



The shipping industry on its way to decarbonisation

Naples 01 October 2020

Summary



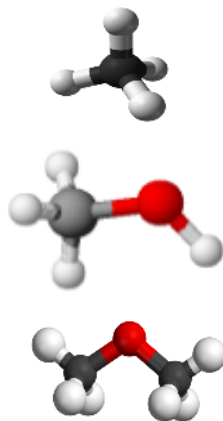
THE TARGET: strong emission reduction

- Which are the most promising alternative fuels for the near future and in the long term?
- Which are the barriers to overcome?
- Are alternative fuels alone a possible solution?
- Actual regulatory framework on CO₂ and GHG emission as per IMO document and discussions

Most Promising Fuels

Last decade 2010 - 20

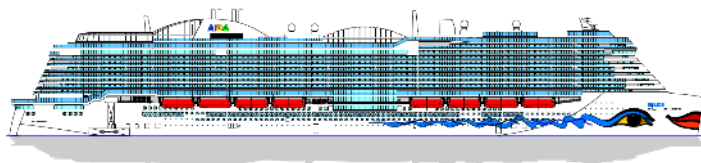
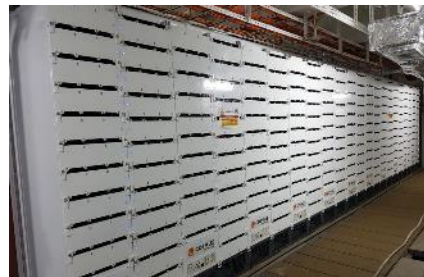
- **LNG Liquefied Natural Gas**
- LPG Liquefied Petroleum Gas
- **Methanol**
- Ethanol
- DME Di-Methyl-Ether
- Synthetic Diesel (Gas To Liquid, Coal To Liquid)
- RME Raps-Methyl-Ether
- Bio oils



... in the future

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

Where we are?



Barriers to overcome

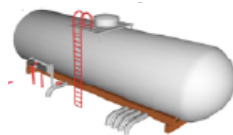
- Availability
- Safety
- Health Impact
- Environmental impact
- Technical issues
- Logistic chain
- Cost
- Rule requirement availability
- Social perception
- ...

Decarbonization = Alternative Fuels + ...?

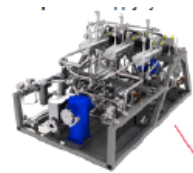


| FUEL TYPE | Energy Density [MJ/kg] | Volumetric Energy Density [GJ/m ³] | Storage Pressure [bar] | Storage Temperature [°C] |
|---------------------|------------------------|--|------------------------|--------------------------|
| Marine Gas Oil | 42,8 | 36,6 | Atm | Ambient |
| Liquid Methane | 50.0 | 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 |

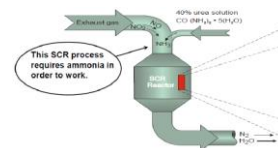
Ammonia & Hydrogen



Fuel Tank



Fuel Preparation



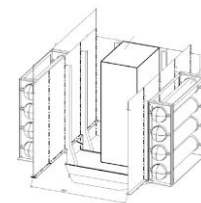
NOx abatement

Bottles Rack
for MH



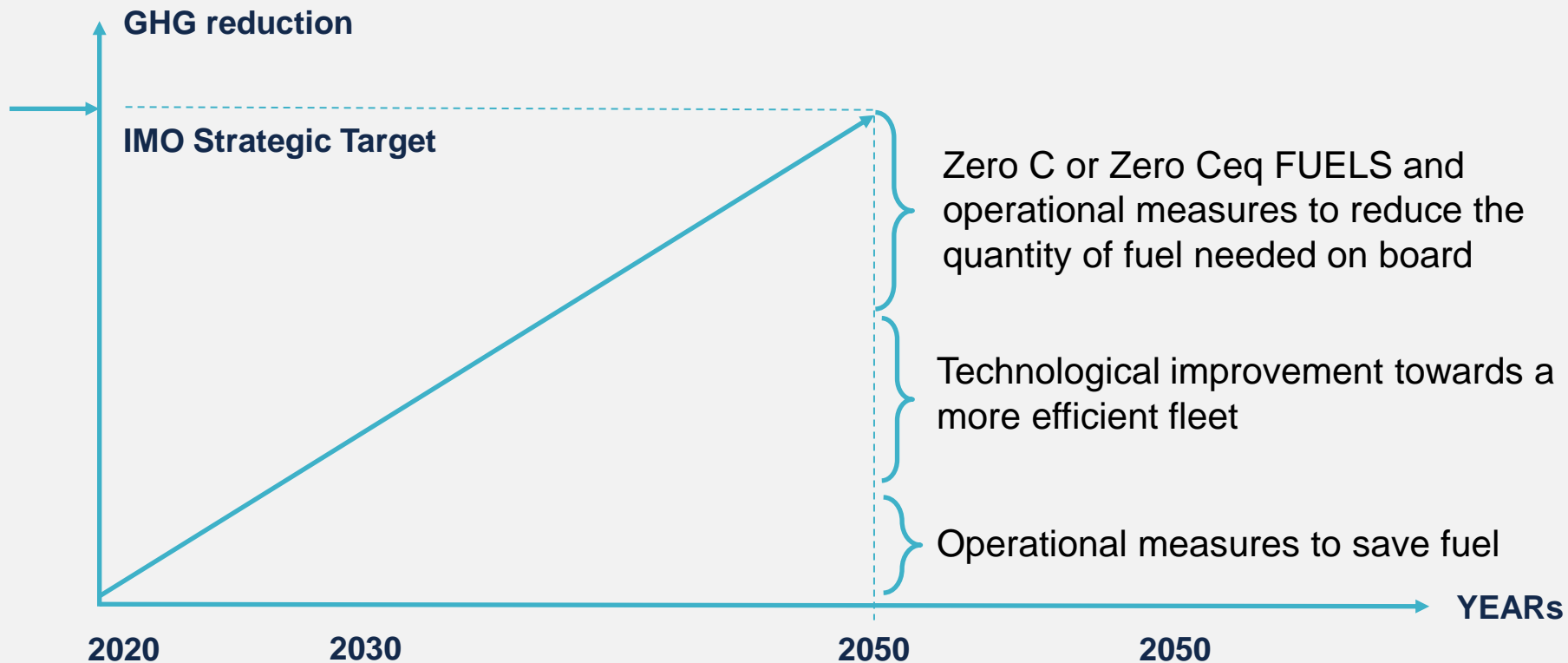
I.C.E.

Fuel Cell Rack
120 kW (4x30
kW)



On board
arrangement

Efficiency and Fuel Saving



The regulatory framework

IMO Strategy



IMO Initial Strategy on reduction of GHG emissions from ships (Res. MEPC.304(72))

- **Total annual GHG emissions** to **50%** by **2050** compared to those in 2008
- **CO₂ emissions per transport work**, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008

The IMO strategy will be revised on the basis of the Fourth IMO GHG Study and the fuel oil consumption data collected during the 2019-2021 period.

Concrete proposals to improve the **operational energy efficiency of existing ships**, with a view to developing draft MARPOL amendments (EEXI, SEEMP, CII). Next MEPC 75 (Nov. 2020) is the **latest opportunity for IMO** to adopt any mandatory **short-term measures** applicable from 1 January 2023.

The regulatory framework

Ongoing discussion on fuel cell and hydrogen



Due to the postponement of IMO meeting during 2020:

- The **Interim Guidelines for the safety of ships using methyl/ethyl alcohol as fuel** are expected to be approved in November 2020
- The **Interim guidelines for the safety of ships using fuel cell power installations** are expected to be finalized in 2021 and approved in 2022

At the moment, there is no mention to the use of hydrogen and other fuels due to the lack of concrete agreed proposals.





Further info @
andrea.cogliolo@rina.org
pieter.vandenouden@rina.org

Make it sure, make it simple.