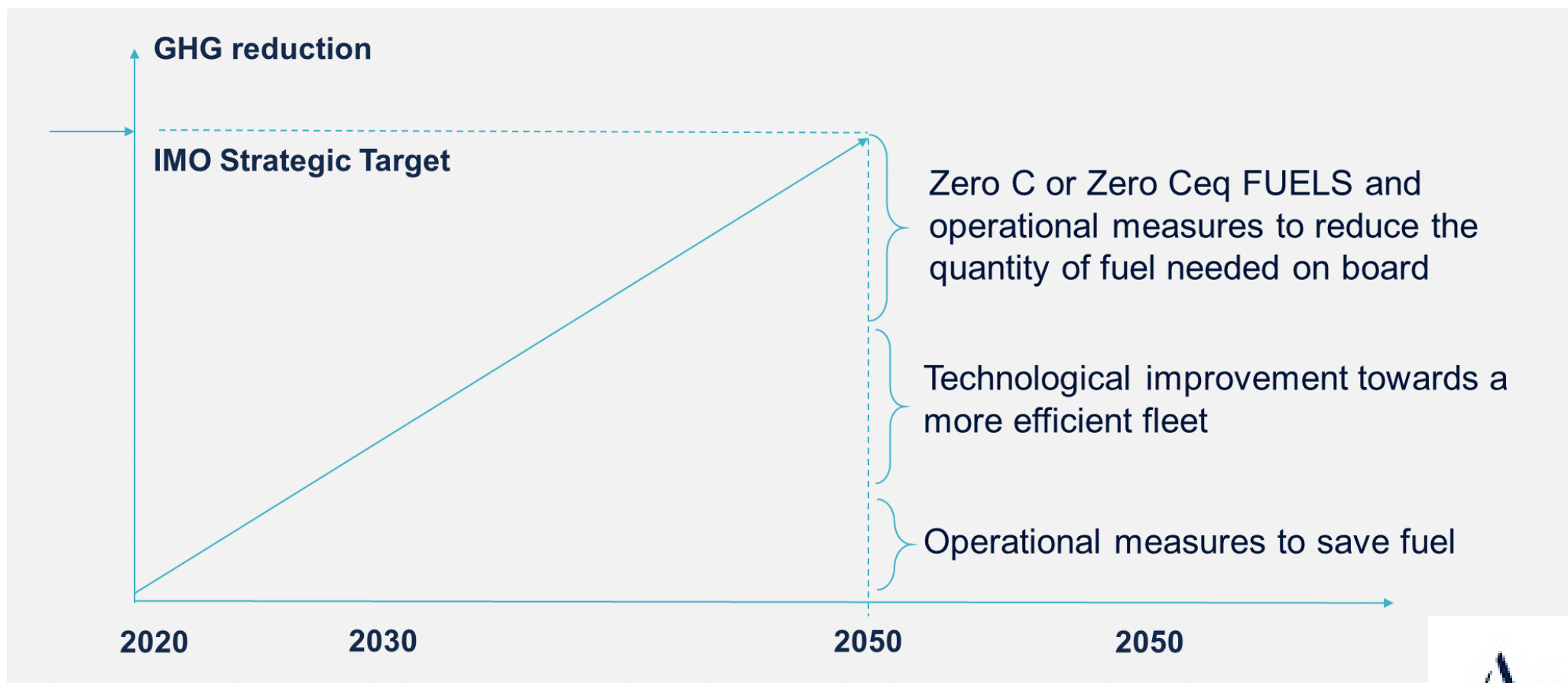
- ❑ Possibility of **banking and borrowing** of compliance surplus between reporting periods
- ❑ Possibility of **pooling** of compliance between two or more ships, even of different Companies but with the same verifier
- ❑ OPS or zero-emission technology compulsory as of 2030 for container ships and passenger ships
- ❑ **Penalties** in case of non-compliance
- ❑ **EU Fuel Certificate of Compliance** to be kept on board

Decarbonization = Alternative Fuels + ...?

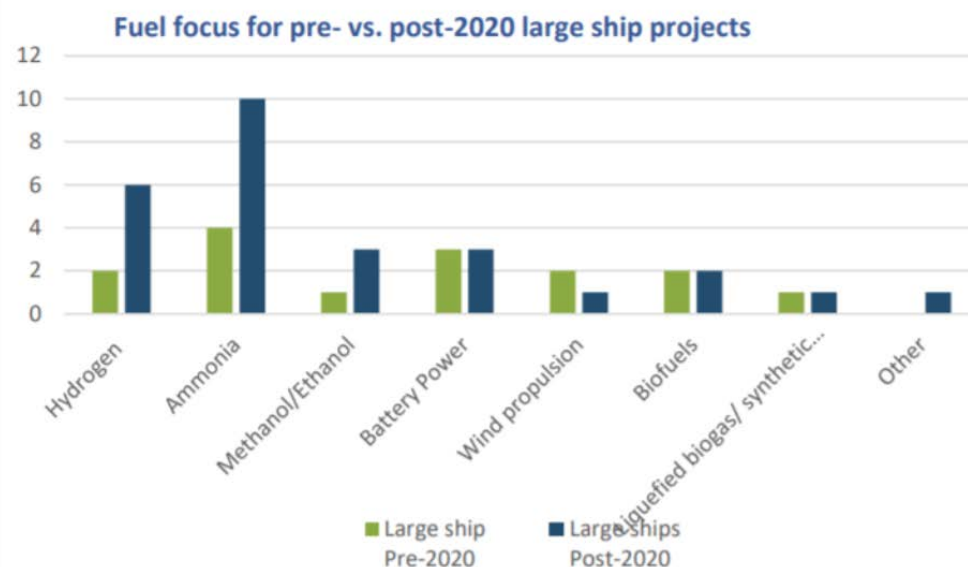


FUEL TYPE	Energy Density [MJ/kg]	Volumetric Energy Density [GJ/m ³]	Storage Pressure [bar]	Storage Temperature [°C]
Marine Gas Oil	42,8	36,6	Atm	Ambient
Liquid Methane	50.0	23.4	Atm	-162
Ethanol	26.7	21.1	Atm	Ambient
Methanol	19.9	15.8	Atm	Ambient
Liquid Ammonia	18.6	12.7	Atm up to 10	-34 or 20
Liquid Hydrogen	120.0	8.5	Atm	-253
Compressed Hydrogen	120.1	7.5	700	Ambient

Efficiency and Fuel Saving



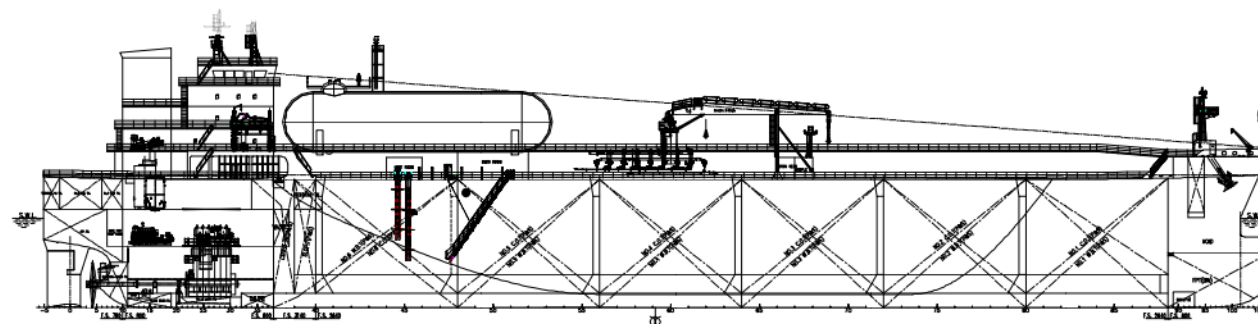
Ammonia as marine fuel



Source: Getting to zero coalition

SDARI BLUEWHALE 49

49,000DWT TANKER



R&D project: SDARI, RINA, MAN

Type: MR Tanker - Methanol and Ammonia versions

Size: 49.000 DWT

Special Feature: Option 1 - Methanol Engines

Option 2 - Ammonia Engines

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Ammonia as marine fuel



Cooperation Agreement China Merchant - CCS on New Marine Energy Technologies

Extensive cooperation on new energy technology with joint research aiming to increase the understanding of hydrogen & ammonia application for the marine sector.

Joint Development Project SeaTech – F.lli Cosulich Bunkers

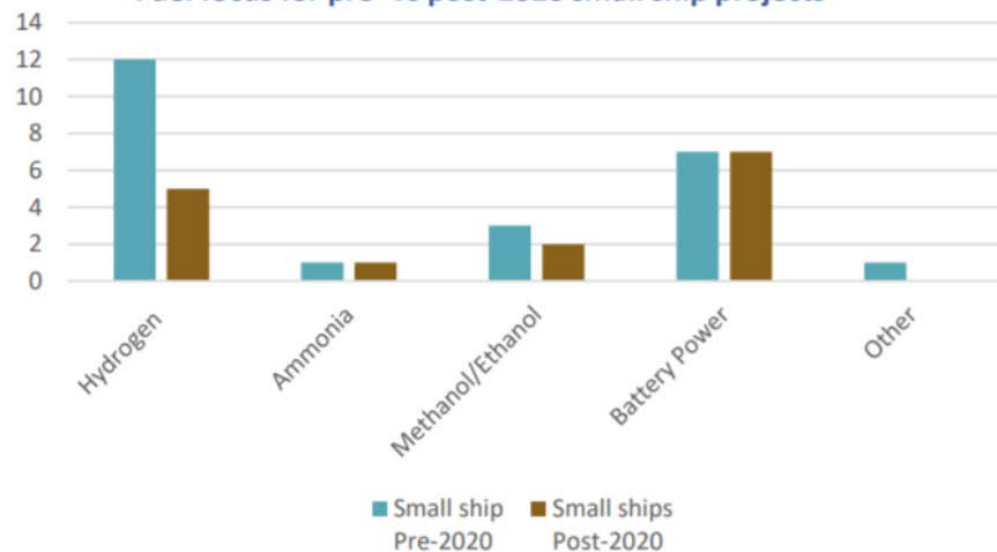
Approval in Principle of an ammonia bunker tanker



Hydrogen as marine fuel



Fuel focus for pre- vs post-2020 small ship projects



Source: Getting to zero coalition



Research ship - Zeus - FINCANTIERI – Under Construction

Experimental ship for Hydrogen Cyl & Fuel Cells testing.

Fuel Cell up to 120 kW,
Lithium Batt. up to 130 kW,
Stored H₂ up to 50 kg – Metal Hydride storage

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SOME EXPERIENCE on BIOFUELS



Joint Industry Project with d'Amico Shipowner to test Biofuel from 2° Generation Feedstock



TARGETS

- Evaluation of the possible reduction of CO₂ emissions
- Lifecycle strategy using the WTW analysis
- Behavior of engines and boiler
- Stability and degradation of the biofuel in relation to the storage time
- NOx emissions
- Effects on EEXI and CII



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