

Climate and Air Quality Implications of Maritime Shipping

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Energy & Environmental
Research Associates



Introduction

- International shipping is coming under increasing scrutiny
- ~3% of global Greenhouse Gases (GHGs), 90% of traded goods
- Significant transboundary, regional, and local impacts from criteria pollutants
 - ~30% global nitrogen oxides (NOx)
- Tightening regulatory environment
- Developing alternative fuels landscape

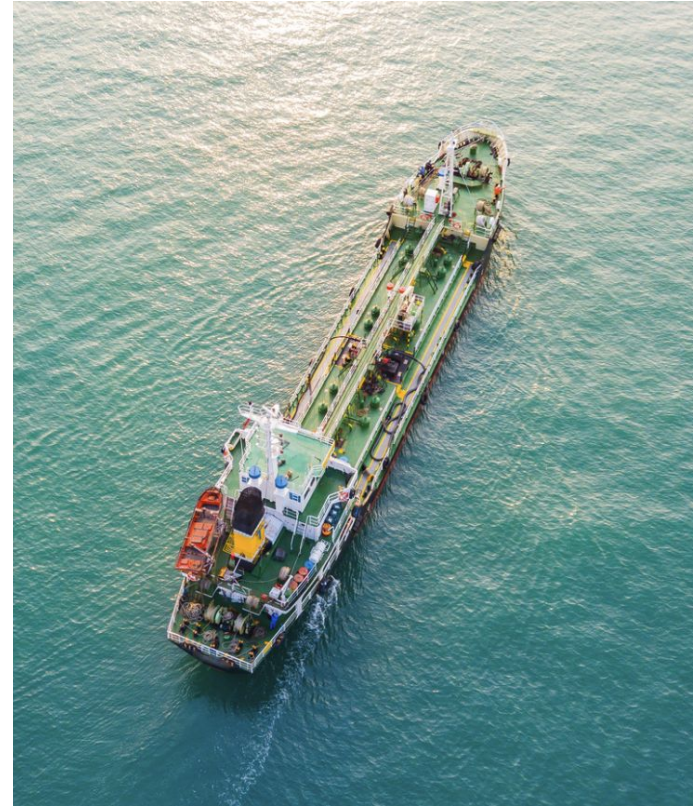


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Global Health Impacts

Mortality: 250k

Asthma (≤ 17): 6.4M

IMO 2020:

Mortality: \downarrow 34%

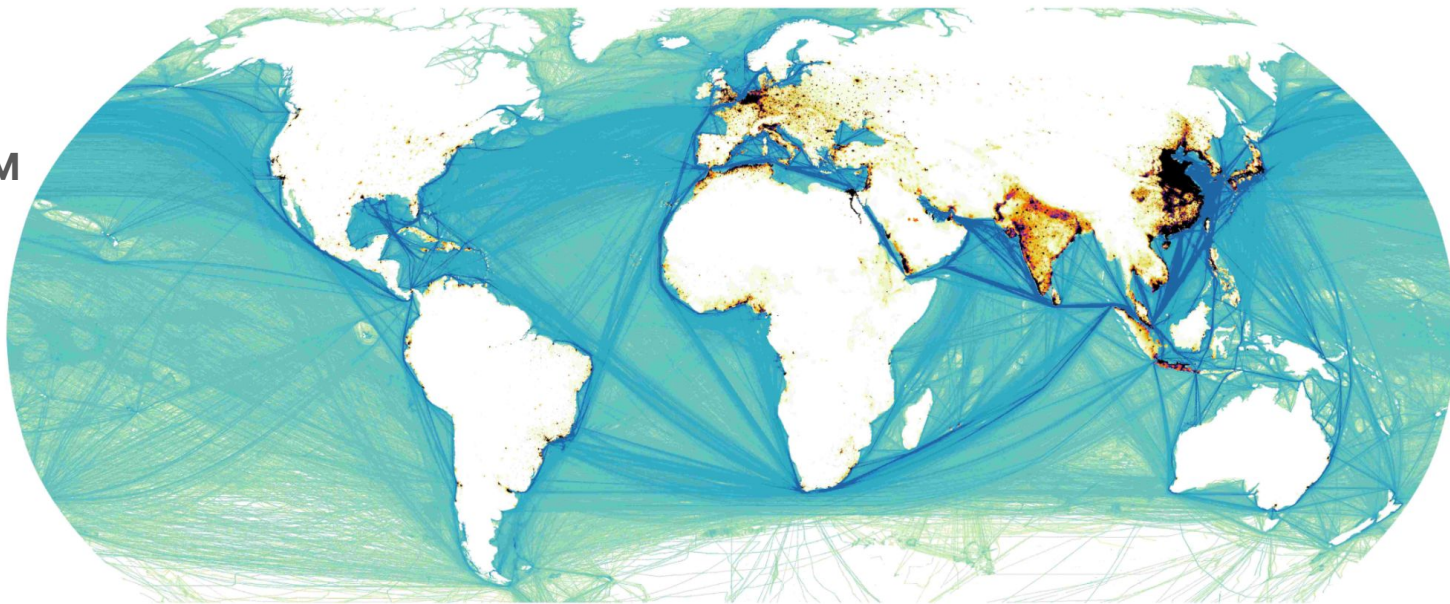
Morbidity: \downarrow 54%

Aerosols: \downarrow 80%

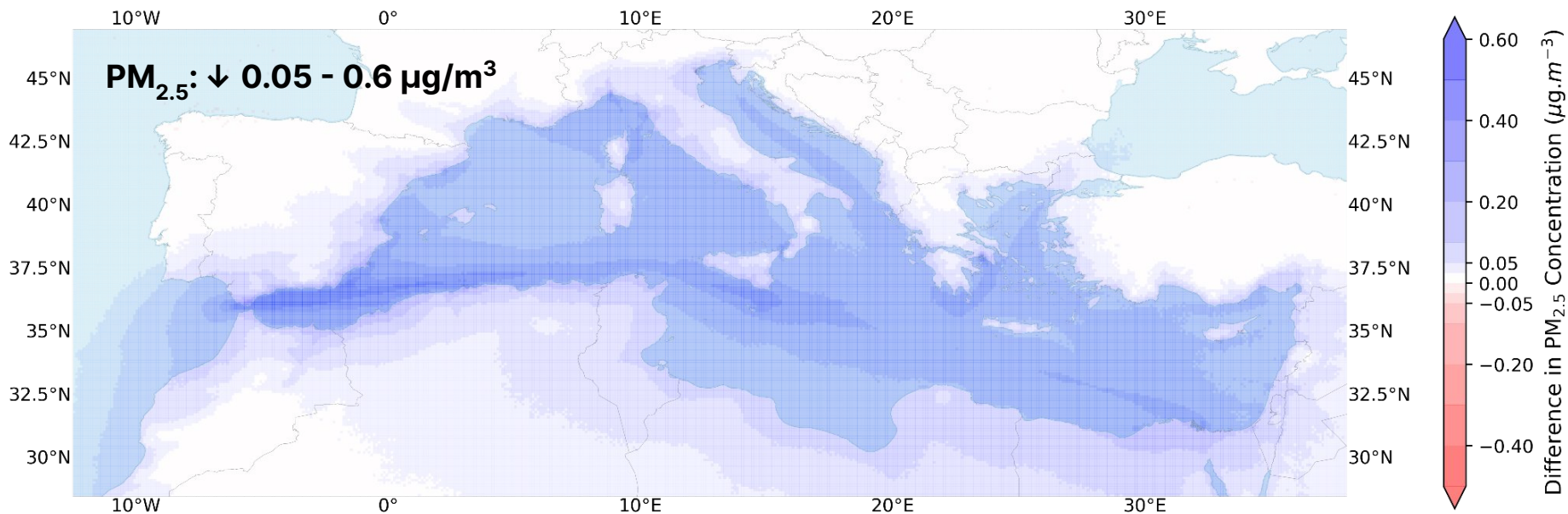
Forcing: \uparrow 3%

IMO: International Maritime Organization

Sofiev et al. (2018)



Regional AQ and Health Impacts: Med ECA PM_{2.5}

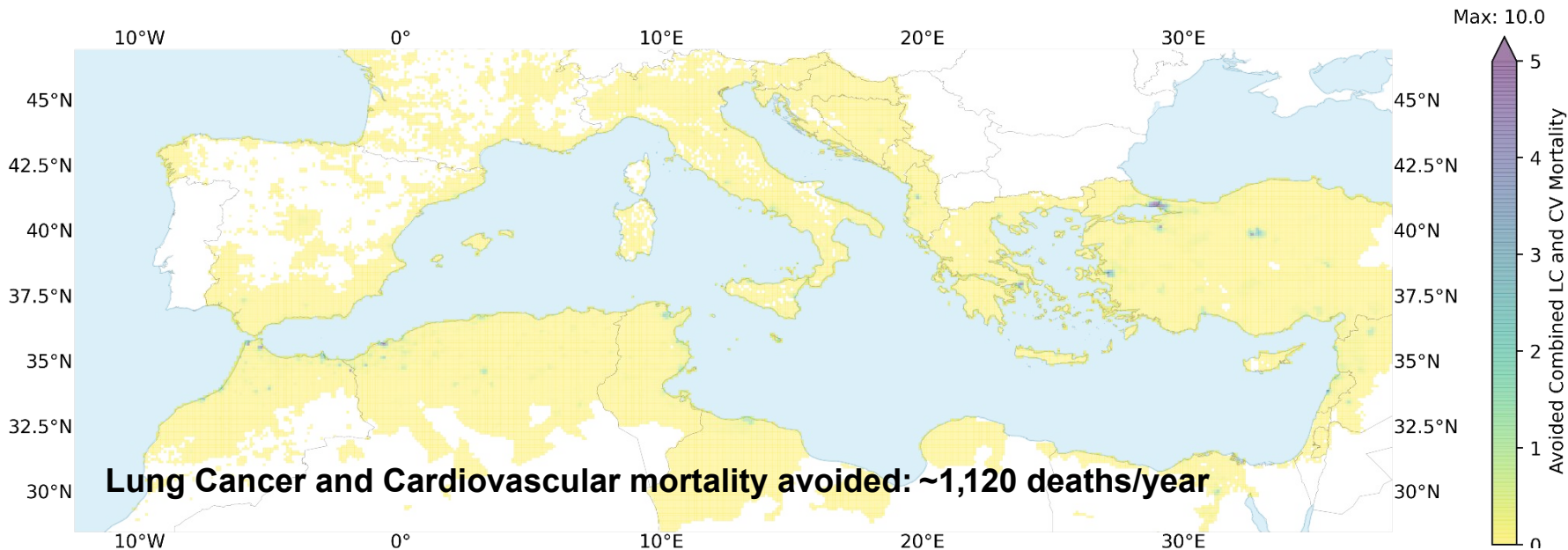


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ECA: Emission Control Area

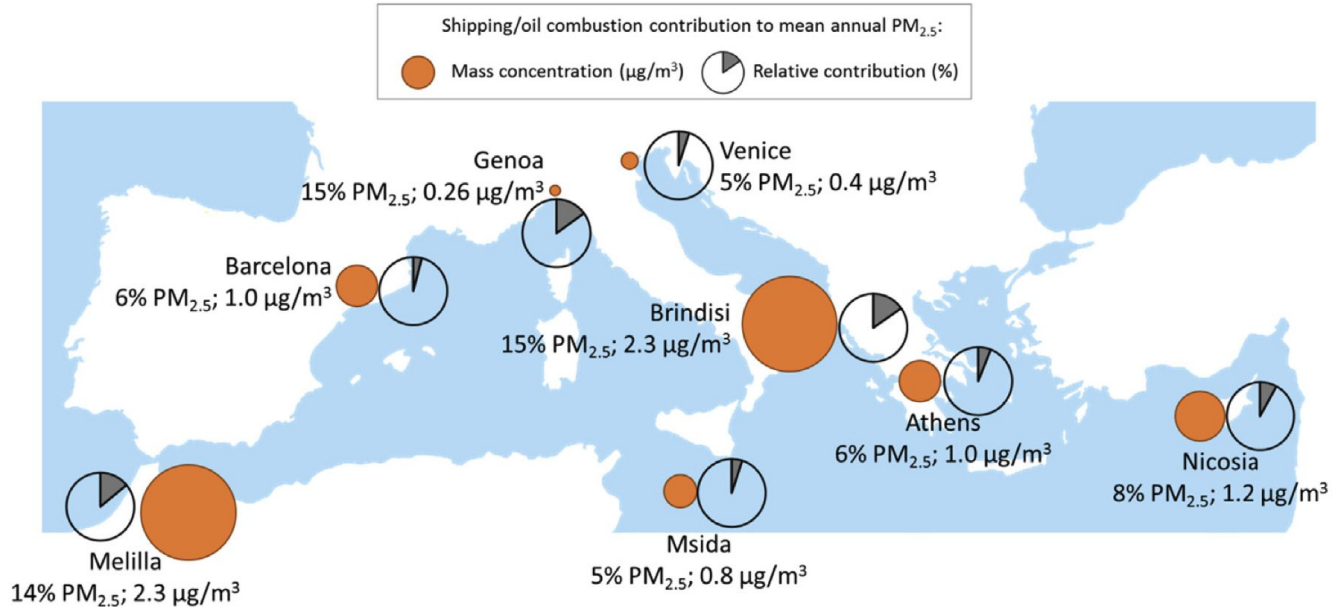
PM_{2.5}: Particulate matter $\leq 2.5\mu\text{m}$

Regional AQ and Health Impacts: Med ECA Mortality



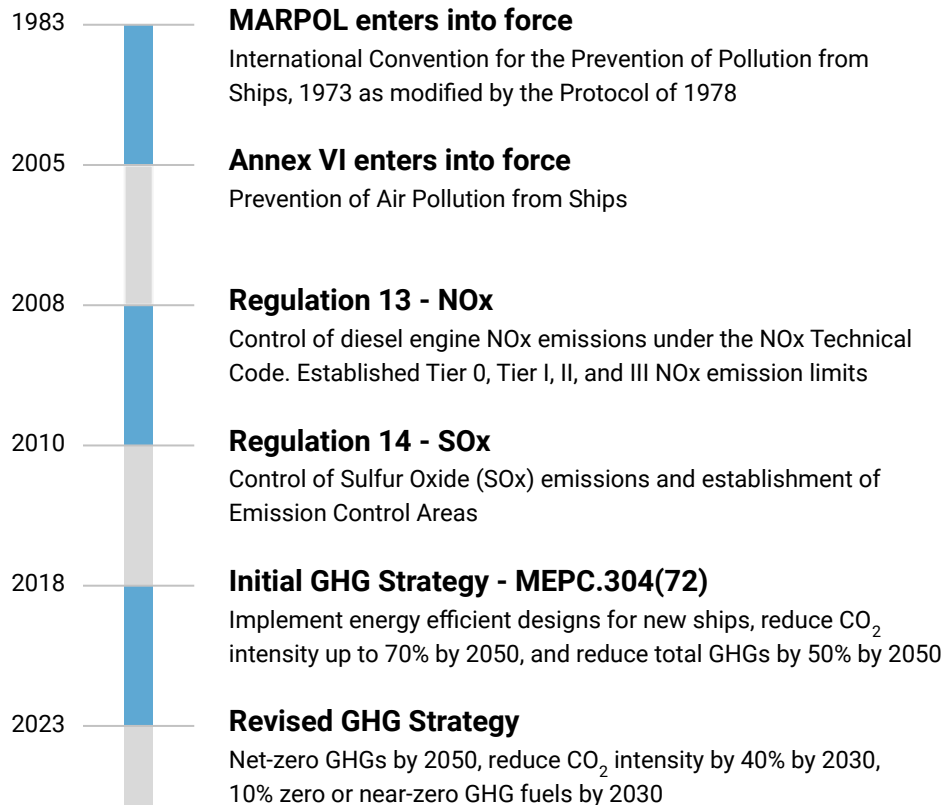
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Local Air Quality and Health Impacts

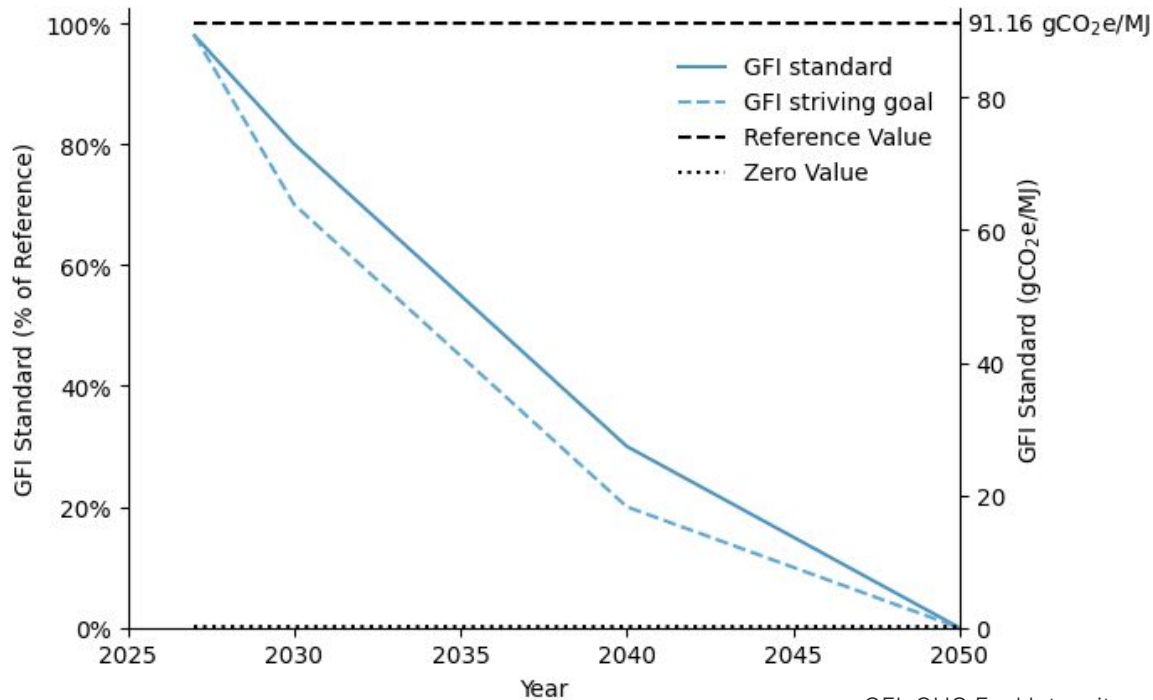


Viana et al. (2020)

IMO Regulatory Timeline



IMO Revised GHG Strategy



GFI: GHG Fuel Intensity

National and Regional Regulations

**FuelEU Maritime
(2025)**

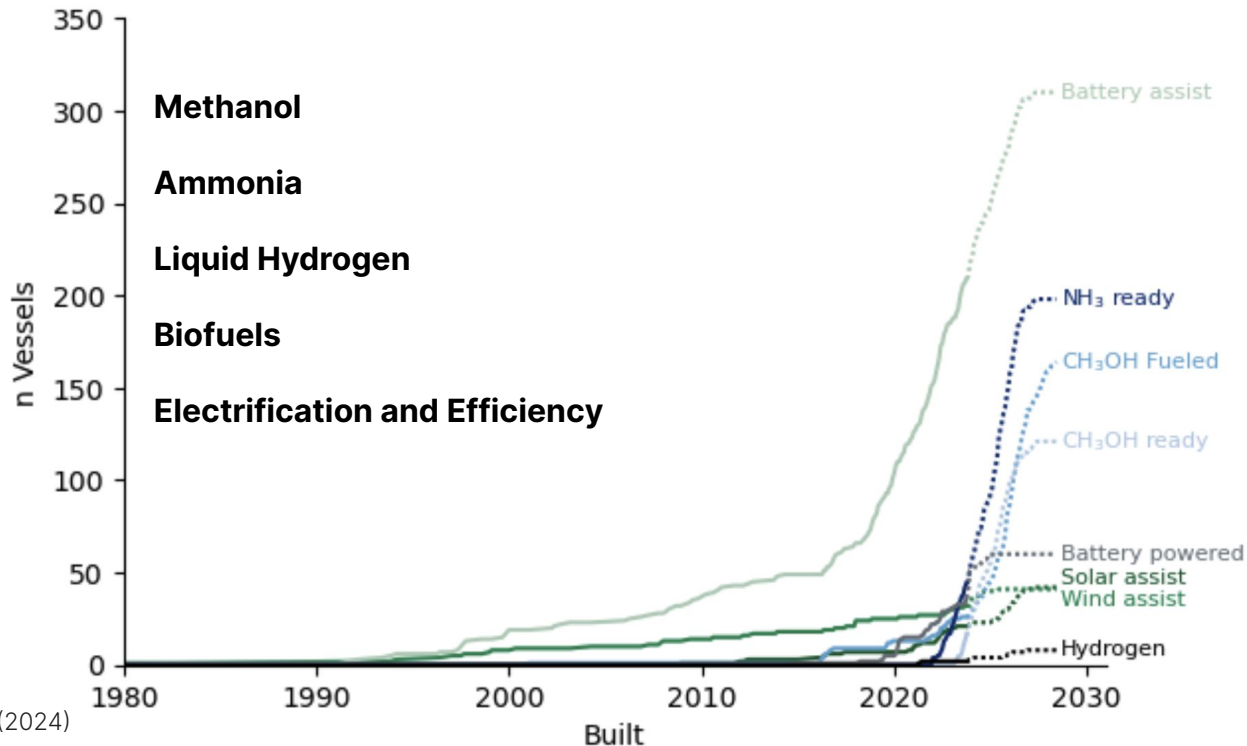
**EU ETS
(2026)**

**CARB At Berth Regulation
(2023)**

Domestic and regional ECAs

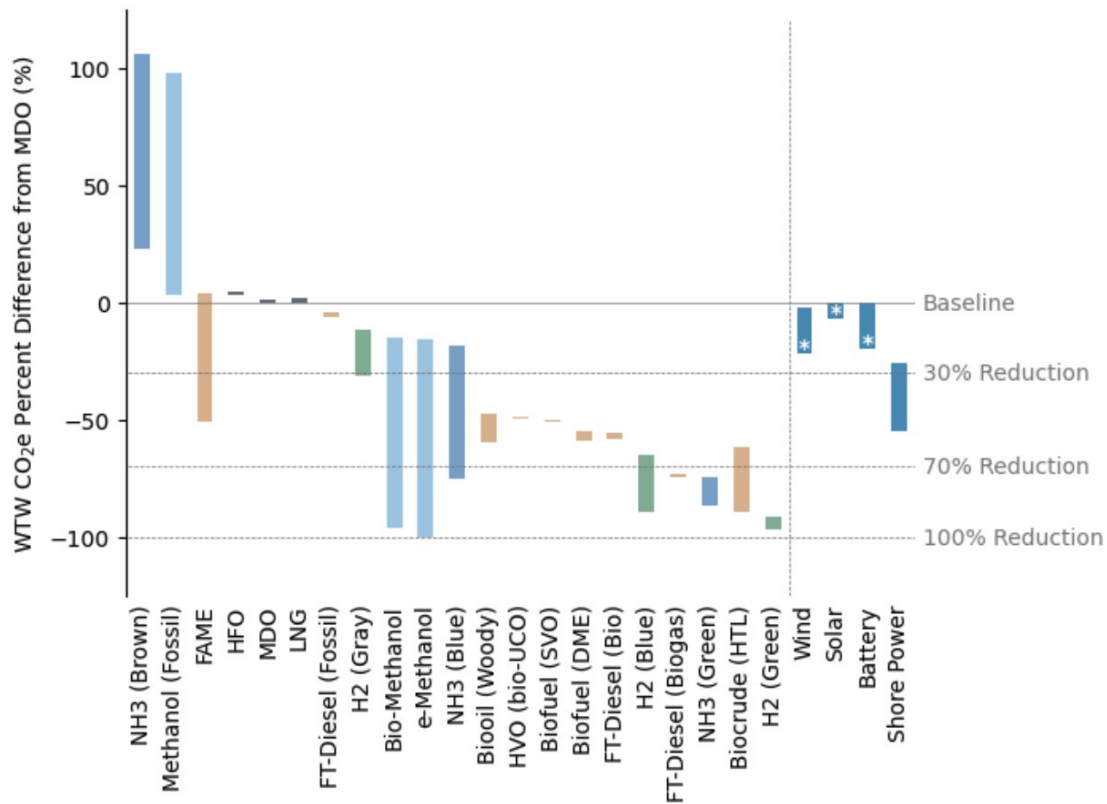
- **North America (2012)**
- **Baltic (2005)
+ North Sea (2006)**
- **Mediterranean (2025)**
- **China (2016)**
- **Arctic Canada +
Norwegian Sea(2025?)**
- **Northeast Atlantic?**

Alternative Marine Fuels



OGV Decarbonization
Technology Assessment (2024)

Alternative Marine Fuels - GHG Abatement



www.safet.io

OGV Decarbonization
Technology Assessment (2024)

Conclusions

1. Significant AQ and health impacts from shipping
2. Tightening regulatory environment
3. Rapid growth in alternative fuel capability
4. Technology readiness and fuel supply
5. Research needs and directions
 - a. Grid decarbonisation
 - b. Economic measures
 - c. Climate and health tradeoffs

References

1. Sofiev, M., Winebrake, J. J., Johansson, L., Carr, E. W., Prank, M., Soares, J., ... & Corbett, J. J. (2018). Cleaner fuels for ships provide public health benefits with climate tradeoffs. *Nature communications*, *9*(1), 406.
2. MEPC 78/11. 4 February 2022. Proposal to Designate the Mediterranean Sea, as a whole, as an Emission Control Area for Sulphur Oxides. Developed by EERA for REMPEC.
3. Viana, Mar, V. Rizza, Aurelio Tobías, E. Carr, J. Corbett, M. Sofiev, A. Karanasiou, G. Buonanno, and N. Fann. "Estimated health impacts from maritime transport in the Mediterranean region and benefits from the use of cleaner fuels." *Environment international* 138 (2020): 105670.
4. EERA (In Press) OGV Decarbonization Technology Assessment (2024). Prepared for Pacific Environment with University of California Berkeley.

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