

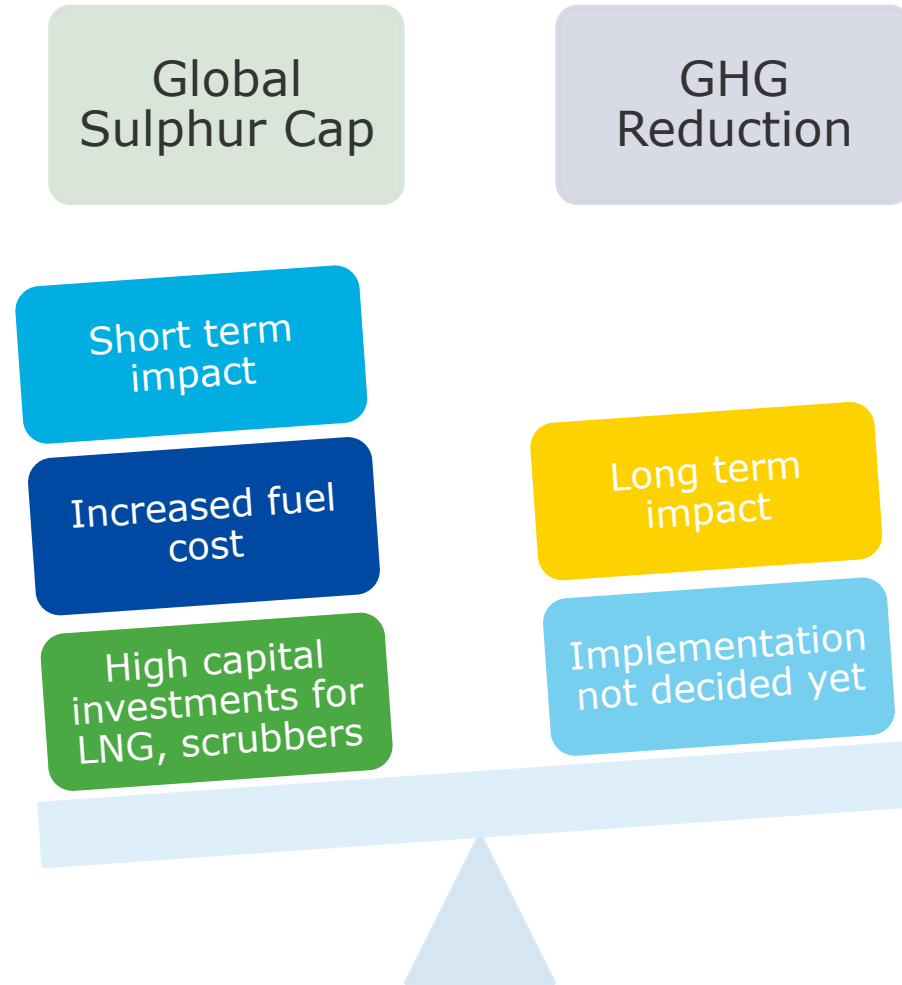
Update on the forthcoming regulations on GHG and compliance options

The road to 2030-2050 and beyond

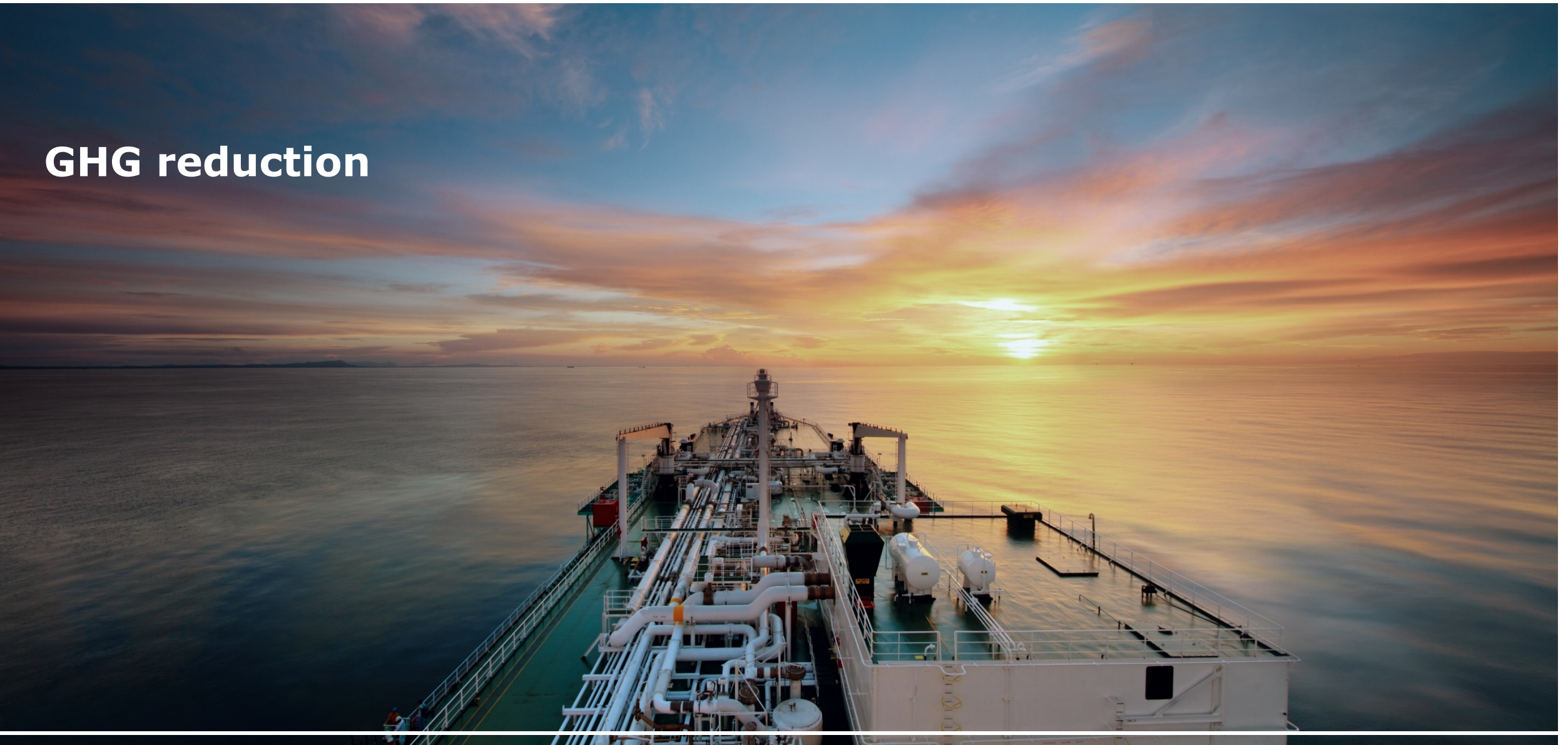
George Teriakidis

12 November 2019

Short vs. Long Term Challenges – Global Sulphur Cap vs. Greenhouse Gas Reduction Targets

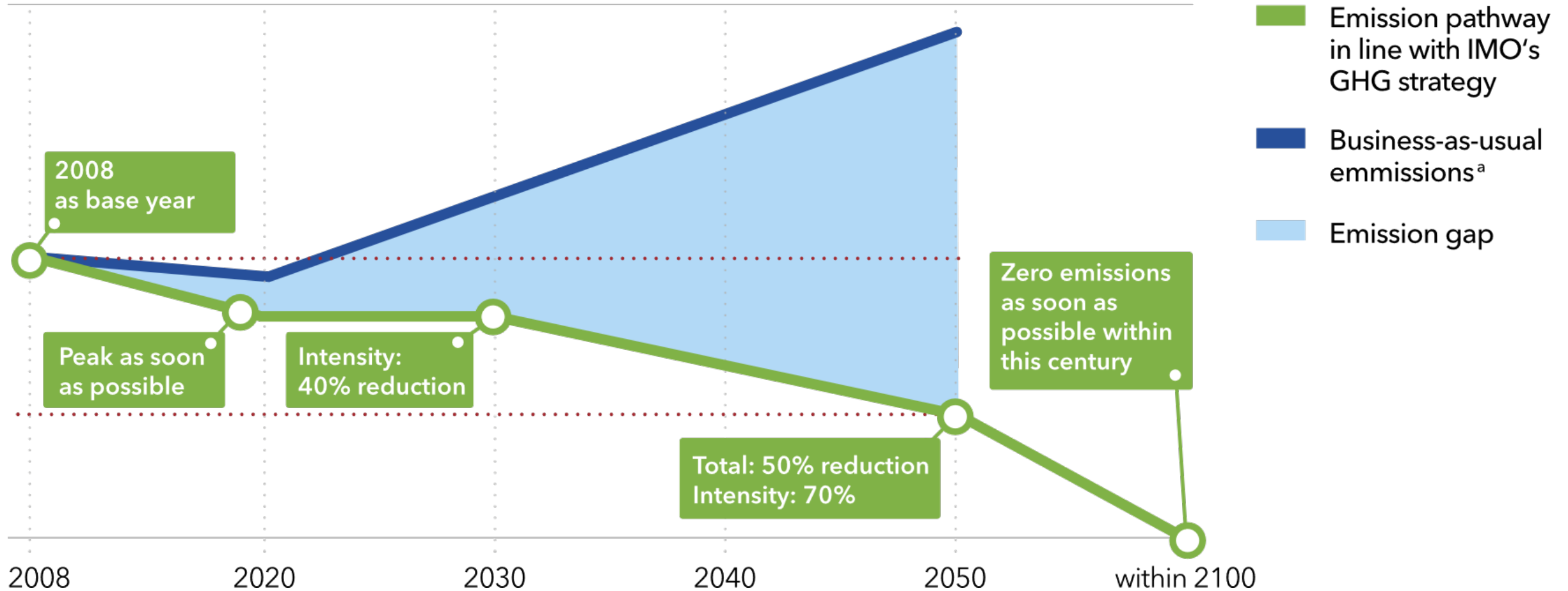


GHG reduction



IMO GHG strategy

Units: GHG emissions



Decarbonization options for shipping



LOGISTICS AND DIGITALIZATION

■ Significant **GHG reduction** can be achieved by technical and operational measures

■ **Up to 100%** GHG reduction can only be achieved with Alternative fuels. Barriers to implementation includes:

- Cost
- Availability and infrastructure
- Onboard storage

>20%



HYDRODYNAMICS

10%-15%



MACHINERY

5%-20%



FUELS AND ENERGY SOURCES

0%-100%

Other fuel options

LPG

- 2017: no activity
- 2019:
 - 4 LPG carriers -retrofits
 - 7 new LPG carriers ordered

DNV GL just published class rules for LPG as a fuel

Methanol

- 1 passenger vessel
- 7 methanol tankers
- 5 new methanol tankers orderd
- Main challenge:
Fuel cost

DNV GL low flashpoint liquid fuel rules address methanol

Hydrogen

- 2 Passenger ferries ordered
- Main challenges:
 - CapEx
 - Fuel cost
 - Storage space
- Mainly for short-sea shipping

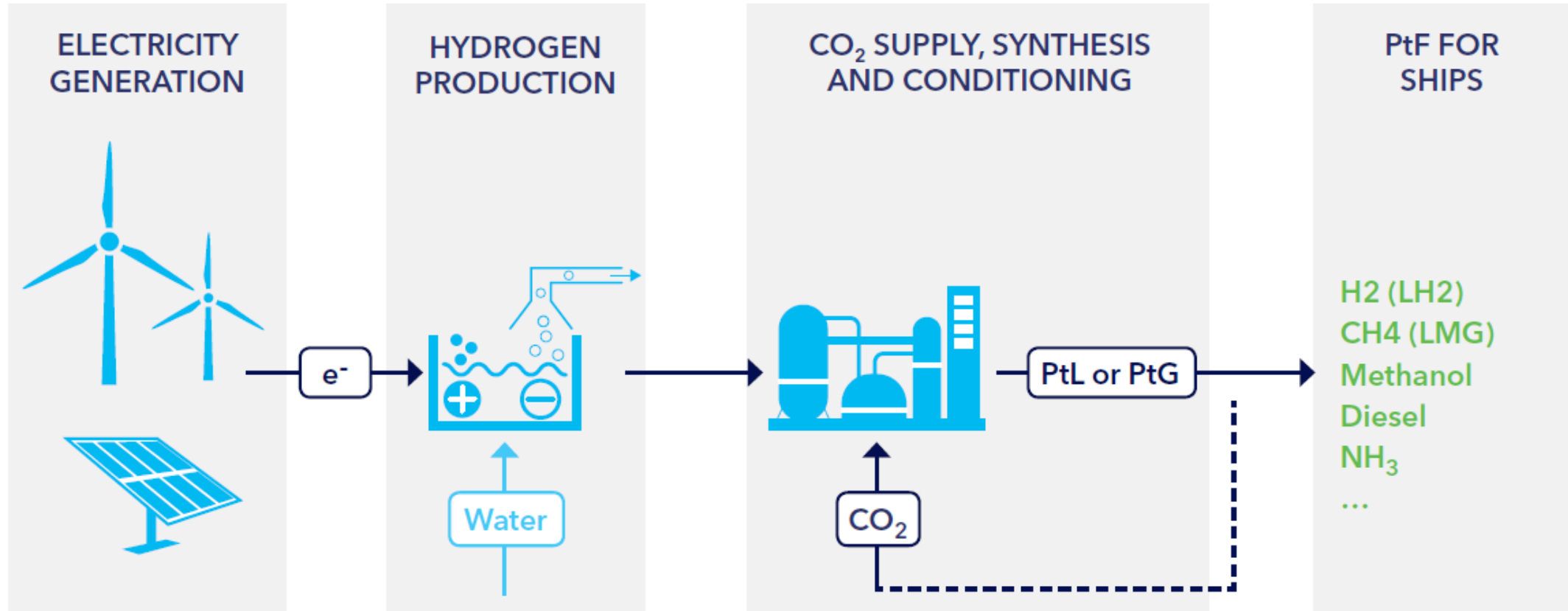
DNV GL is working with industry partners to remove barriers for hydrogen and ammonia

Ammonia

- Can be used in internal combustion engines
- Suitable for deep-sea shipping
- Easy to store
- Main challenge:
Toxic and corrosive
- Ammonia tankers already interested

How will fuels be produced?

Power to Liquid (PtL), Power to Gas (PtG) = Power to Fuel (PtoF)



The Alternative Fuel Barrier Dashboard:

Indicative status of key barriers for selected alternative fuels

Barriers exist on many levels for different fuels.

Adoption of alternative fuels depend on

- demand from charters/cargo owners,
- proactive regulators, procurement policies and
- incentive schemes and international cooperation

Designer, yard, engine/equipment supplier, shipowner, cargo owner



Feedstock suppliers, fuel suppliers, authorities



Fuel supplier, authorities, terminals, ports



IMO, Class, regional, national



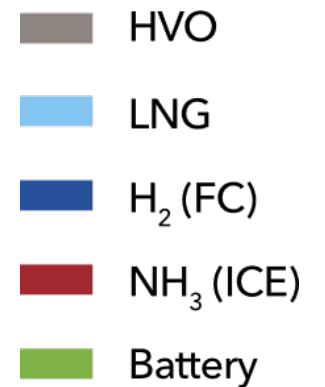
Equipment supplier, designer, yard, incentive schemes



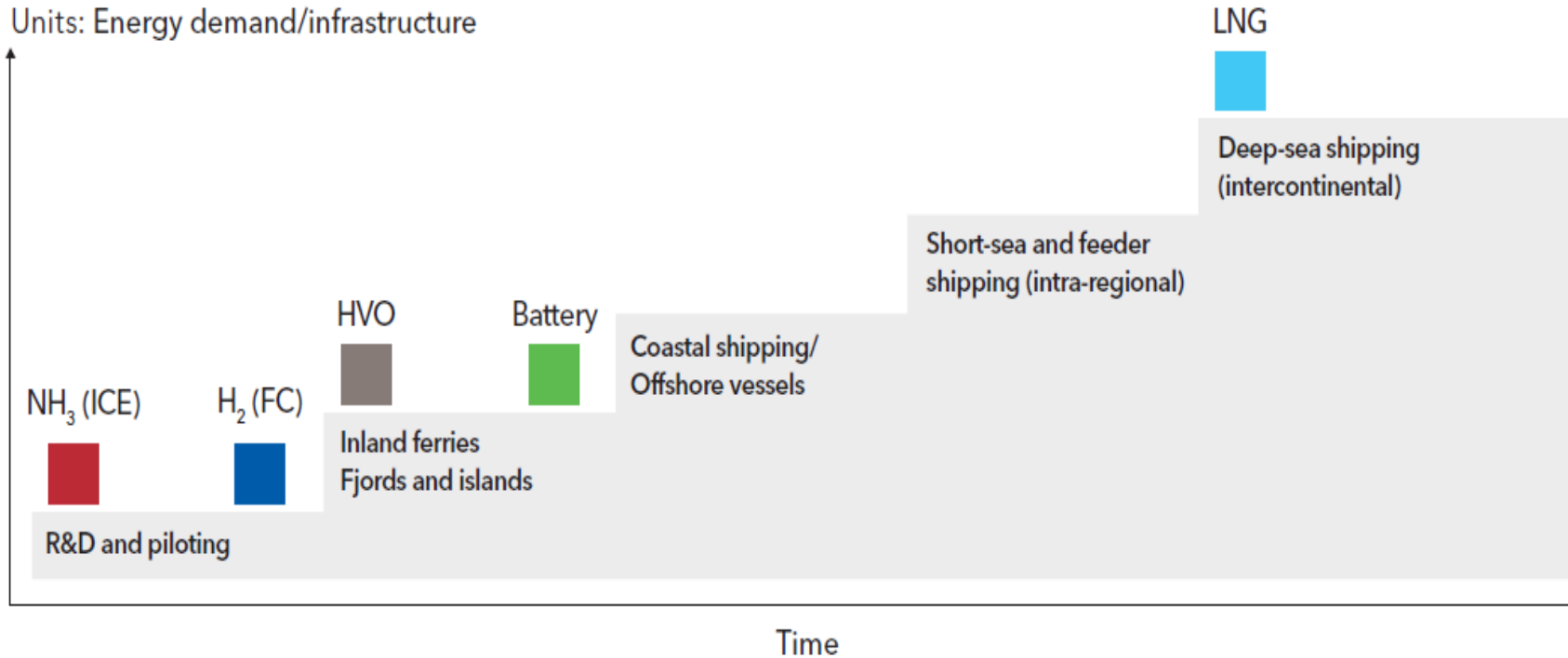
Feedstock supplier, fuel suppliers, competition authorities



R&D, designer



Alternative fuels must evolve over time to increase market penetration



Gradual steps allow for:

- **maturing** of technology
- scaling of supply and **infrastructure**

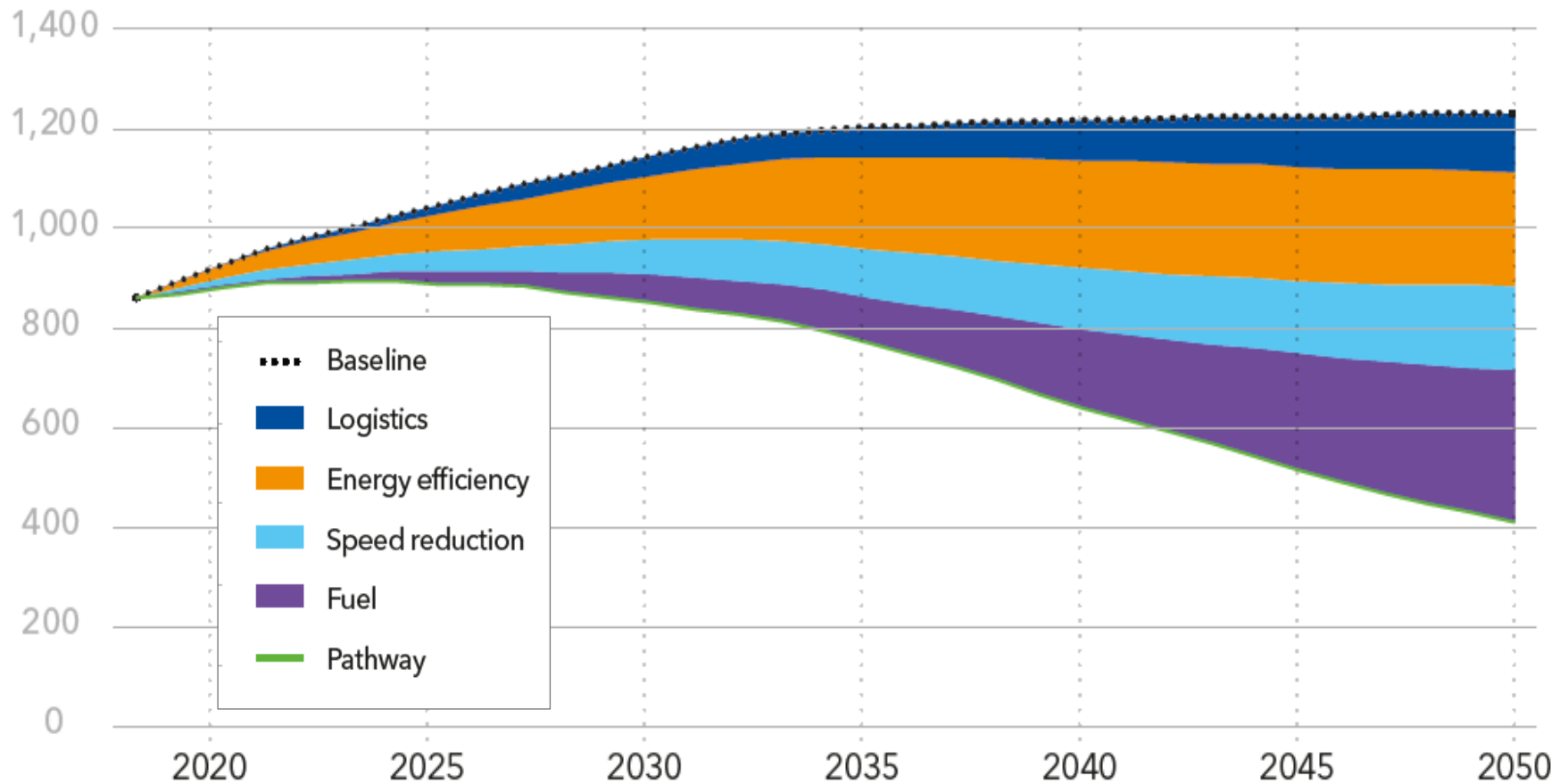
Not all the options have the potential to reach the deep-sea stage, mainly due to limited energy density

It took LNG around 20 years to climb all steps. To reach the IMO targets, carbon-neutral fuels must mature faster!

CO₂ emissions towards 2050 in the 'Design requirements' pathway

- Both the **design** and **operational** focused regulatory pathways fulfill the IMO ambitions:
 - New fuels, alongside energy efficiency, will play a key role.
 - Carbon-neutral fuels need to supply 30%–40% of the total energy in 2050.

Units: CO₂ emissions (Mt)

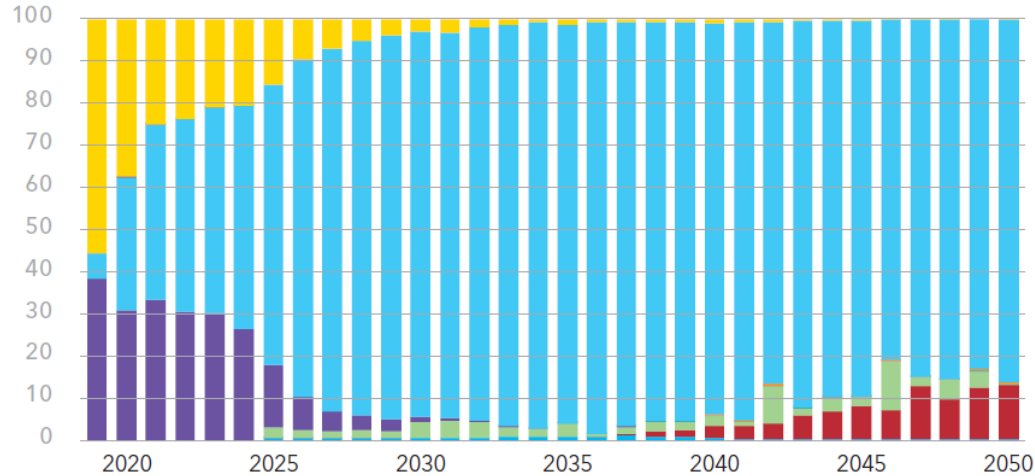


Several ways to meet the IMO targets - policy matters

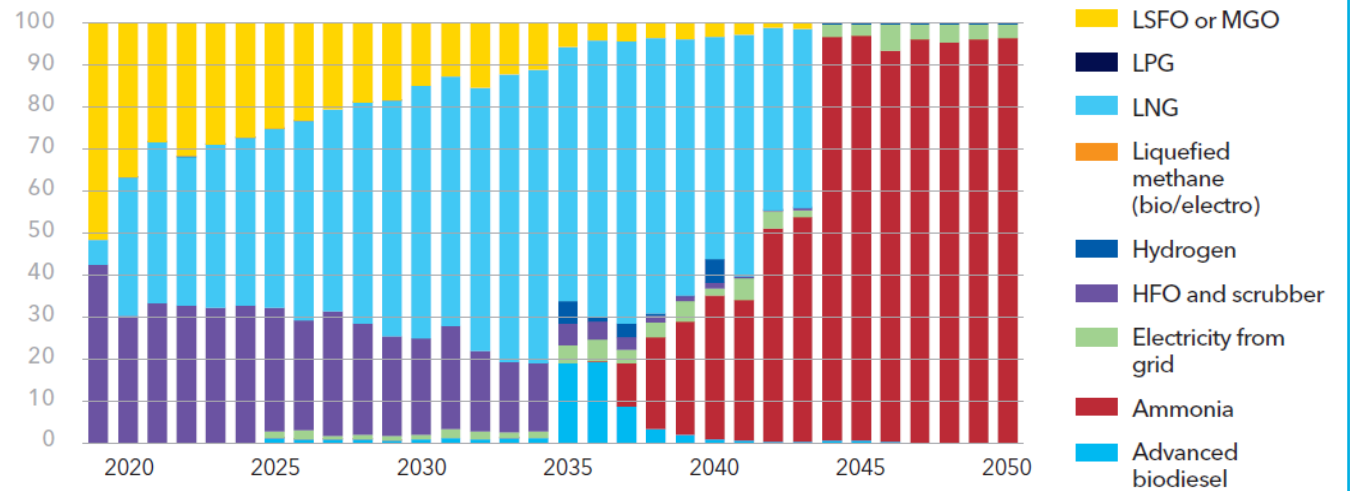
Focusing on **operational requirements**, the uptake of alternative fuel for **newbuilding's** is more gradual

If main focus is on **design requirements**, the shift in fuel and fuel-converter technology on **newbuildings** is very abrupt

Units: Percentage (%)



Units: Percentage (%)



LNG play an important role – transition to carbon neutral fuels will be needed

Key takeaways



Short Term vs Long Term targets to meet

Fuel & technology cost: main deciding factor

Current uptake of LNG, LPG is a basis for transition into a low-carbon future

Compliance through combination of solutions – no silver-bullet today

Thank you!

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