

The Evolving Role of Biofuels in Maritime Decarbonization



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Current Regulations

G IMO

MARPOL Annex VI
EEDI / EEXI / CII / SEEMP / DCS
IMO LCA Guidelines
IMO Net-Zero Framework

R Regional

EU ETS
FuelEU Maritime
EU MRV

N National regulations

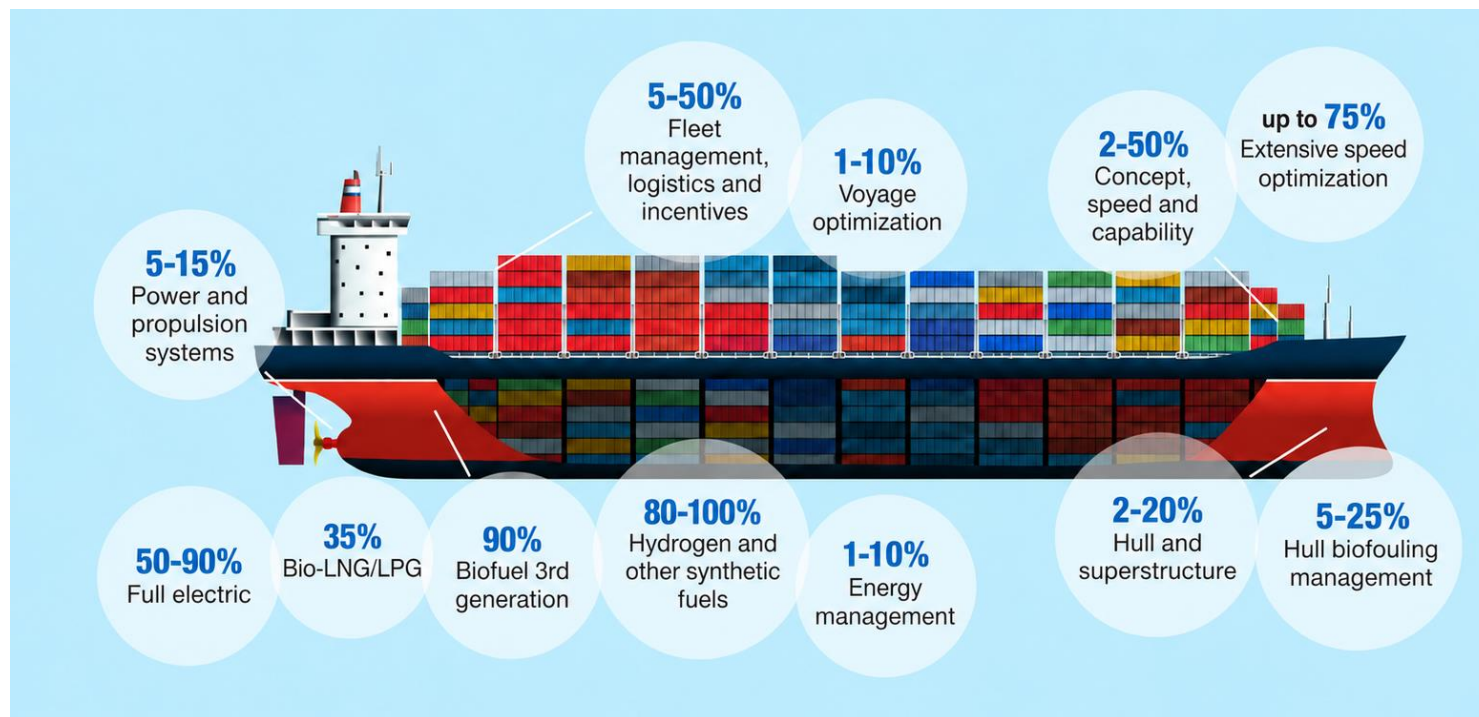
National implementation, taxes, incentives, domestic shipping requirements, national zero-emission policies.

L Port / local regulation

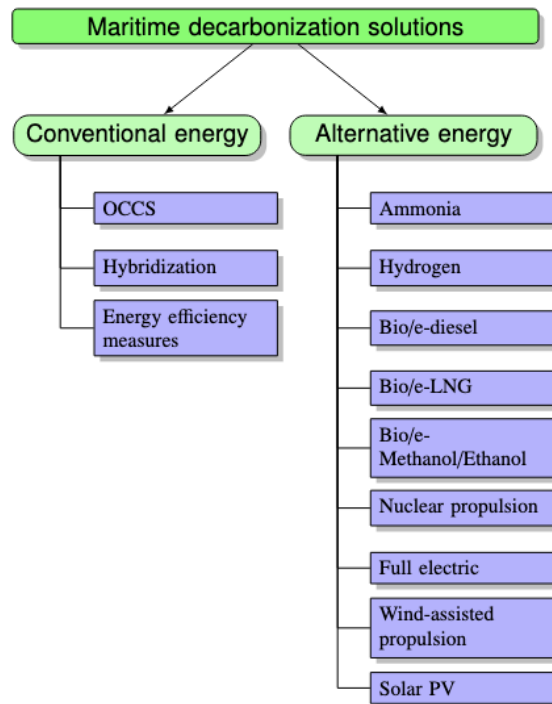
Port-specific emission limits, shore-power requirements, environmental fees, local restrictions and incentives.



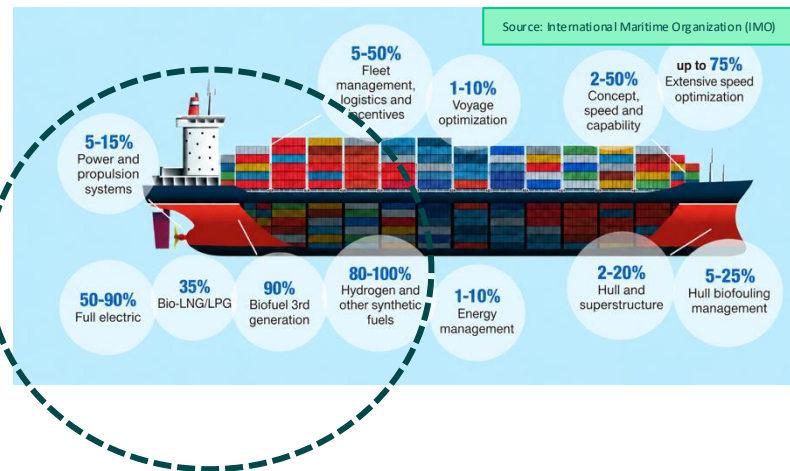
Ways to Decarbonize a Ship



Alternative Solutions for Marine Propulsion Systems



Selected fuel-based options may be classified by production route, e.g., green hydrogen/ammonia from renewable electricity and blue hydrogen/ammonia from fossil resources with carbon capture and storage.



Different Solutions for Different Ship Types



Pilot boat
≈ 12 m LOA



Tugboat
≈ 20 m LOA



Fishing vessel
≈ 25 m LOA



Offshore supply vessel
≈ 85 m LOA



RoPax ferry
≈ 150 m LOA



Small bulk carrier
≈ 180 m LOA



LNG carrier
≈ 290 m LOA



Oil tanker
≈ 330 m LOA

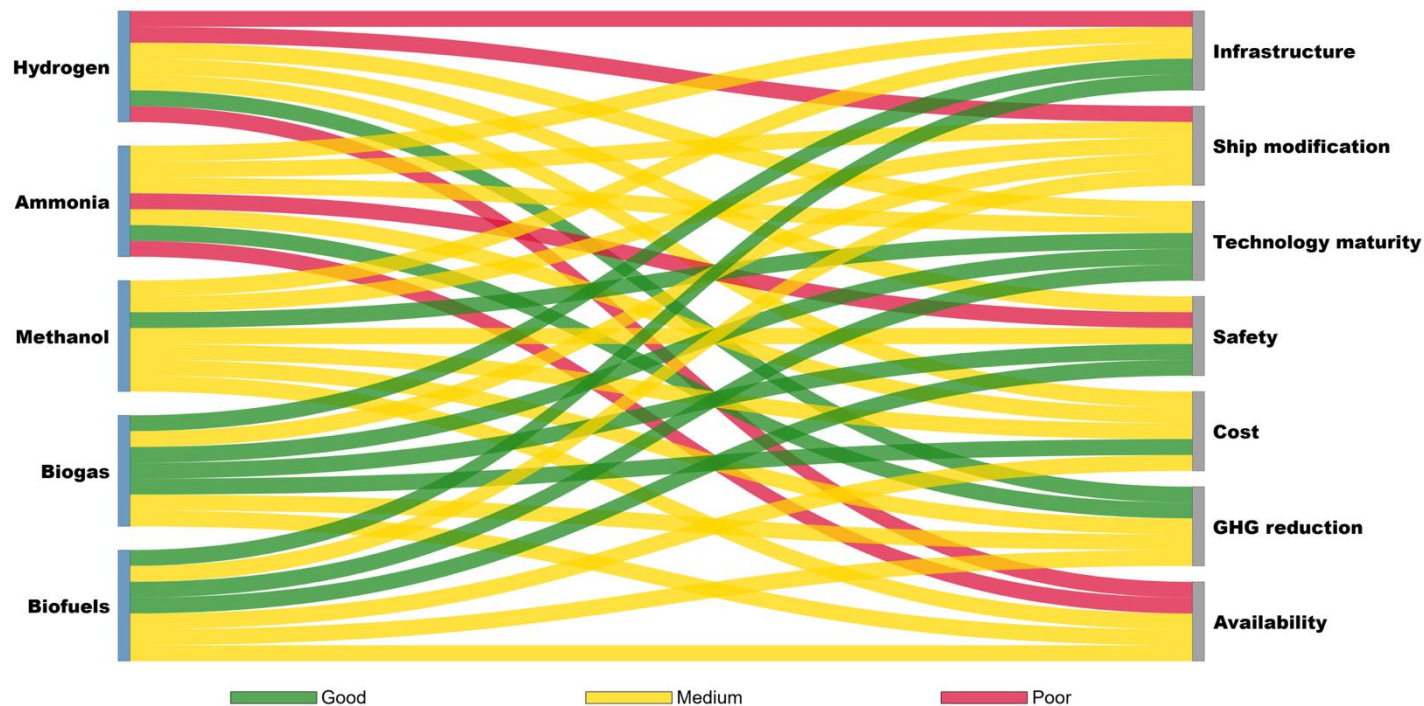


Cruise ship
≈ 330 m LOA



Ultra-large container ship
≈ 400 m LOA

Alternative Fuels Are Not Equal!



For illustration in this presentation only; values are qualitative, non-validated, and not intended for reuse or citation.



Main Advantages of Biofuels: Compatibility and Infrastructure Advantages

- **Applicable across many ship types and sizes**
from smaller vessels to large ocean-going ships
- **High compatibility with existing ships**
often usable in conventional diesel engines with limited or no major modifications.
- **Existing bunkering infrastructure can be used**
storage, transport and fuel-supply systems are largely similar to current liquid fuels
- **Mature logistics and supply-chain concepts**
easier integration into existing port and fuel-distribution systems

Main Advantages of Biofuels: Operational Advantages

- **Lower technical complexity onboard**

no cryogenic storage, fuel cracking, or highly specialized fuel systems are normally required

- **Fast implementation**

potentially one of the quickest pathways for reducing lifecycle GHG emissions from the existing fleet

- **Minimal crew retraining**

operation and handling are generally much closer to conventional fuels than hydrogen or ammonia

- **Can be blended with conventional fuels**

allowing a gradual transition and lower initial investment

Challenges to Wider Biofuel Adoption in Maritime Shipping

- Marine fuel regulations and standards are largely fossil-fuel based
- Uncertain compatibility with marine engines and onboard systems
- Limited long-term onboard experience, and potential microbial growth
- Higher fuel quality requires costly upgrading
- Limited cost competitiveness against heavy fuel oil (HFO)
- Competition with aviation for sustainable feedstocks



Future Development of Biofuels in Maritime Shipping

Maritime may potentially use:

- Heavier fractions
- Lower-grade renewable liquids and Intermediate products
- Waste-derived streams (second generation)

Maritime does not necessarily need to compete with aviation for exactly the same high-quality renewable molecules!

Maritime Energy Systems Laboratory (M-Lab) at SINTEF Ocean



Five test cells

01

2-Stroke engine

- Conventional fuels,
- LNG, Methanol,
- Ammonia,
- Hydrogen.

02

4-Stroke engine

- Conventional fuels,
- LNG, Methanol,
- Ammonia,
- Hydrogen.

03

Fuel cells (planned)

- PEMFC
- SOFC

04

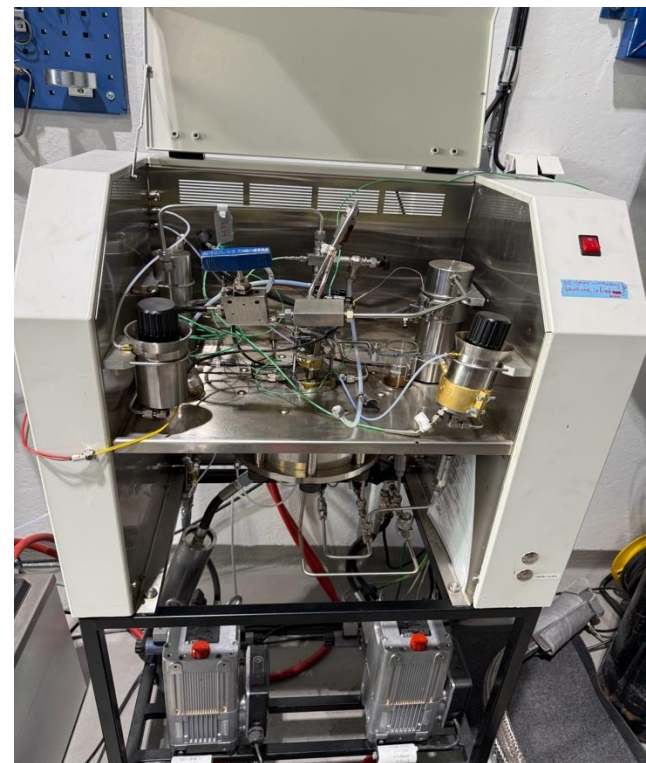
Battery-Hybrid

- Power: 500 kW
- Capacity: Up to 2000 KWH

Testing Biofuels: From Crude to Distillate



Testing HPO-Marine and Bio-Naphtha–Methanol Blends in the FuelUp Project



Testing HPO-Marine and Bio-Naphtha–Methanol Blends in the FuelUp Project

FuelUp



The Way Forward...

A biofuel can achieve a very low lifecycle GHG intensity, while being **incompatible** with marine machinery!



A biofuel may be compatible with marine machinery but has a **high lifecycle GHG!**

The optimum marine biofuel must balance environmental performance, fuel quality, engine compatibility, and cost.

Thank you!



SCAN ME



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 **LIST**
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