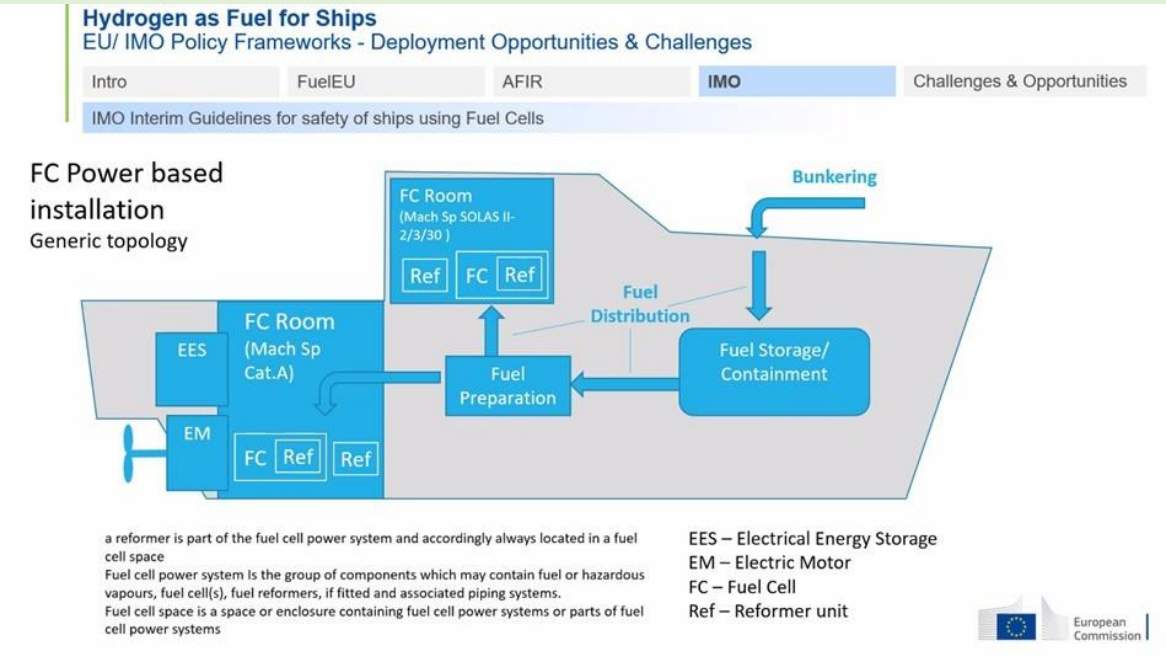
Hydrogen as a fuel for Ships | EU, IMO policy frameworks

Brussels and discussion around the maritime sector.

Key participants from the European Union and the UN backed International Maritime Operation.

The community may find curated takeaways of interest.




"Hydrogen as Maritime Fuel: Defining New Guidelines a Sustainable Future"
CEN-CENELEC Management Centre, Brussels
Clean Hydrogen Partnership
e-SHIPS
ON THE WAVE OF HYDROGEN
The e-SHyIPS project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under grant agreement No 101007226. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation programme, Hydrogen Europe and Hydrogen Europe research.

Hydrogen as Fuel for Ships
EU/ IMO Policy Frameworks - Deployment Opportunities & Challenges

Intro	FuelEU	AFIR	IMO	Challenges & Opportunities

Regulatory Development framework

- Interim **Guidelines for safety of ships using fuel cells** (MSC.1/Circ.1647 15 June 2022)
- Interim **Guidelines for safety of ships using Hydrogen** as fuel (under development)
- EEDI
- Carbon Intensity Index (CII) and EEXI – from 2023
- Life Cycle Analysis Guidelines - **RESOLUTION MEPC.376(80)**
- Low GHG Fuel Standard – **LGFS** (under discussion at IMO)

- **FuelEU** regulation proposal – promotion of renewable and low-carbon fuels in the maritime sector
- **ETS** extension to maritime sector.
- **AFIR** – Alternative Fuels Infrastructure Regulations (standardization mandate – hydrogen bunkering)
- **RED revision (REDIII)** - renewable hydrogen/ RFNBO certification provisions

European Commission | Mobility and Transport

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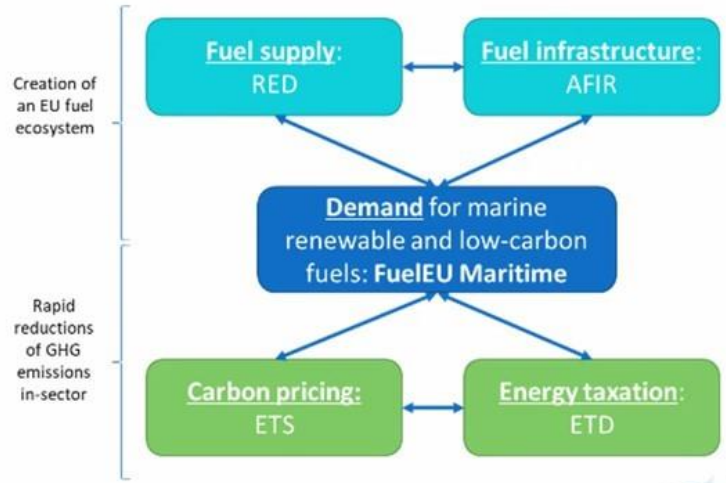
Fitfor55



European Commission | Mobility and Transport

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Proposed approach

- Focus on **fuel** and on **demand – promotion of uptake of renewable and low-carbon fuels** for maritime transport – complement to Energy Efficiency
- **Technology-neutral approach:** maritime operators will need to use an increasing proportion of zero and low carbon sustainable fuels, without obligation to use a specific technology
- **Establishes** target reduction % for the yearly average GHG intensity of the energy used on-board **(gCO2eq/MJ)**

2025	2030	2035	2040	2045	2050
-2%	-6%	-14,5%	-31%	-62%	-80%

- **Exemptions:** Small islands < 200,000 residents; PSO connections between island MS and another MS and between an island and the mainland of the same MS; outermost regions; transhipment ports; ice class ships and ships navigating in ice.
- **Scope:** ships above 5000 GT, intra-EU traffic + 50% international, EU ports (same as for ETS)
- **Additional requirement for Zero-Emission at berth** (OPS and alternative zero-emission technologies) - compulsory as of 2030 for container and passenger vessels (some exemptions up to 2035)

- Inclusion of **CO_2, methane and nitrous oxide** on a full Well-to-Wake calculation: allows fair comparison of fuels

$$GHGe\,[gCO_{2eq}] = (WtT\,(fuel, electricity) + TtW(\text{combustion, slip}))$$

- **Flexibility mechanism** via banking and borrowing: surpluses and (small) deficits can be carried over to the next year
- Voluntary and open **pooling mechanism** to reward/ incentivise overachievers and encourage the rapid deployment of the most advanced options
- **Non-compliance** – deterrent financial penalty
- Monitoring and Reporting is based on **MRV approach,** with some additional data (e.g. calculation of Compliance Balance)

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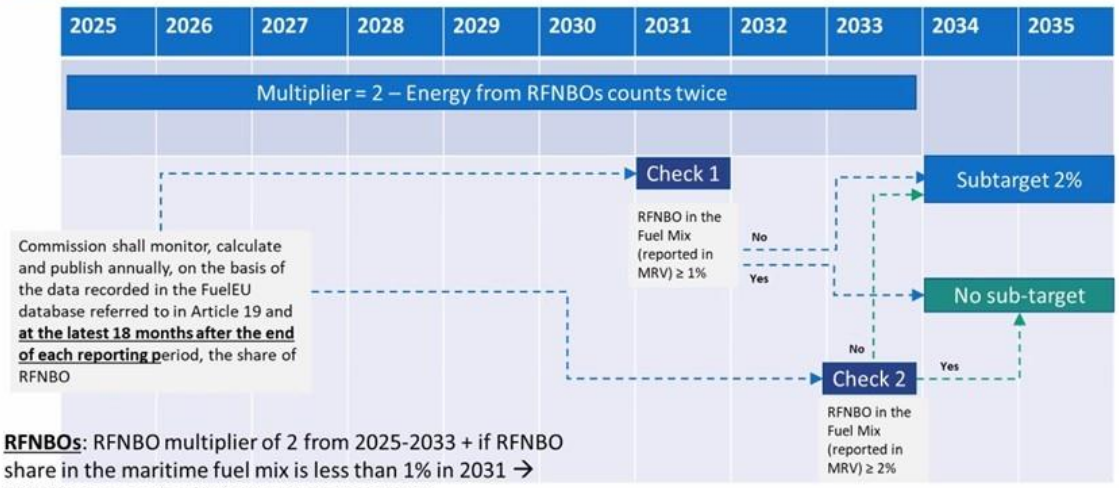
Support to RFNBOs



RFNBOs: RFNBO multiplier of 2 from 2025-2033 + if RFNBO share in the maritime fuel mix is less than 1% in 2031 → RFNBO subtarget of 2 % will kick in from 2034.

European Commission

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Hydrogen refuelling infrastructure for ships

- **Does not include specific targets** for deployment of Hydrogen refuelling/ bunkering infrastructure
- **BUT** includes specific obligations for Member States to included hydrogen refuelling for maritime transport in the National Policy Frameworks (NPF) – Article 13
  - *(m) a **deployment plan** for alternative fuels infrastructure in maritime ports, in particular for electricity and **hydrogen, for port services** as defined in Regulation (EU) 2017/352 of the European Parliament and of the Council26*
  - *(n) a **deployment plan** for alternative fuels infrastructure in maritime ports other than for LNG and shore-side electricity **supply for use by sea going vessels, in particular for hydrogen**, ammonia and electricity;*
- NPFs to be notified to Commission by 1 January 2025.

Standardisation Mandate
New European standards supporting a harmonize an interoperable infrastructure for vessels for **hydrogen,** methanol and ammonia bunkering
AFIR Delegated Regulation standardization needs:

1. technical specifications with a unified solution for **gaseous compressed hydrogen refuelling points and bunkering for maritime and inland waterway hydrogen-fuelled vessels** 31.12.2026

2. technical specifications with a unified solution for **liquefied hydrogen refuelling points and bunkering for maritime and inland waterway hydrogen-fuelled vessels** 31.12.2028

- **But what is the likely development of Bunkering Infrastructure for Hydrogen for sea going vessels?**
- **Green Corridors?** Synergetic development of hydrogen-based energy option over specific routes designated in accordance with Fuel Availability, favourable conditions for fuel production in vicinity of main port hubs.
- **Short Sea Shipping** routes, in addition to the "Green Corridors"!

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IGF Code development roadmap

IGF Code development roadmap/ timeline recently revised

Interim **Guidelines for safety of ships using Fuel Cells** finished 2021 - **MSC.1/Circ.1647 15 June 2022**

Interim **Guidelines for safety of ships using Hydrogen as Fuel** initiated.

Work on Hydrogen and Ammonia taking place in parallel

Increased focus on the development of the safety framework due to pressure to decarbonise the sector.

	CCC6	MSC102	CCC7	MSC105	CCC8	MSC106	CCC9	MSC107	CCC10
	SEP20	NOV20	SEP21	APR22	SEP22	NOV22	SEP23	2023	2024
LNG	Revision Exercise				**Finalize Part A-1 amendments**	**Approve Part A-1 amendments**			
Alcohols	Interim Guidelines finalized	**Interim Guidelines Approved** (MSC.1/Circ.1621)	Interim Guidelines under application				Start discussion of mandatory instruments	Draft mandatory req	
Fuel Cells	Drafting		Finalize Interim Guidelines	**Approve Interim Guidelines**	Interim Guidelines under application				Start discussion of mandatory instruments
LPG	Drafting						Finalize LPG Guidelines	**Approve LPG Guidelines**	
Low-flashpoint Oil Fuels	Discussion		Significant discussion around relevance of this work		How to address safety provisions for low-flashpoint oil fuels? DECISION				
Hydrogen			Initiate development of Interim Guidelines	Drafting					
Ammonia			Initiate development of Interim Guidelines	Drafting					

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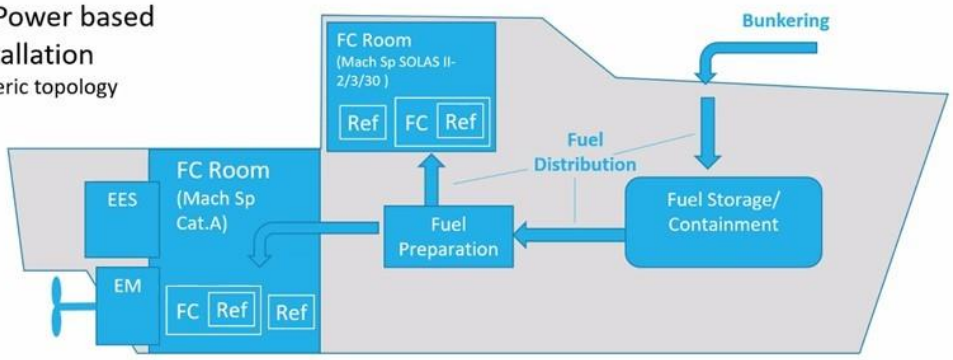
IMO Interim Guidelines for safety of ships using Fuel Cells

FC Power based installation
Generic topology



a reformer is part of the fuel cell power system and accordingly always located in a fuel cell space
Fuel cell power system Is the group of components which may contain fuel or hazardous vapours, fuel cell(s), fuel reformers, if fitted and associated piping systems.
Fuel cell space is a space or enclosure containing fuel cell power systems or parts of fuel cell power systems

EES – Electrical Energy Storage
EM – Electric Motor
FC – Fuel Cell
Ref – Reformer unit

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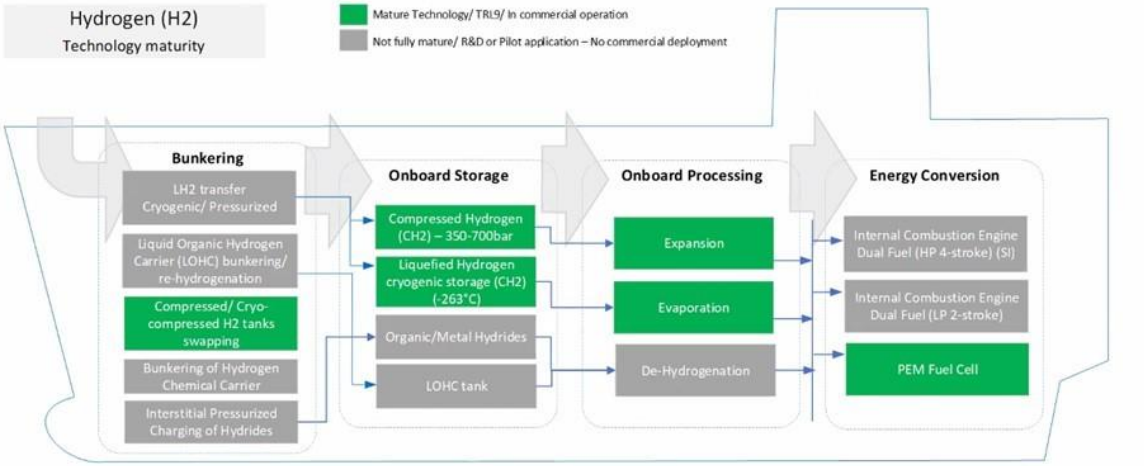
Technology Readiness

Hydrogen (H2)
Technology maturity



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Hydrogen as Fuel for Ships

EU/ IMO Policy Frameworks - Deployment Opportunities & Challenges

Strengths	Challenges
- **Zero-carbon** - Renewable electricity **storage for long-term** energy use. - Good potential for multi-modal synergies – and cross sector applications. - Good **"state-of-the-art" technology** with new innovative business case developments.	• **Energy content/ Specific Energy** of Hydrogen onboard storage solutions – challenge for sea going vessels • **Well to Wake/ Life Cycle Assessment** – Zero-Emissions required • **Risk Assessment** framework for use of hydrogen onboard ships – lack of standard "failure scenarios" • Onboard Hydrogen **Storage** – Suitability for different cases • **Ship Design challenges** / integration
Opportunities	**Threats**

- **FuelEU**
  - **Reduction Targets** for GHG intensity of energy used onboard
  - **RFNBOs incentive (multiplier/subtarget)**
  - **Mandate for ZERO-EMISSIONS at berth** – OPS will not be enough/possible for all cases
  - **Pooling Mechanism** – reward for "over-achievers"
- **AFIR, Green Corridors**
- **IMO Revised GHG reduction strategy**
	• **Multiple fuels will compete in the future** – important to get the business case right
	• **Lack of standardization** initiative with reduced industry involvement – "**wait and see**" attitude
	• Proliferation of **"tailor-made" solutions**

CHALLENGES

Climate change

- Energy consumption
- Demand and Supply complexities
- World population increase (47% until 2050).

Shipping`s influence on climate change

- 3% of global GHG emissions
- Growing continuously (0.7 to 2 billion DWT within 30 years)
- Energy consumption
- Operation costs are energy/Fuel linked (65%)

Image 1. 21st century (Joc.com 2018)

Image 2. 20th century (Schoonderbeek, 2009)

"Port of Rotherham"

SOLUTIONS

- **Sustainable shipping**
  - Green applications, fuels & technologies
    - Energy efficient shipping
    - Efficient technologies
    - Environmentally friendly applications - decarbonisation
  - Integrated system for overall effectiveness and better safety measures.
  - **Regulations and funds**

IMO

Recently, the Maritime Environment Protection Committee (MEPC 81) met in London in March 2024.

Proposed new Chapter 5 of MARPOL Annex VI will include:

- A marine fuel standard to reduce GHG intensity.
- Economic mechanisms to incentivize the transition to net-zero."

MEPC 82 in September 2024.

Challenges and Opportunities

Industry Challenges

- Regulatory and economic hurdles: Global emission standards alignment, high initial tech costs.
- CAPEX - Additional cost like retrofit
- OPEX - Carbon tax is game changer
- New Build - Risk of being a first-mover

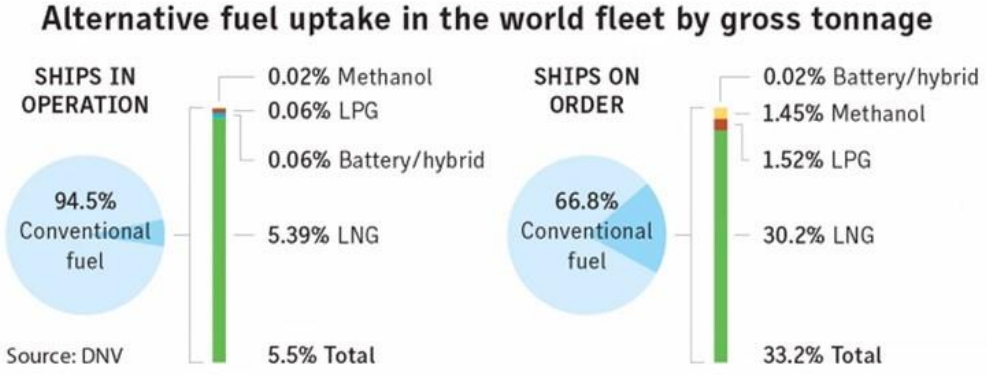
Emerging Technologies

- Harmonized approach needed: blend tech innovation and strong policies.
- New Tech brings additional safety measures & training needs
- In 2022, government incentives increased by 30%, spurring industry investment in green tech (IEA, 2023).

Opportunities by 2030&2050

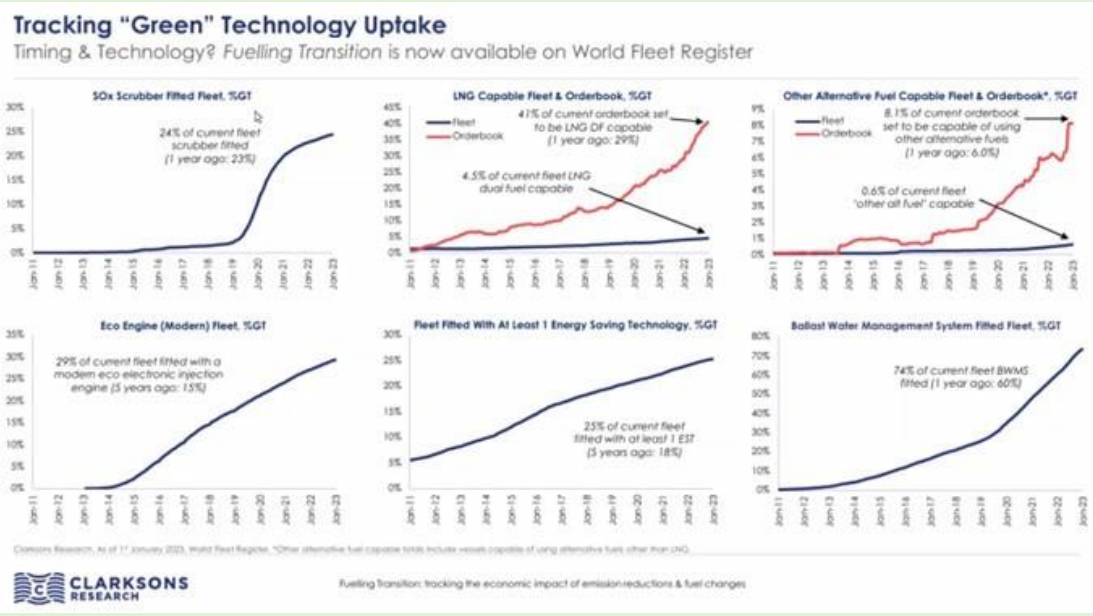
- Projections estimate a $62 billion market for green tech and and sustainability industries by 2030 (Laricchia, 2023).
- Commitment to alternative fuels creates opportunities for sustainable propulsion.
- **2050**

Horizon Scanning- Orderbook



"There are 130 ammonia-ready and 6 hydrogen-ready vessels on order"

Clarksons, 2022



Stay informed at the curated focus group https://bit.ly/3tHcLlO

Hydrogen Shipping

Join us for Hydrogen sectoral training.

https://lnkd.in/eMx4PHv4

Hydrogen training