Energy efficiency challenges in shipping post 2020

MADRID LNG & SHIPPING FORUM
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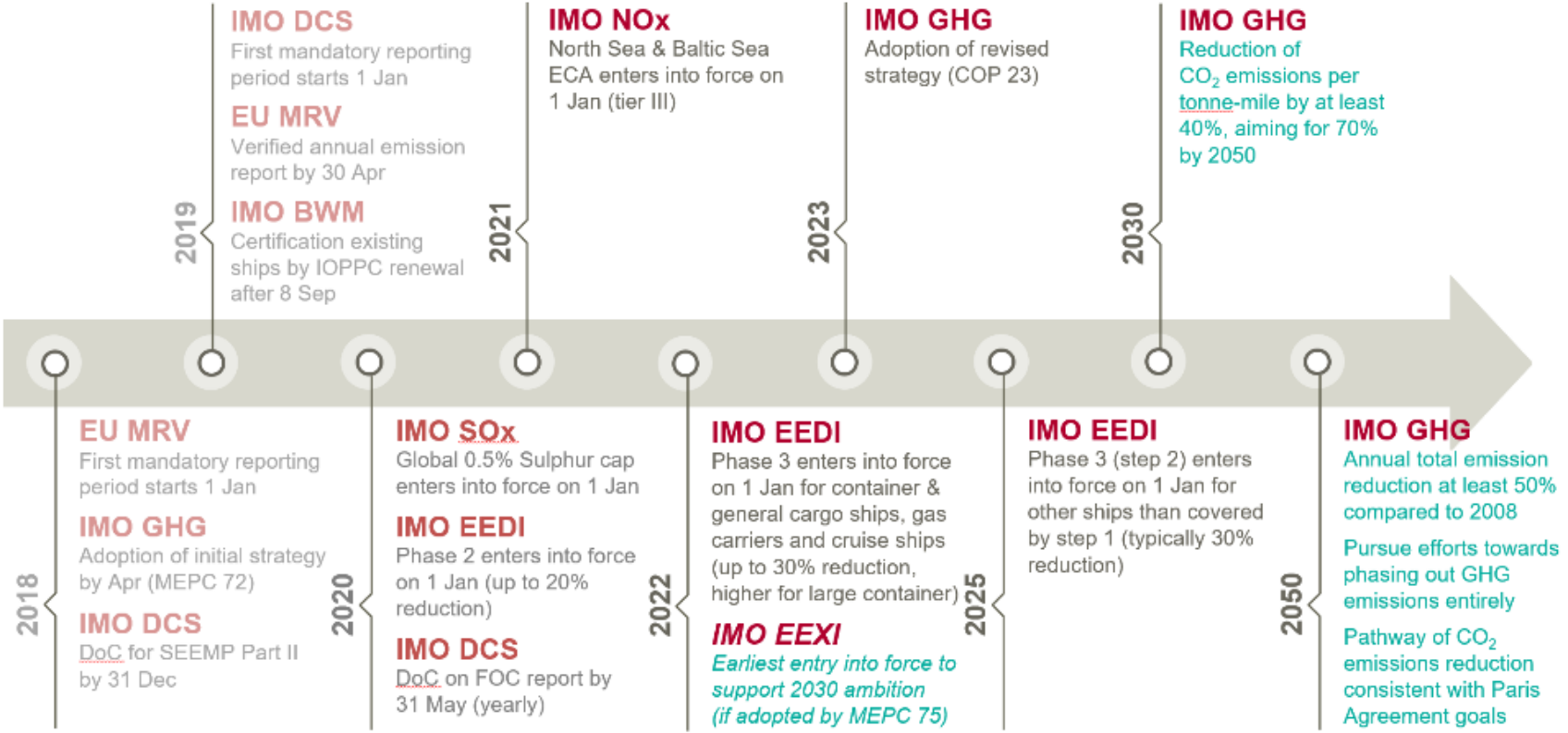
The Most Challenging Scenario Ever

Focus on Air Emissions



Towards 2050

Alternative fuels outlook

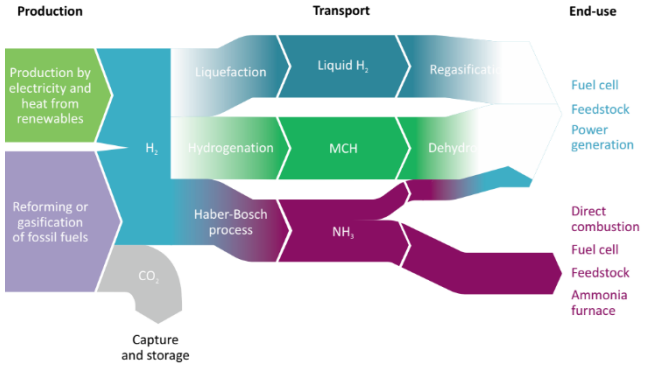
→ LNG as fuel going forward

- Not a question of if, but when...
  - Only mature solution directly compliant with all current regulations
  - Real use cases show LNG now cheaper than IFO380 (based on equivalent energy)
  - Rapidly expanding bunkering infrastructure
- Long term viability as biogas or synthetic methane/ substitute natural gas (SNG), in combination with carbon capture and/or direct LNG fuel cells
  - Combined cycle diesel/fuel cell with carbon capture could reduce CO_2 emissions by 80%

Fuel type	Bunker US$/t	Logistics US$/t	MWh/t (LHV)	Total cost US$/MWh	IFO380 eq. ratio
IFO380 (HSFO)	392	20	11.25	37	1
ULSFO (0.1%)	560	20	11.25	52	1.41
LSMGO (0.1%)	590	20	11.86	51	1.40
LNG (real case 1)	320	150	13.68	34	0.94
LNG (real case 2)	280	117	13.68	29	0.79

→ Other alternative fuels

- LPG & methanol/ethanol technically feasible, but not carbon neutral while lacking bunkering infrastructure
- Green (m)ethanol can be produced from black liquor
- Growing availability of biofuels, but high demand competition (other industries) & sustainability issues
- Hydrogen/ammonia carbon-free, but in R&D phase
- Ammonia has higher potential for shipping due to easier storage & handling (even if toxic & caustic)



Short Term Challenge

What to choose TODAY?

→ Technology options

- LNG suitable as clean transition fuel
  - Proven track record, expanding distribution
  - Step in right direction for CO_2/GHG reduction (despite fossil fuel, methane slip)
  - Easy switch to carbon neutral “drop-in fuels” (biogas, synthetic methane/SNG)
- Fully electric (battery powered) ships on short transit routes with recharging facilities (ferries)
- Electric-hybrid ships suitable for vessels with large power variations (OSV, tugs, cruise)
- Wind assisted propulsion (WAP) suitable to reduce Energy Efficiency Design Index (EEDI) and emissions (weather/routing dependent)
- Further energy efficiency design optimization of hull/ appendices and systems, e.g. hull lines, air lubrication, power distribution (DC grid), waste heat recovery (WHR), etc. (gradual improvement)

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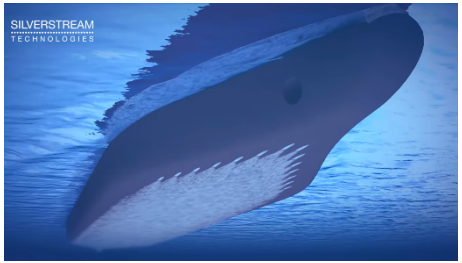
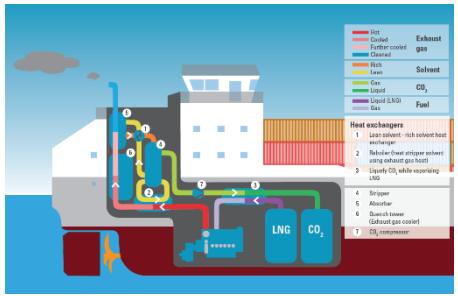
Means to Improve Efficiency

A close look

- → Air lubrication systems (ALS)
  - Still limited experience in ships but existing
- → Wind assisted propulsion (WAP)
  - Few companies involved but different technologies available: Sail, kite and Flettner Rotor
- → Fuel Cells
- → Energy Storage Systems
- → CO_2 capture on board. It is a dream?
  - CO_2 exhaust gas emissions capture
  - Treatment and liquefaction of the CO_2 on board
  - Discharge/disposal to shore





Beyond 2020

Multiple pathways, horses for courses

→ No silver bullet

- Best solution will depend on ship type, size and operational profile (speed, route, range, load profile)
- Transition to decarbonized industry will take time
  - Co-existence of different fuels & power systems
  - Hybrid solutions (electric-hybrid, wind/solar assisted propulsion/power)
- Both technical and operational measures needed
- Incentives are key: shipping is a reflection of society

→ Next decade will be crucial

- Collective action/investment needed to develop technical means and fuel distribution networks
- Alternative fuels: LNG, biofuel (diesel, gas), methanol, methane/SNG, hydrogen/ammonia
- Alternative power systems: fuel cells, batteries, combined cycle (e.g. diesel-carbonate fuel cell)
- BV involved in R&D projects to shape the future
  - New/updated rules/notations and guidelines
  - Working in partnership with key stakeholders

Thank you for your attention

Questions & Answers