Reducing the Complexity of Decarbonisation

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TANKEROperator

Contents

1. Introduction

Shipping & Environment

- More than 90% of global trade is carried by sea
- No viable alternative for the majority of goods
- Shipping by far the most energy efficient means of transport
- Improvements must still be made
- Cannot be complacent!

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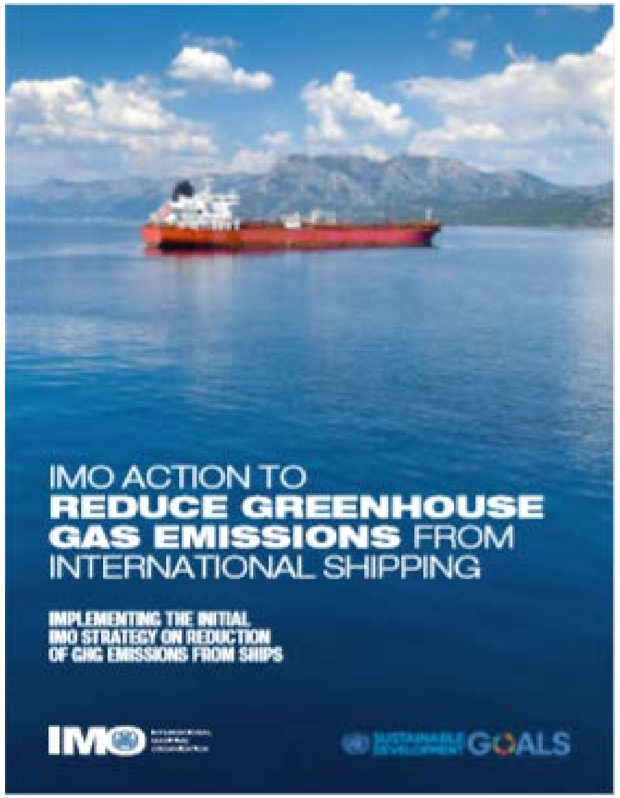
IMO GHG strategy



Zero-carbon Shipping Industry

Strengthen the energy efficiency design requirements for ships with percentage improvement

Reduce CO_2 emissions per transport work by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008

Reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008

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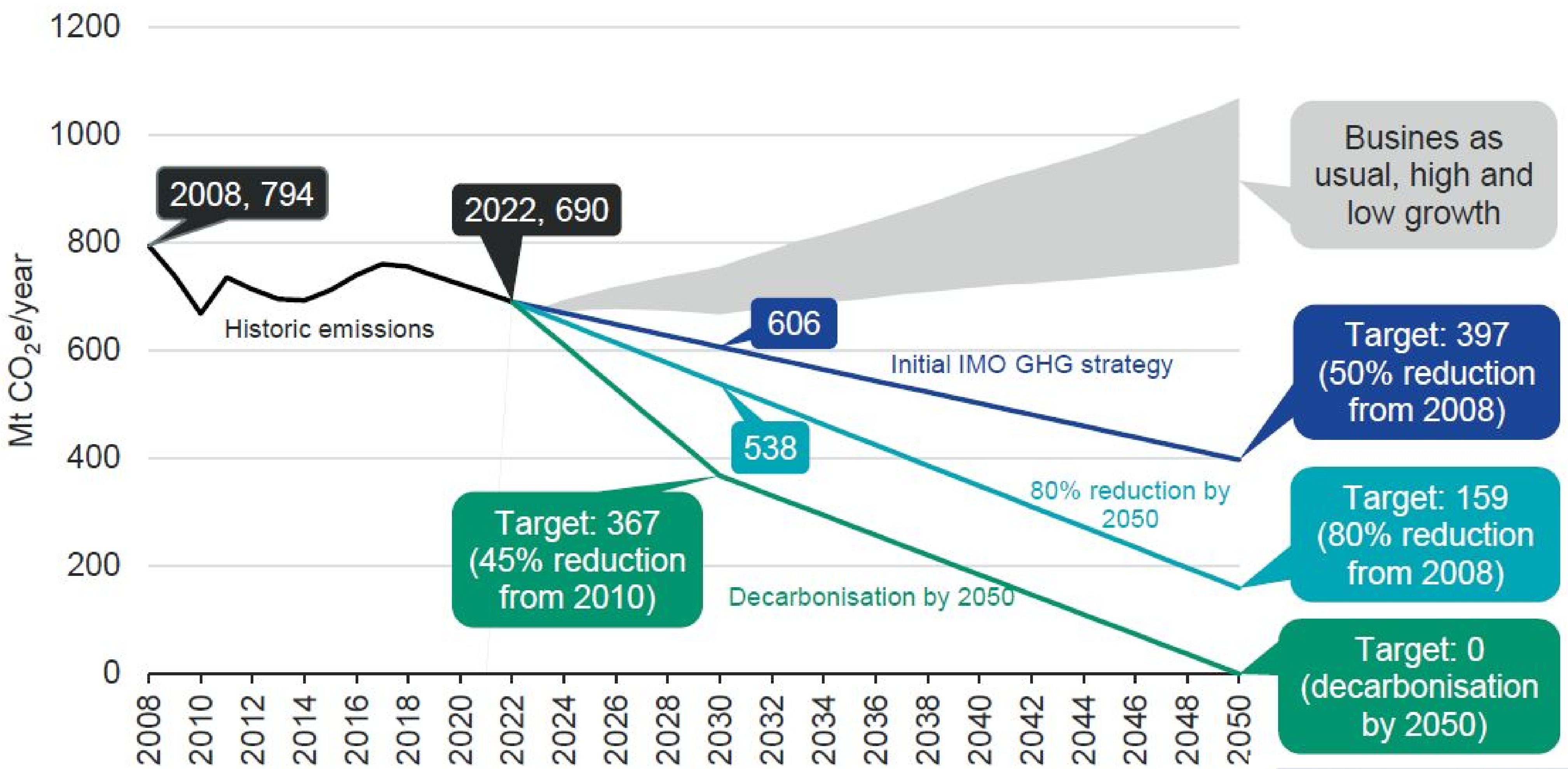
Decarbonisation scenarios with targets



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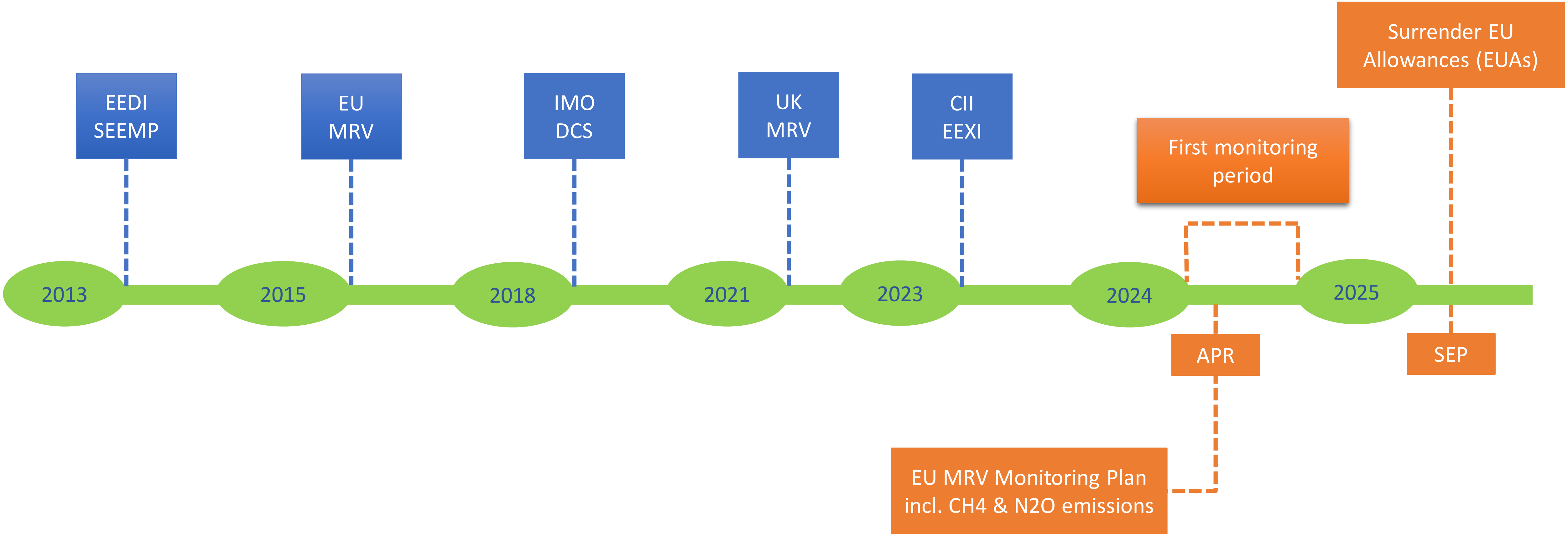
When are things changing?

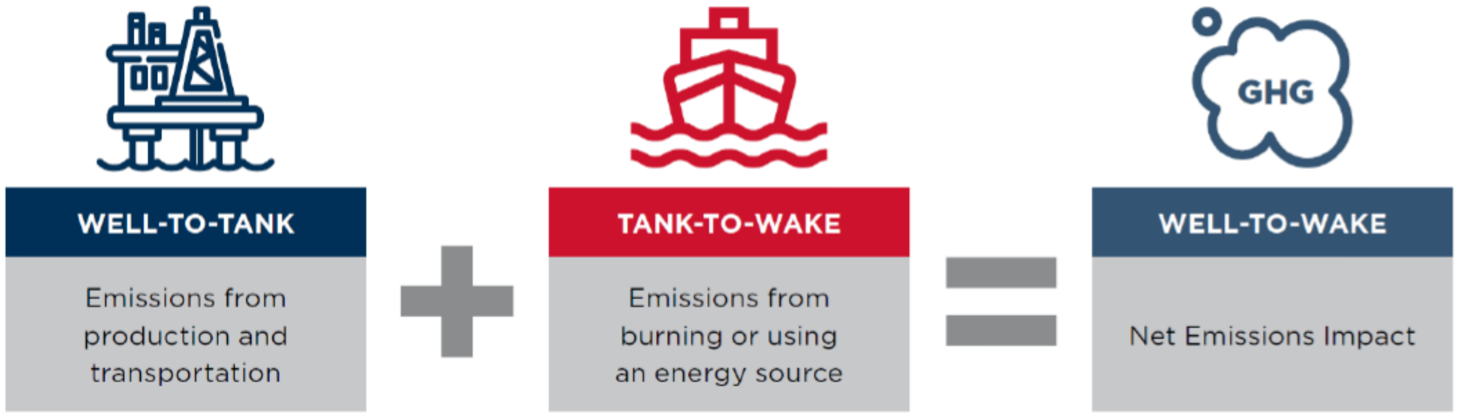


Europe: EU Fit for 55

Goal is to **reduce GHG emissions by 55% by 2030**, through:

- **EU ETS**: EU Emissions Trading System – Ships to purchase allowances for the CO2 they emit (MRV). Starts 2024

- **FUEL EU**: Ships to reduce the GHG intensity of the energy used. Starts 2025



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2. Current Challenges

- Technological
    - Limited Availability of Alternative Fuels
    - Vessel Retrofitting and New Technologies
- Economic
    - Cost Implications
    - Return on Investment (ROI)
- Regulatory
    - Lack of Harmonized Global Regulations
    - Long Lifecycle of Vessels (i.e. compliance with evolving regulations)
- Infrastructure Challenges
    - Lack of Infrastructure for Alternative Fuels
    - Port Infrastructure and Shore Power

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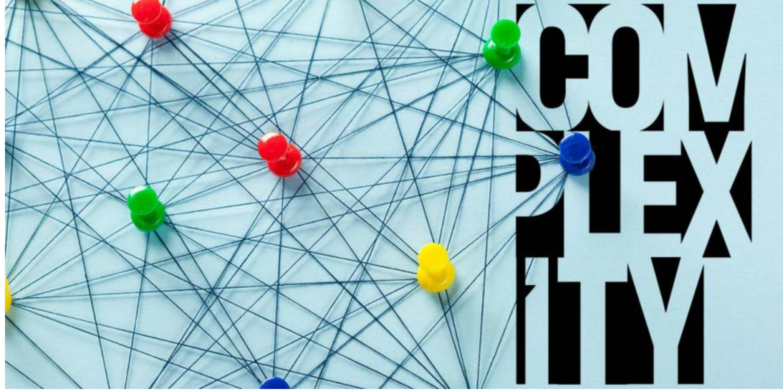
3. Solutions to Reduce Complexity



- Energy Efficiency: Optimizing vessel design, improving operational practices, and utilizing energy-efficient technologies to reduce emissions
- Alternative Fuels: High potential of low-carbon or carbon-neutral fuels like biofuels, hydrogen, and ammonia as alternatives
- Electrification and Hybridization: Electric propulsion systems and hybrid solutions can contribute to reducing emissions in certain types of vessels and short sea routes
- Digitalization and Smart Systems: Data analytics, artificial intelligence, and smart technologies in optimizing vessel performance and reducing energy consumption
- Infrastructure Development: Developing shore-side infrastructure to support the adoption of alternative fuels and technologies

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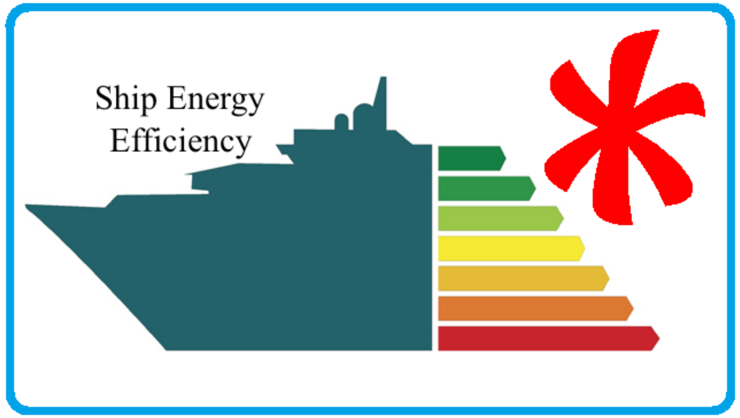
Energy Efficiency



Hull optimisation

- Hull design
- Interceptor trim plates
- Hull coatings
- Hull cleaning
- Air lubrication

Optimisation measures are generally applied on new-built ships but also in the retrofitting of existing ships. However, it is important to understand in detail the ship's performance and its operating profile before considering any design modification.

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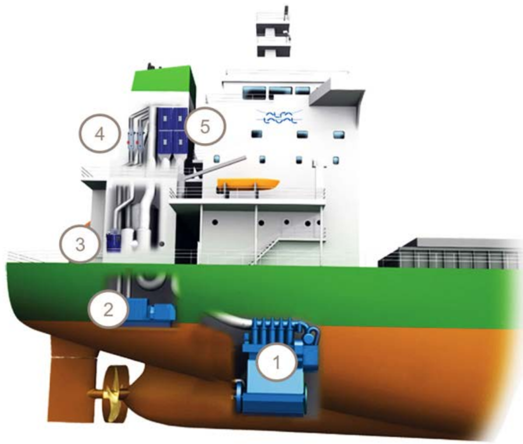
Energy Efficiency



A **waste-heat recovery system** (WHRC) recover and use heat that is generated by existing vessel systems and otherwise lost. Heat can be collected from exhaust gases, excess steam, or cooling water and used to generate electricity on board, typically for auxiliary engines that would otherwise rely on marine diesel fuel.

Waste heat recovery is well proven onboard ships, but the potential is variable depending on the size, numbers, usage and efficiency of the engines on board.

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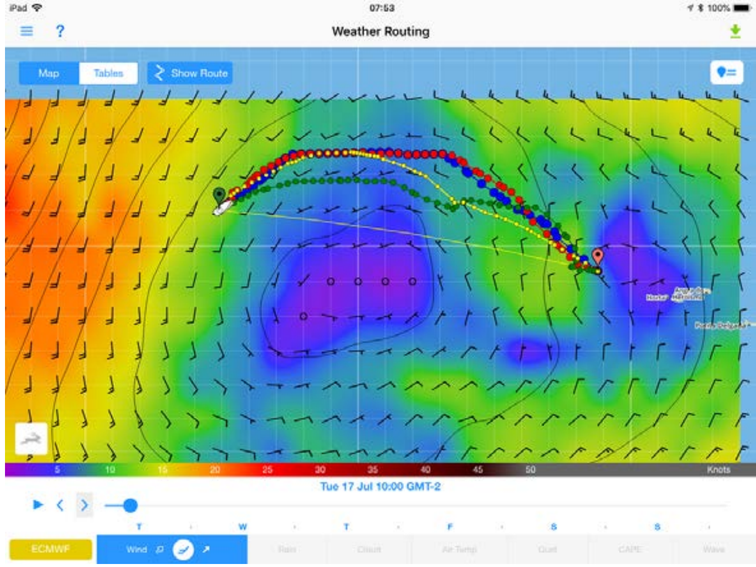
Energy Efficiency



Operations optimization

- Speed
- Routing
- Other (e.g. wind or solar propulsion assistance, reducing onboard power needs)

A small reduction in speed and using forecasting capabilities lead to a much larger reduction in power and associated fuel consumption.

Combining optimal speed and routing factors with arrival time considerations can balance and optimize fuel savings and economics.

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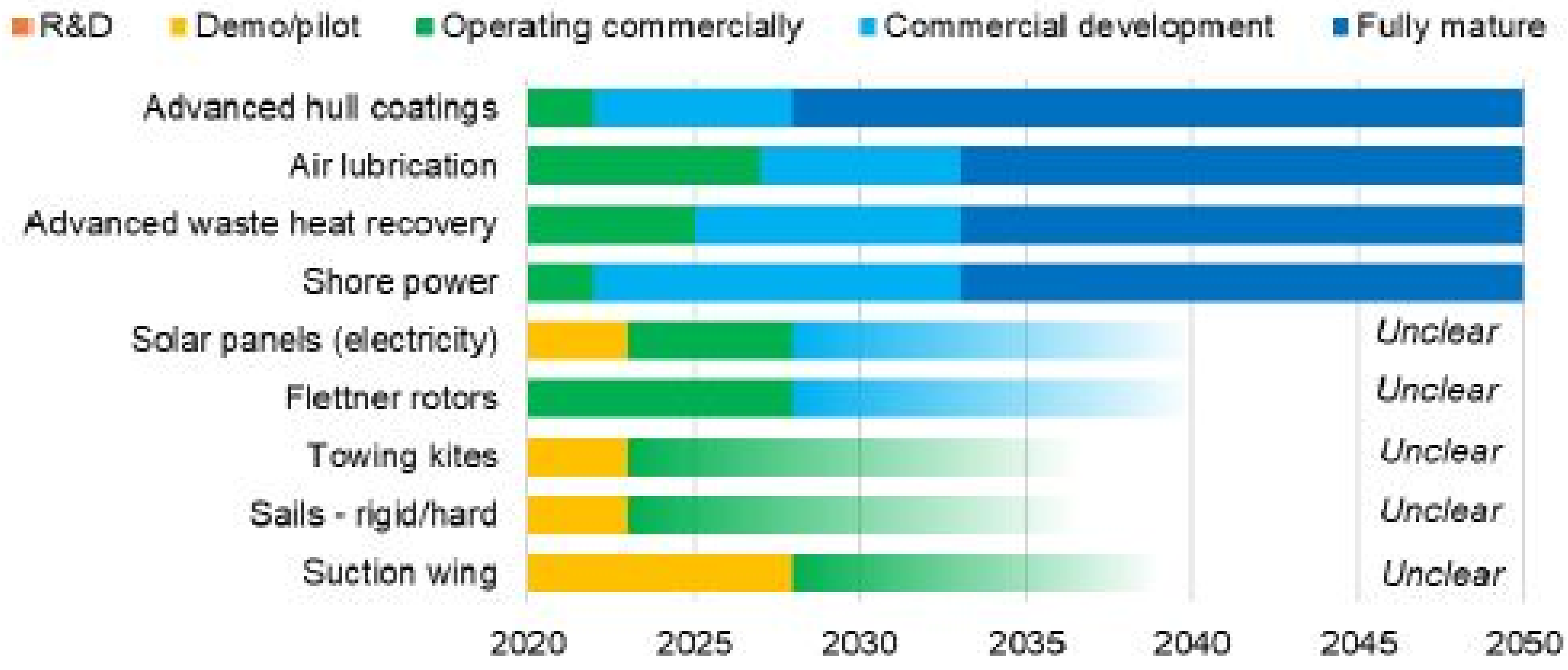
Forecast of readiness and availability of Energy Efficiency technologies



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Smart Systems

Digitalization and Advanced Technologies

- Carbon capture and storage
- Solar panels
- Wind-assisted propulsion systems
- Artificial intelligence
- Autonomous shipping operations
- Advanced supply chain management
- Internet of Things (IoT)
- Machine learning

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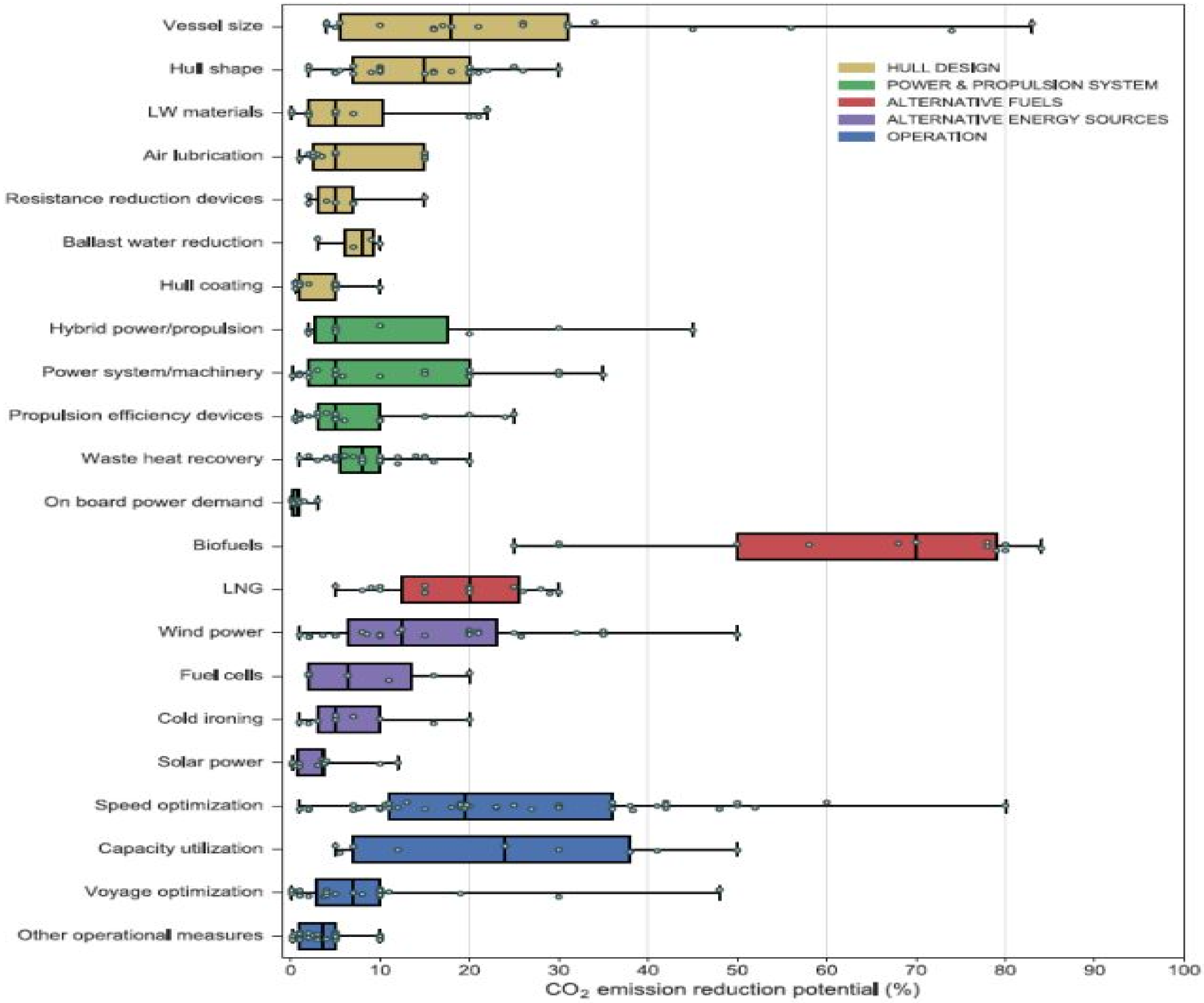

Source: Figure taken from Bouman, et al (2017).

The thicker, solid color rectangular bars indicate the range of “typical” emission reduction potential based on all the data points.

The longer, thin horizonal black line with vertical endpoints represents the full spread of all data points from the studies reviewed, and thus shows the full range of potential carbon emission reduction for the selected measure.

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4. Collaborative Efforts

Need for collaboration among industry stakeholders

- shipowners
- governments
- classification societies
- research institutions
- technology providers

Knowledge sharing, research and development, and policy frameworks to support the transition to greener shipping.

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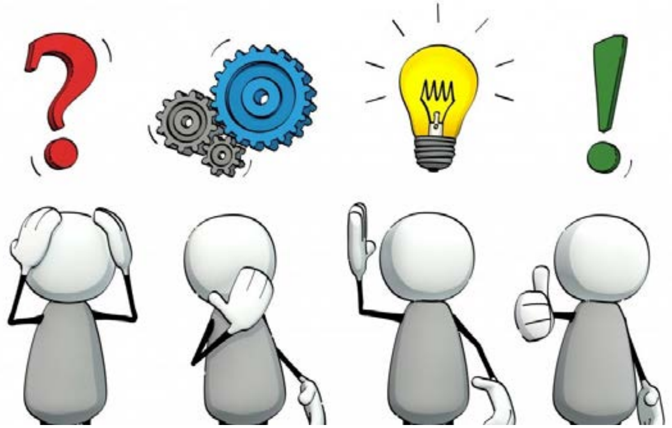

5. Conclusion

- ✓ Continuous innovation
- ✓ Investment
- ✓ Regulatory support

- As optimization technologies are increasingly adopted, higher electricity demands are also likely and must be factored into any total emission reduction potential.
- Factors essential to success include considerable vision, an understanding of the lead-time required for industry-wide adoption of new approaches, and a near-term shift towards systems-thinking about maritime decarbonizing.

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Thank You!

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