

Vessel Operations – Greening ships

IRSO Conference, Hobart October 2019

10 October 2019

Topics covered today

- The need to be green
- Sector drivers
- Alternative fuels
- New approach
- Application to RV segment
- Conclusions



OUR PURPOSE

TO SAFEGUARD
LIFE, PROPERTY
AND THE ENVIRONMENT

Global reach – local competence

12,000

employees

150+

years

100+

countries

100,000+

customers

5% R&D

of annual revenue

MARITIME



OIL & GAS



ENERGY



**BUSINESS
ASSURANCE**



**DIGITAL
SOLUTIONS**



Technology & Research

Global Shared Services

MARITIME



The world's leading ship and offshore classification society

Global reach

Survey stations in 100+ countries and expertise in all ship and offshore segments

20%

market share of the world's classed ships and mobile offshore units (gross tonnage)

11,700

ships + mobile offshore units in DNV GL Class (280.6 mill GT, Jan 2019)

Quality

Among the top ranking societies in Port State Control performance

Pre-amble

- Greening ships – why the need?
 - Shipping accounts for 2-3% of global emissions but carries 80% of world cargo
 - Supply chain approach by investors
 - An estimated 1,700 major firms around the world make their investment decisions based on pricing carbon
 - Several large Australian companies are making moves to slash their carbon emissions, including Atlassian, ANZ and Rio Tinto
 - ASX-listed companies in the clean energy sector have outperformed the ASX 200 index by more than 70 per cent
 - GHG need to be reduced by cutting consumption
 - IMO ambition by 2050 (ref: 2008 level)
 - 50% lower total GHG
 - 70% lower GHG intensity

Climate change in corporate Australia as businesses go carbon-neutral

By business reporter Rachel Pupazzoni

Posted Thu at 3:38pm



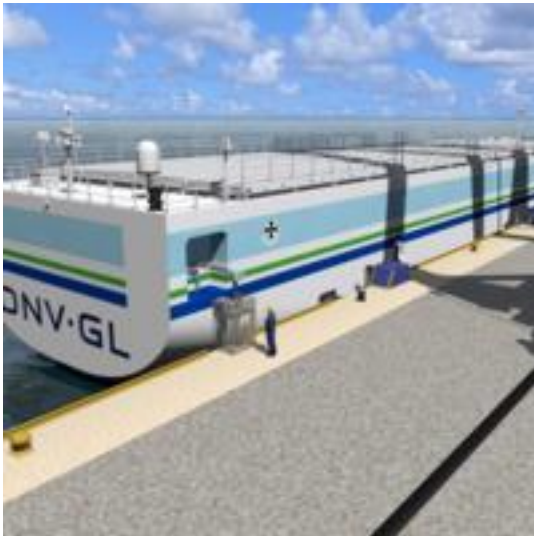
PHOTO: Businesses, big and small, are cutting carbon emissions. (ABC News: Amy Bainbridge)

[Companies](#) [Mining](#) [Paris Agreement](#)

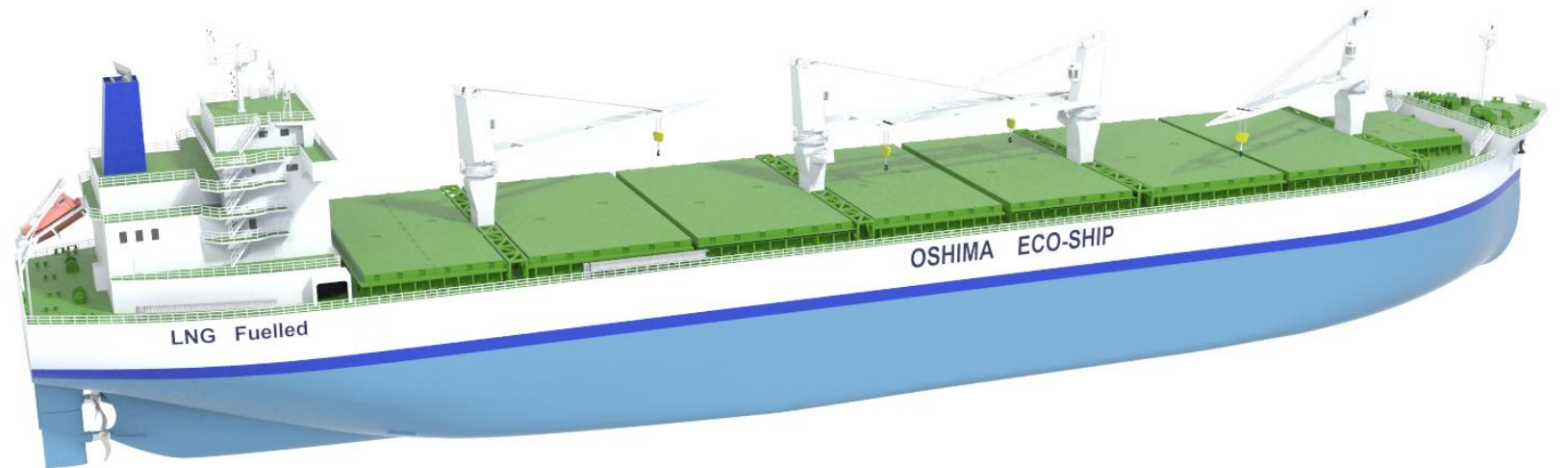
BHP escapes shareholder resolution on emissions

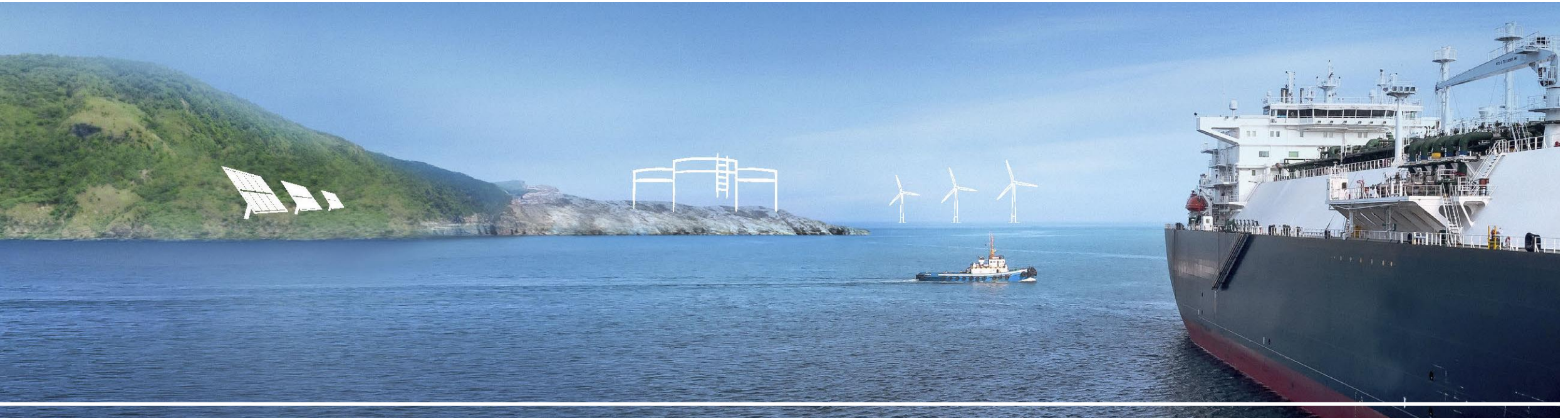
Introduction

- Greening ships – what does it mean?
 - Reducing environmental footprint
 - Cutting waste
 - Increasing efficiency
 - Improving productivity



- Also a competitive advantage
- Financial incentives
 - From 'government'
 - From supply chain
 - From charterers

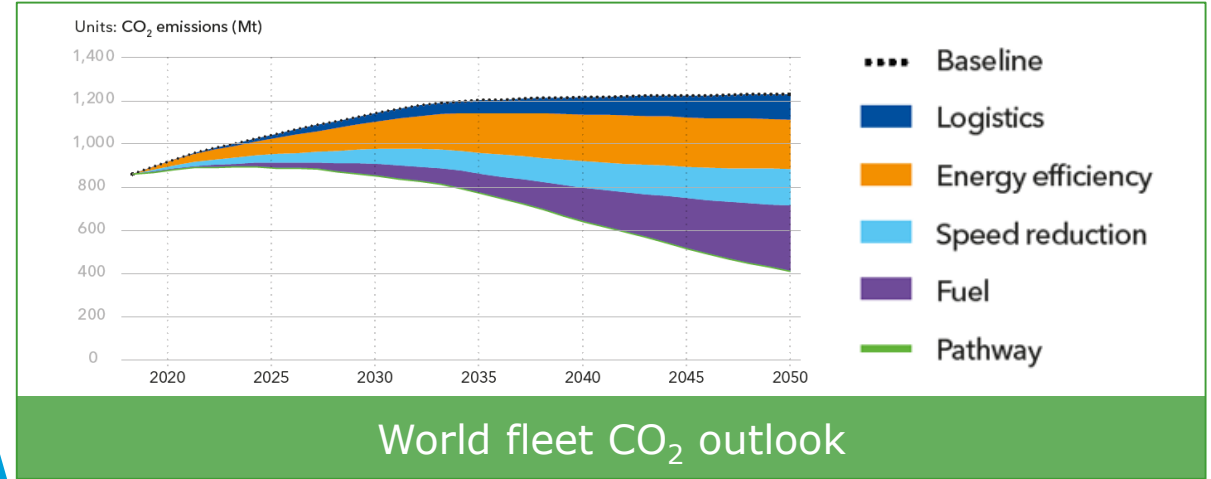
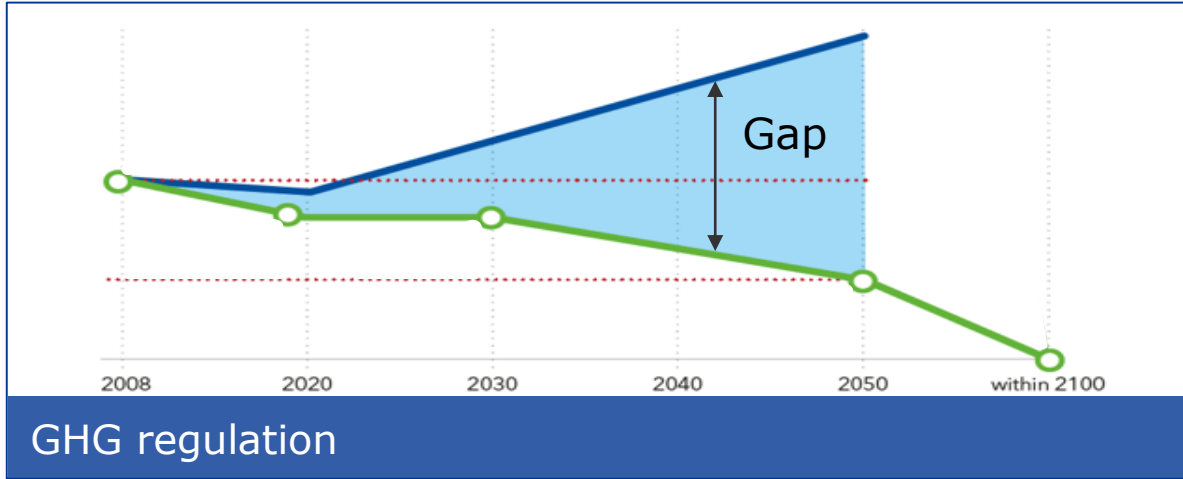




MARITIME FORECAST TO 2050

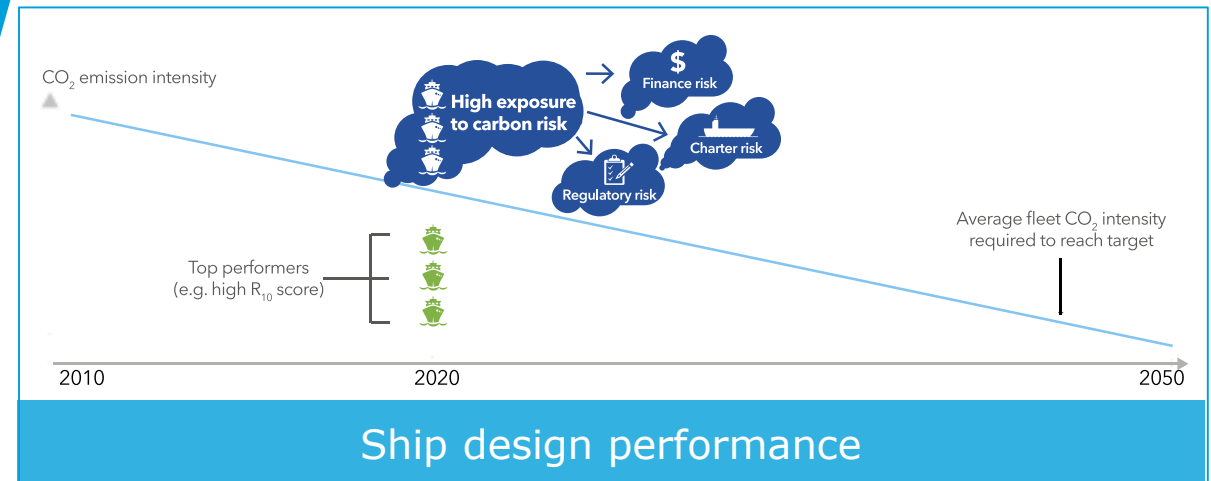
Energy Transition Outlook 2019

Maritime forecast to 2050 in a nutshell



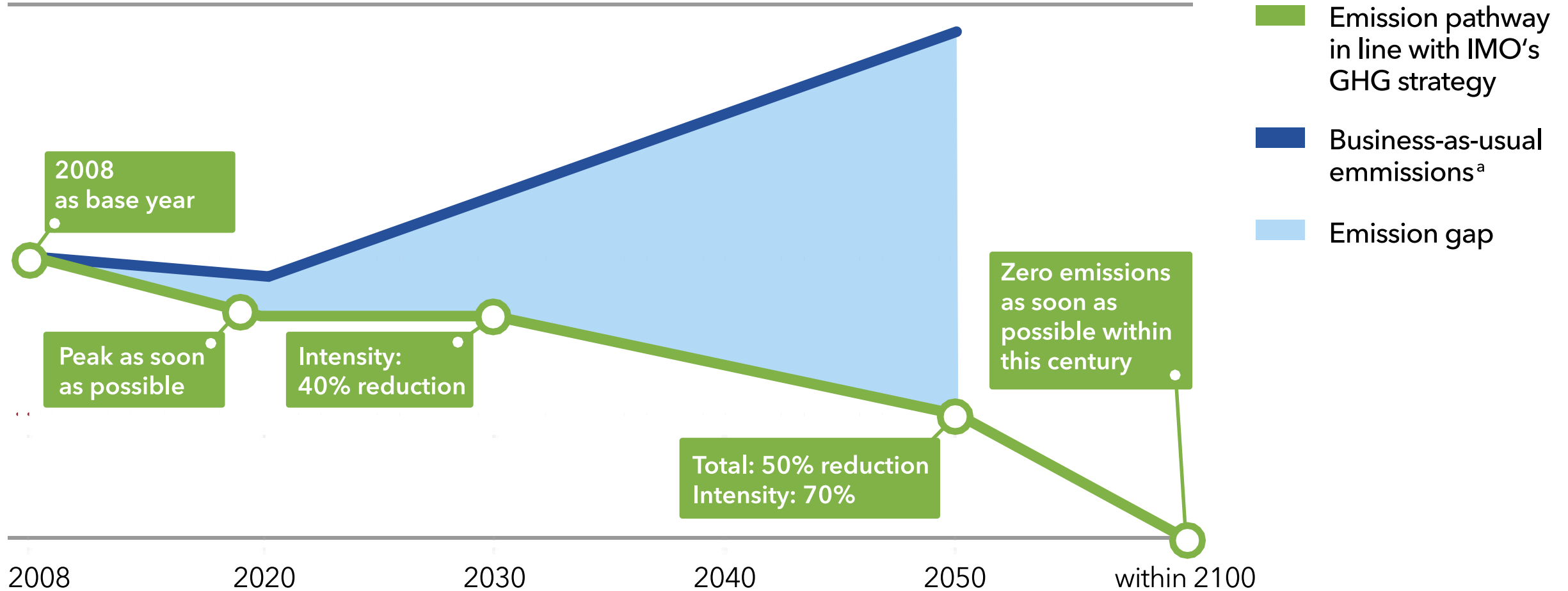
LOGISTICS AND DIGITALIZATION	HYDRODYNAMICS	MACHINERY	FUELS AND ENERGY SOURCES
Speed reduction	Hull coating	Machinery improvements	LNG/LPG
Vessel utilization	Hull-form optimization	Waste heat	Electrification
Vessel size	Air lubrication	Engine de-rating	Biofuel
Alternative routes	Churning	Battery hybridization	Hydrogen

Decarbonization options



The foundation for the outlook is the IMO GHG strategy

Units: GHG emissions



New 'CO₂ Barometer' signals shipping decarbonization is off course

Indicators

1. World fleet CO₂ emissions

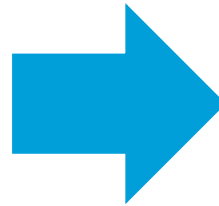
- Slight increase in CO₂ emissions in recent years

2. Alternative fuels uptake

- 0.3% uptake ships in operation
- 6% for newbuildings

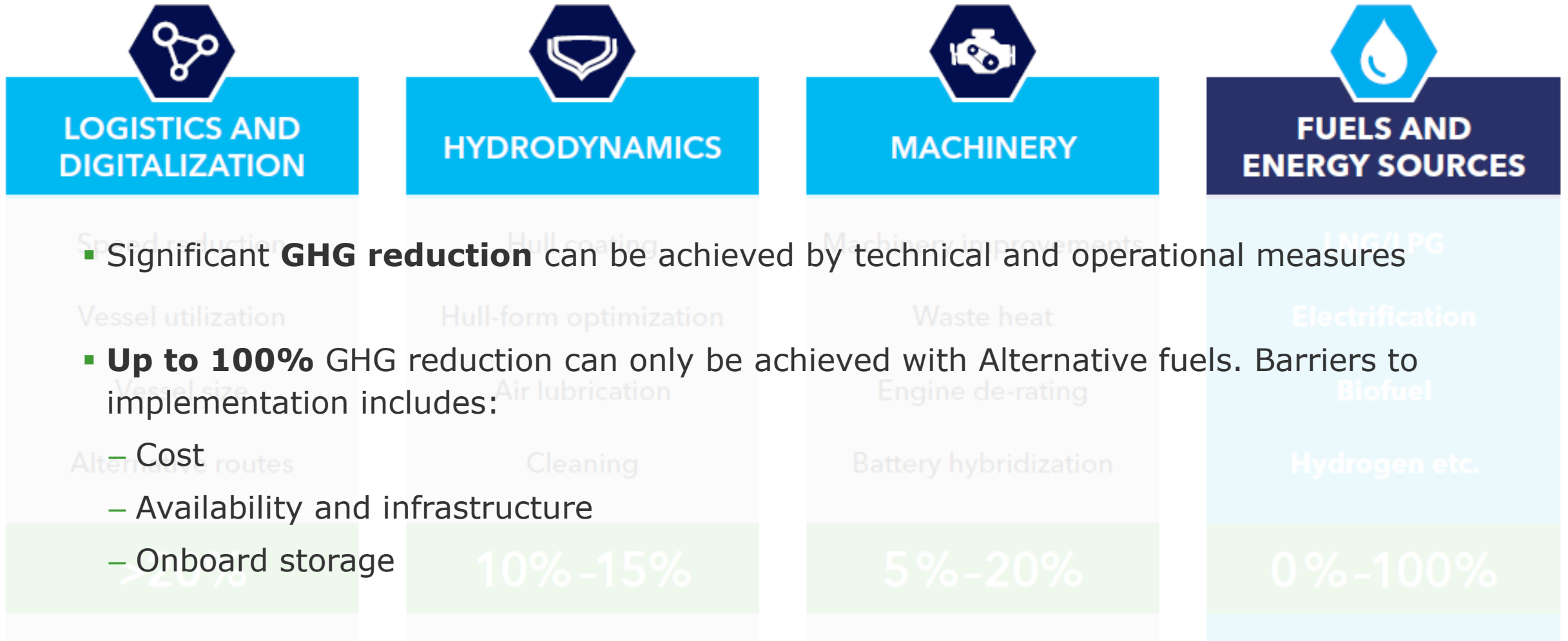
3. Regulation

- Current policy scenario will not meet the IMO ambitions without further policy



The **CO₂ Barometer** provides a high-level decarbonization status in the form of a '**transition pressure level**'

Decarbonization options for shipping



- 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

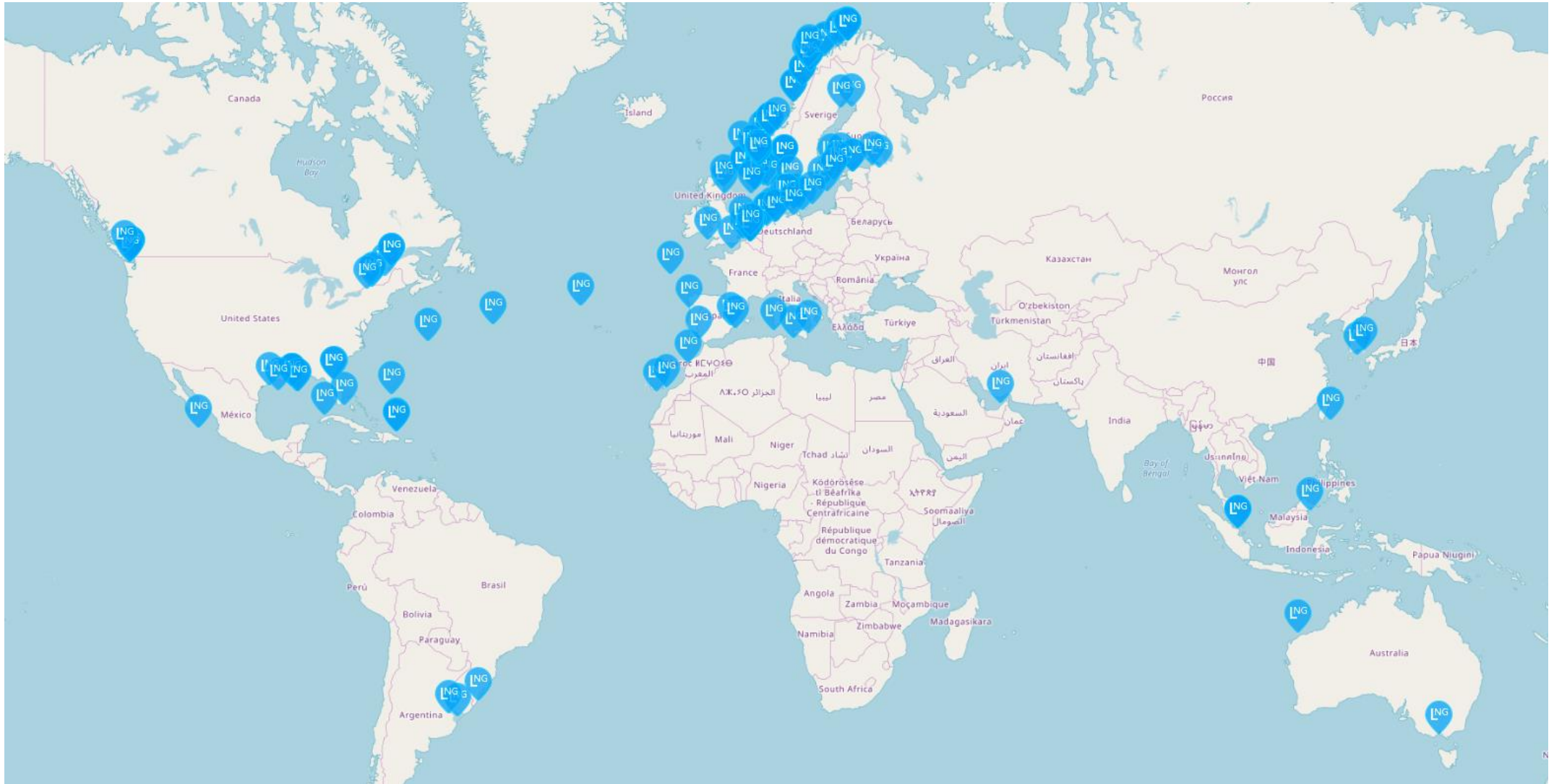
A world map with various icons representing alternative fuels. Blue teardrop-shaped icons labeled 'LNG' are scattered across the map, primarily in the North Atlantic, Europe, and Asia. Green circular icons with a white leaf symbol are placed in North America and Europe. Black circular icons with a white lightning bolt symbol are placed in North America, Europe, and Asia. A white rectangular box with the text 'Alternative Fuels' is centered over the map.

Alternative Fuels

An aerial view of a large industrial port or refinery complex situated along a coastline. The facility includes numerous buildings, storage tanks, and shipping docks. Several large ships are docked at the piers. The surrounding area includes green fields and residential buildings. A white rectangular box with the text 'afi.dnvgl.com' is overlaid on the image.

afi.dnvgl.com

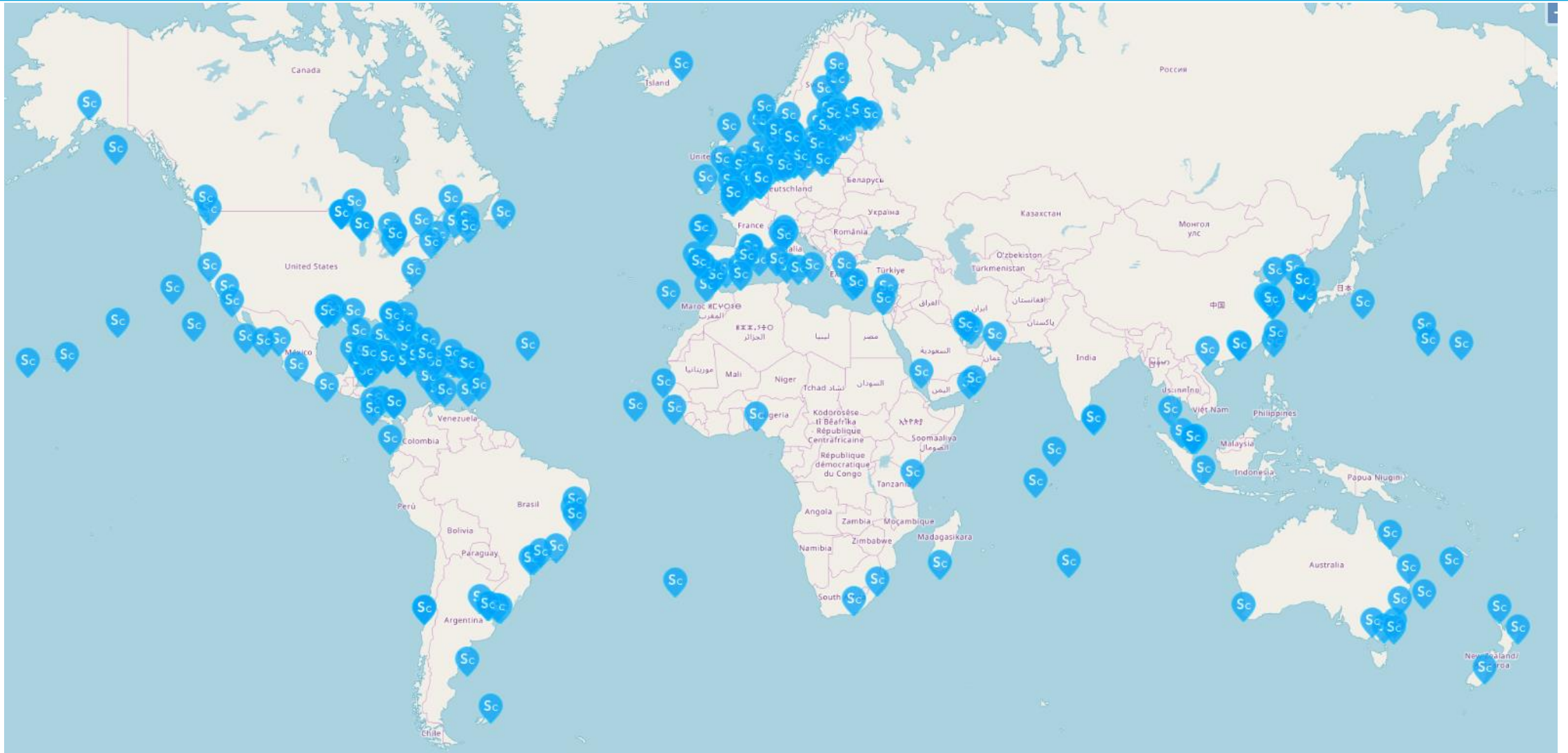
LNG fuelled ships are already covering a large area



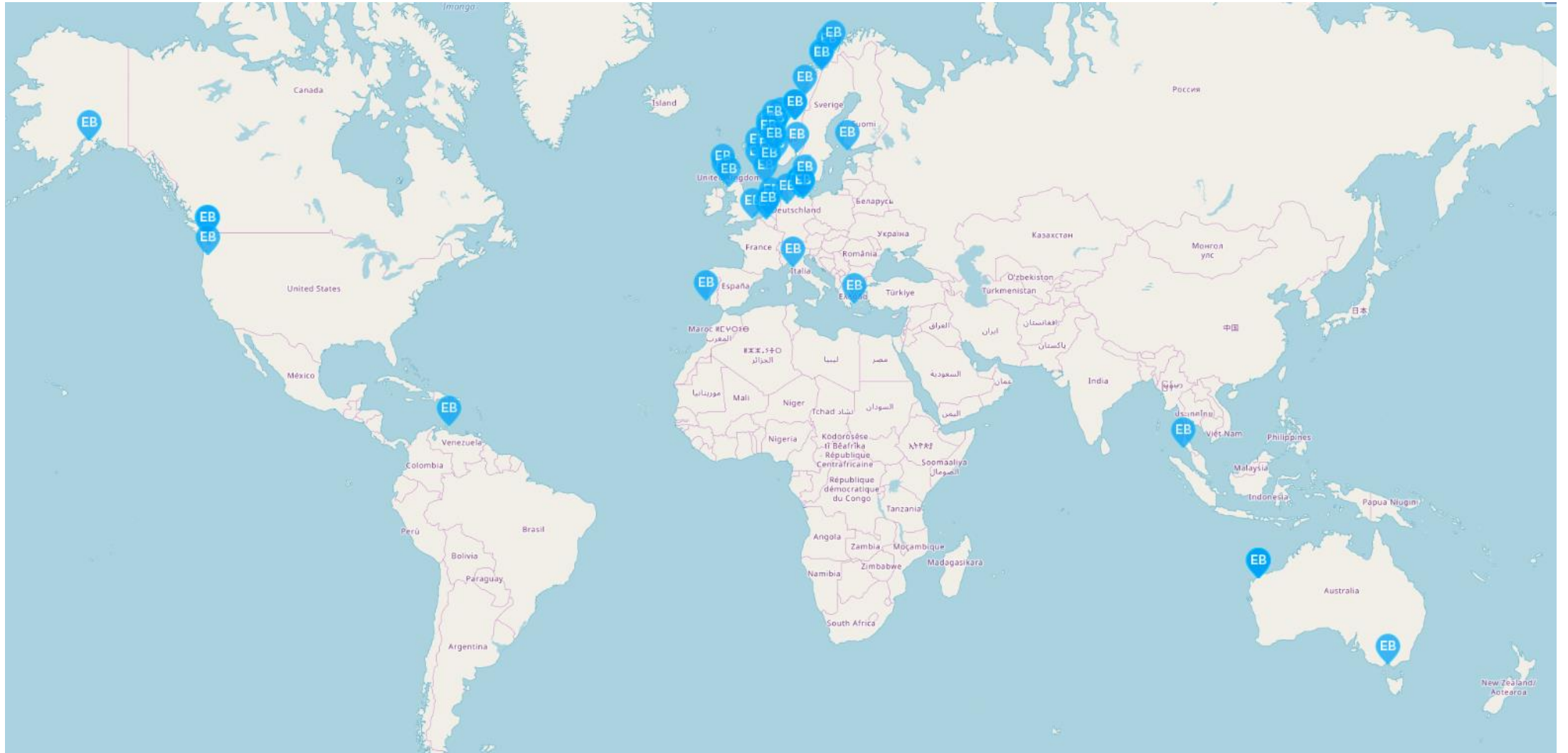
LNG bunkering infrastructure is being developed to supply the growing fleet



AIS-positions of ships with scrubbers installed



AIS-positions of ships with batteries installed



Decarbonization options for shipping - alternative fuels and energy sources

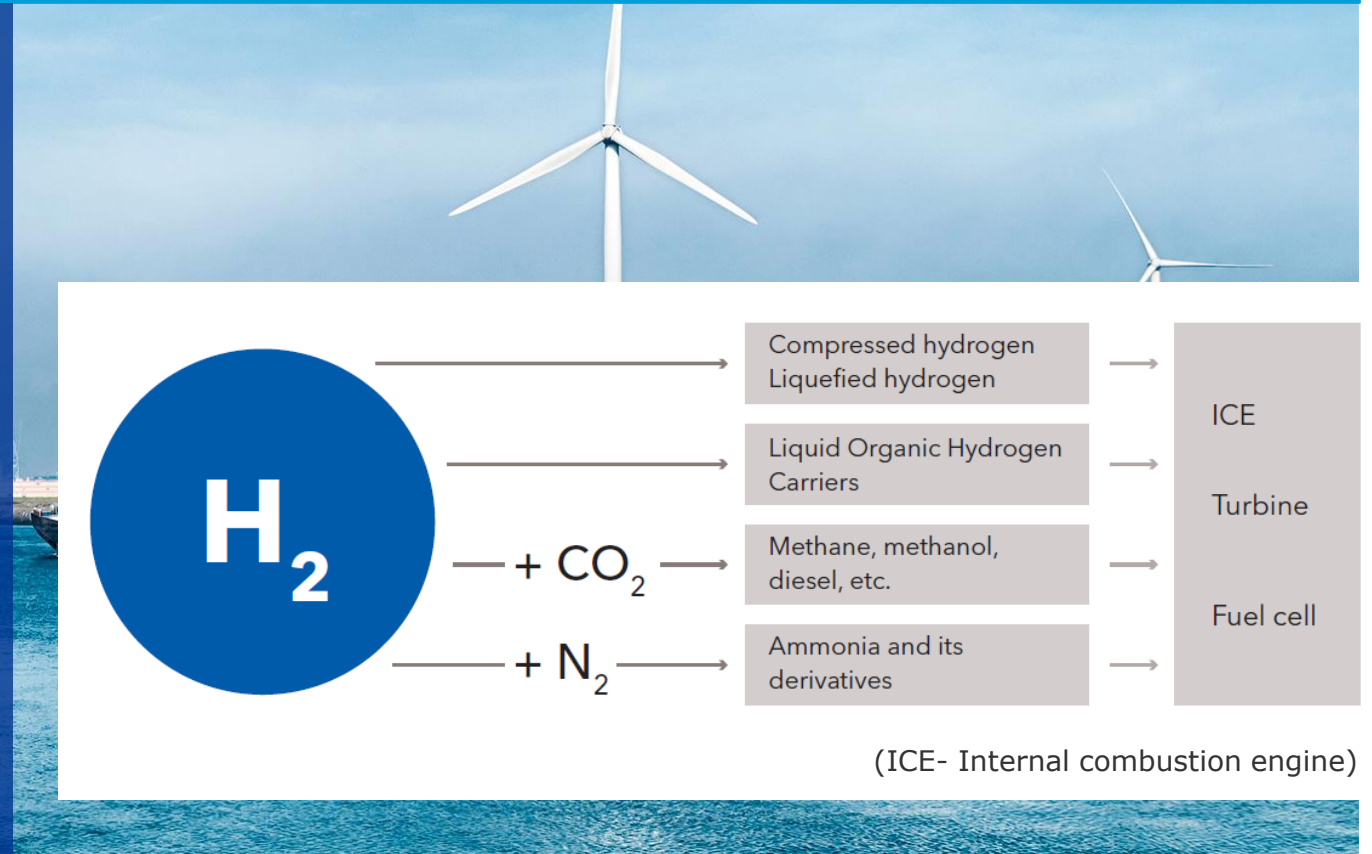
- **Three** main “family types” of fuels, categorized based on energy source.
 - Similar fuels can originate from different energy sources, but lifecycle emissions and cost vary greatly
 - A given energy converter (e.g. combustion engine) may apply many alternative fuels

Fossil-based	Electricity-based	Bio-based
	Battery	
Methane		
Hydrogen/Ammonia		
Diesel		
Other fuels		

Electricity-based fuels

Renewable **electricity** in batteries is energy efficient and carbon free

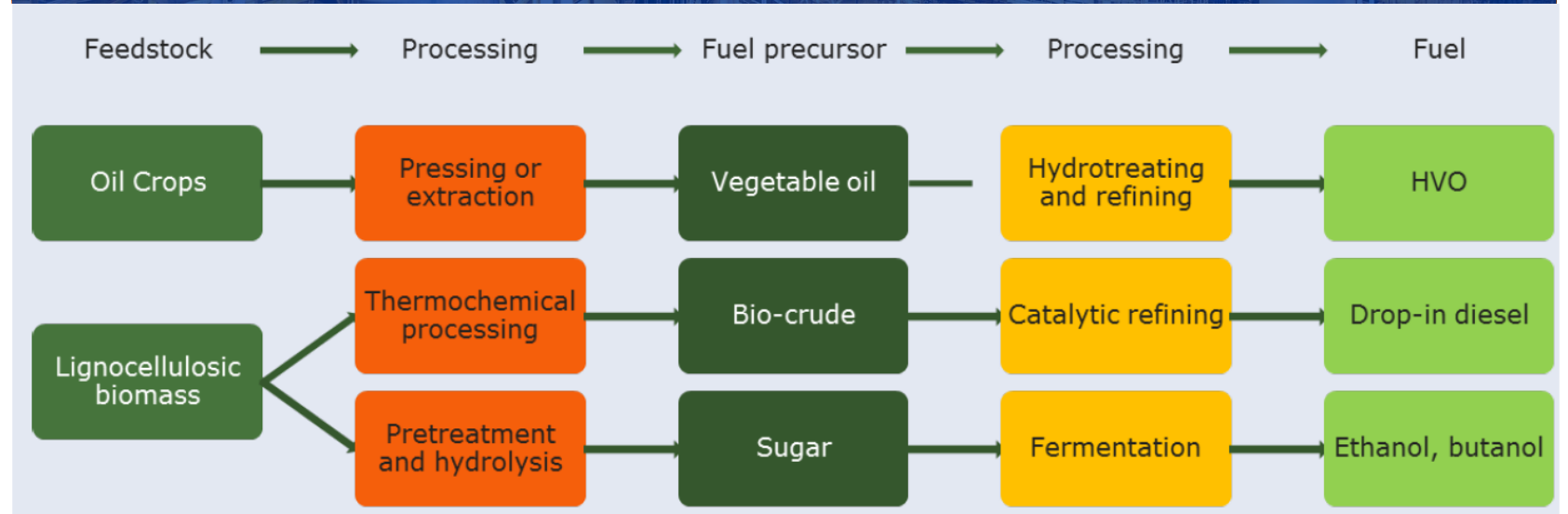
- **Hydrogen** (H_2) is a carbon-free alternative energy carrier produced from:
 - Electrolysis using electricity from renewables or nuclear (i.e. “green” H_2)
 - Reforming natural gas with CCS (i.e. “blue” H_2)
- Carbon neutral fuels can also be produced from renewable **electricity and H_2** (electrofuels):
 - Diesel, methane and methanol (from combining H_2 and CO_2)
 - Ammonia (from combining H_2 and nitrogen)



Biofuels start to gain traction in the market

■ Biofuels

- has carbon emissions at the stack, but the emission is considered as being part of the natural carbon cycle
- exist in gas-phase and liquid-phase
- can be **blended** with conventional fuels or
- used as **drop-in** fuels fully substituting conventional fossil fuels
- challenges relate to price and sustainable production in sufficient volumes



(IEA, 2017)

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



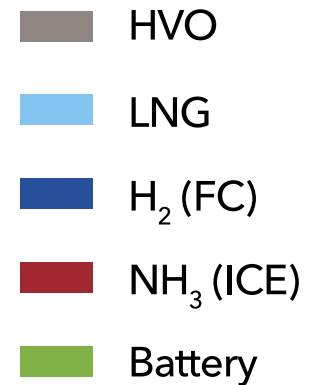
Equipment supplier, designer, yard, incentive schemes



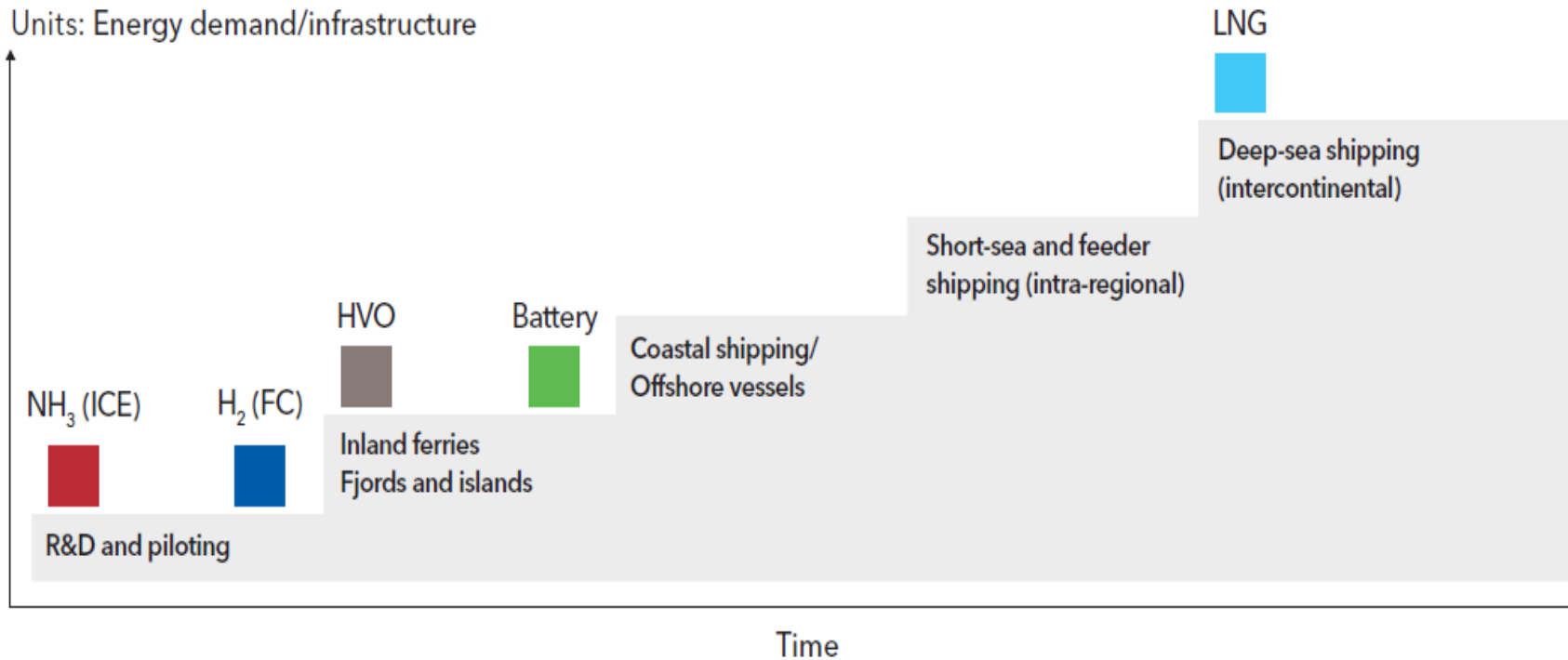
Feedstock supplier, fuel suppliers, competition authorities



R&D, designer



Alternative fuels must evolve over time to increase market penetration



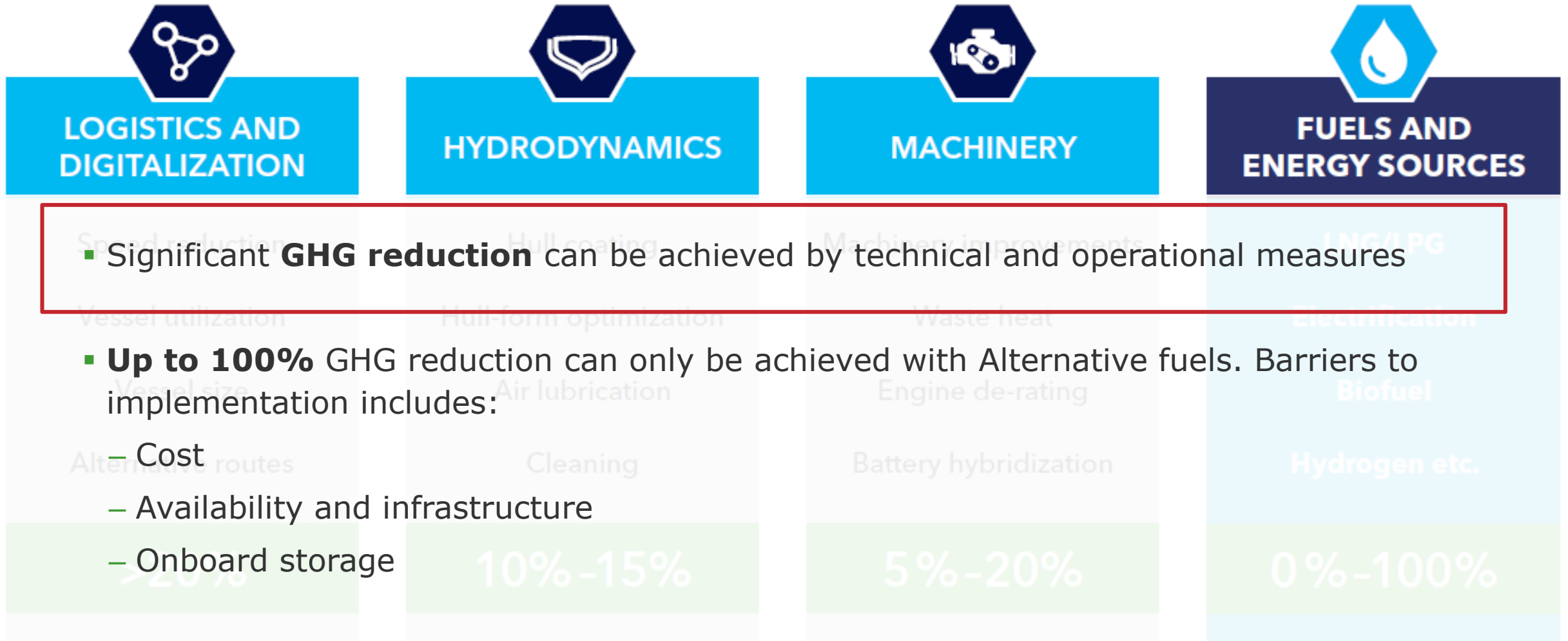
Gradual steps allow for:

- **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!

Decarbonization options for shipping

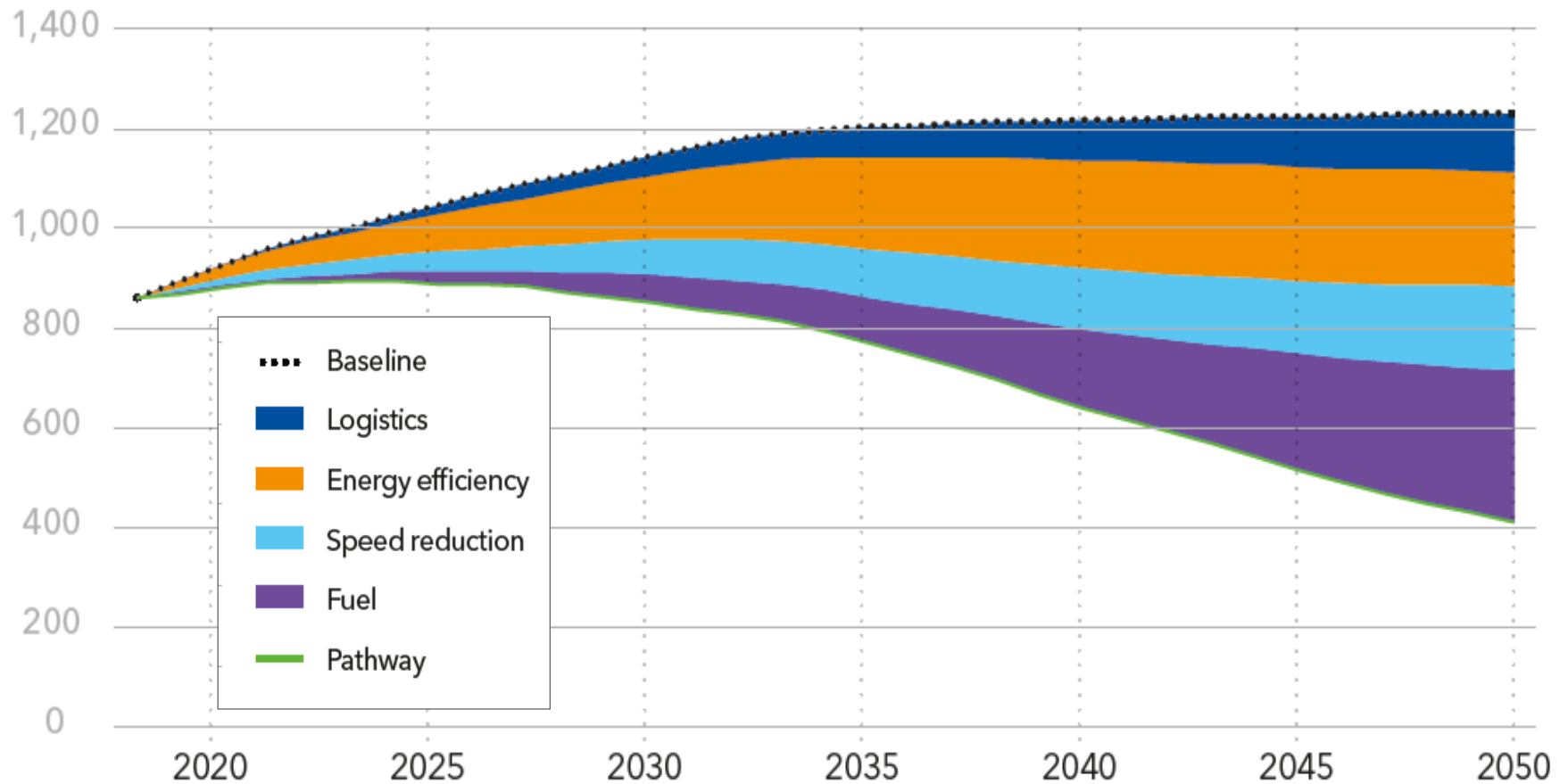


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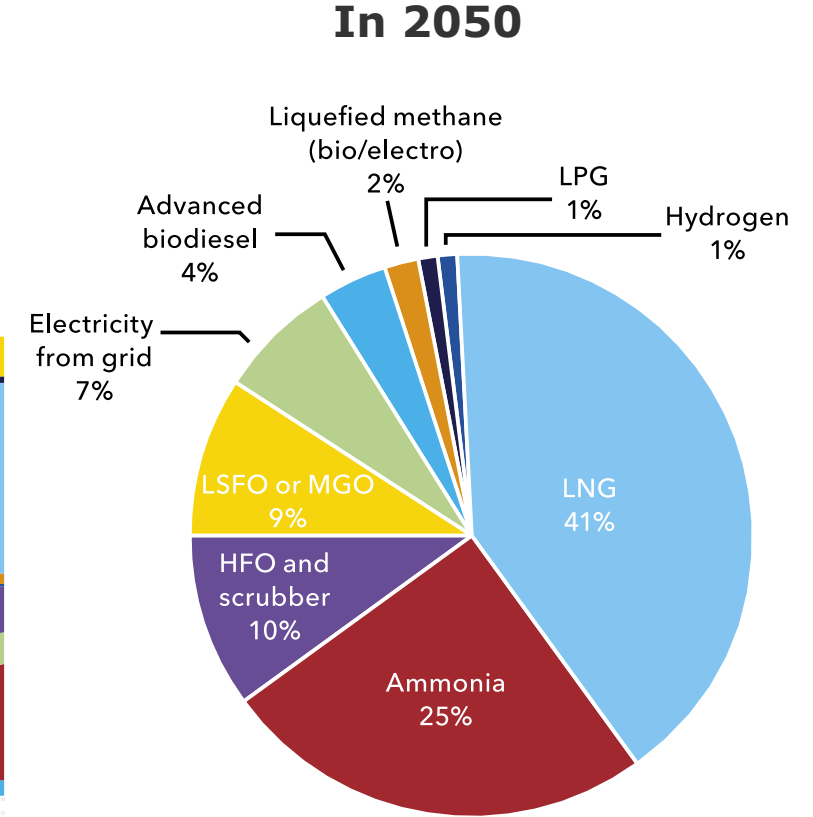
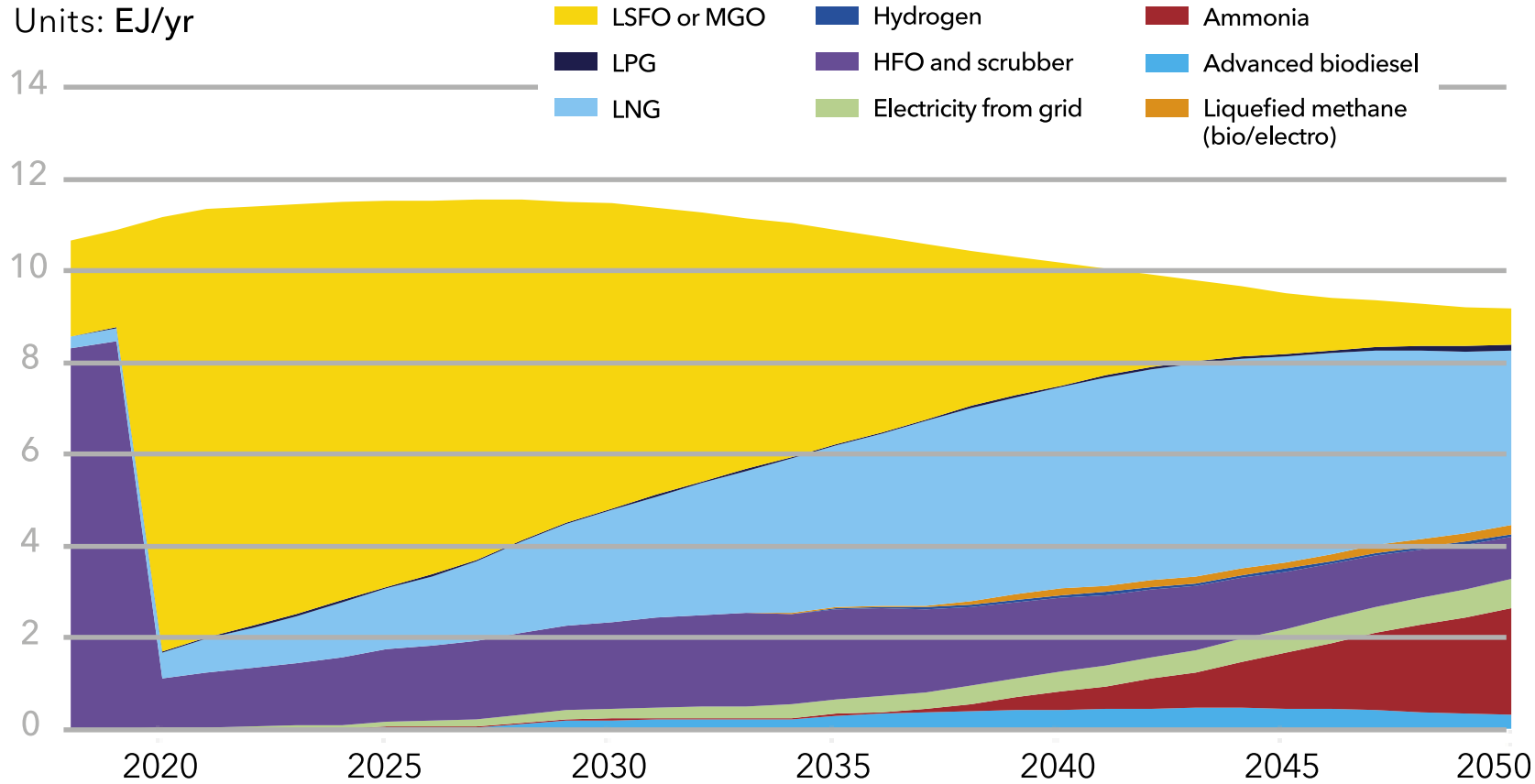
CO₂ emissions towards 2050 in the 'Design requirements' pathway

- 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.
- The “Current policy” pathway **is not** fulfilling the IMO ambitions.

Units: CO₂ emissions (Mt)



Fuel mix towards 2050 in the 'Design requirements' pathway



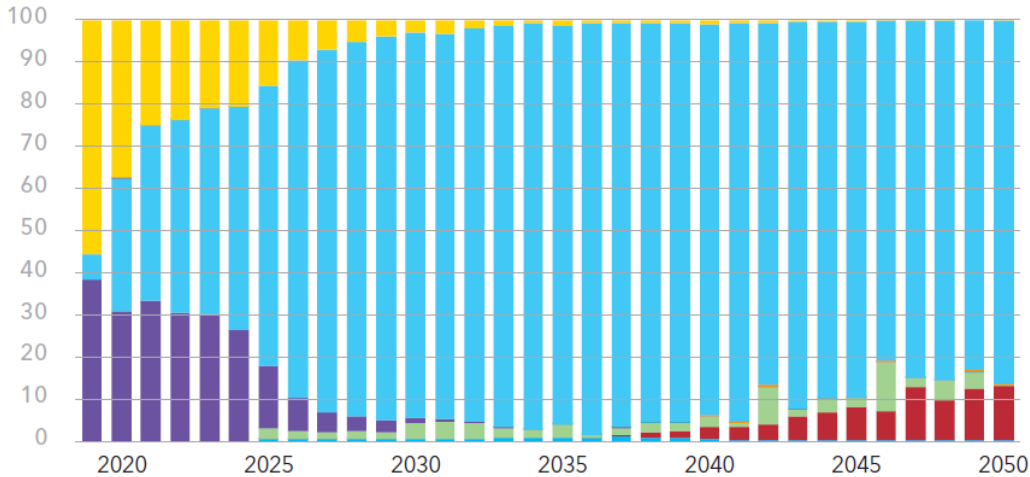
In all three pathways modelled, liquefied methane (both fossil and non-fossil) ends up dominating the fuel mix.

Several ways to meet the IMO targets - policy matters

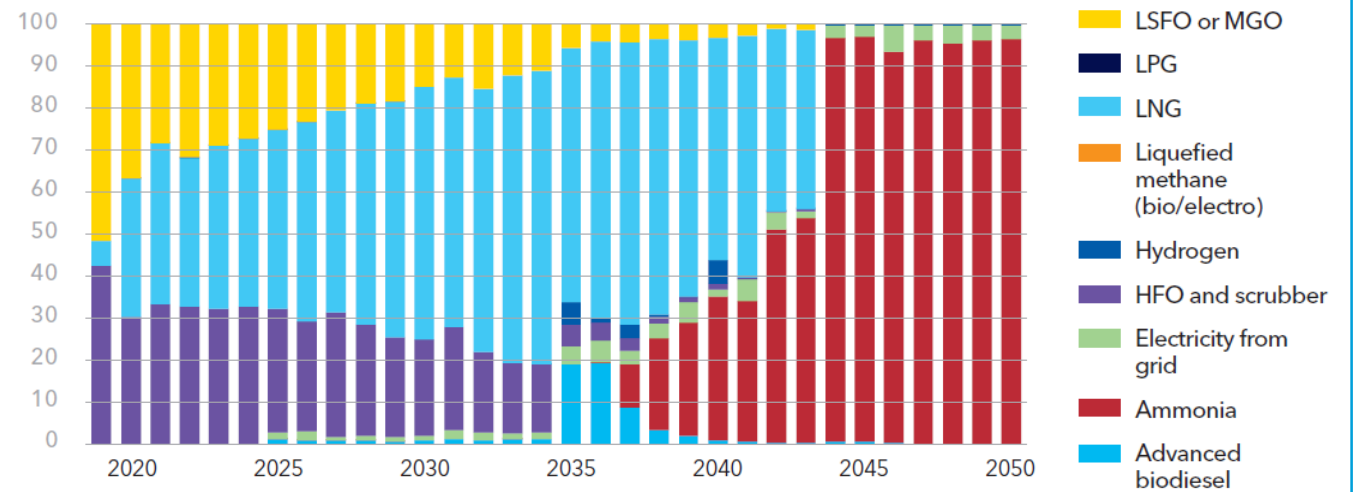
Focusing on **operational requirements**, the uptake of alternative fuel for newbuilding's is more gradual

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

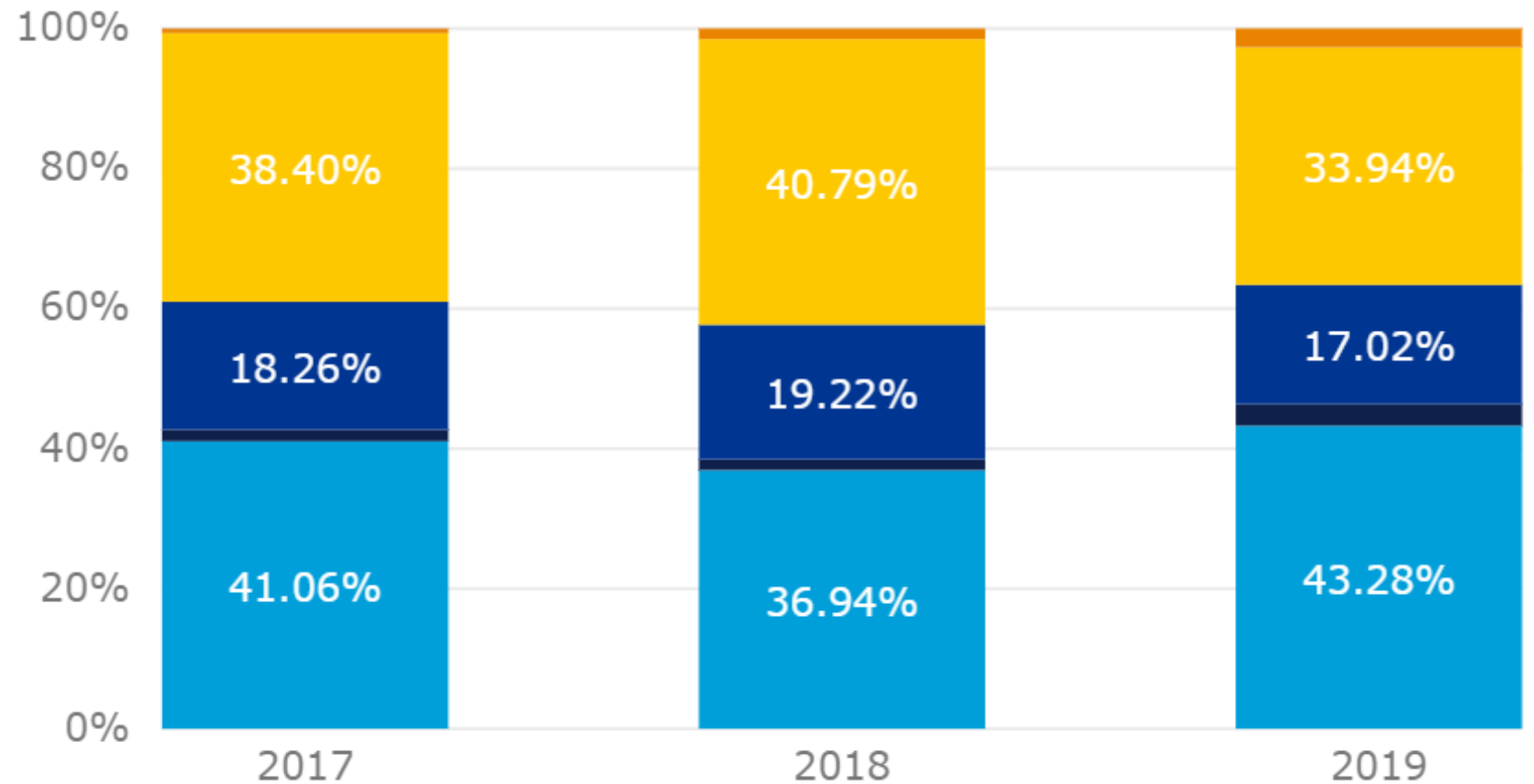
Operational profile – RV sample

Operating Modes

- 0 - under way using en...
- 1 - at anchor
- 2 - not under command
- 3 - restricted manoeuv...
- 5 - moored
- 7 - engaged in fishing
- 8 - under way sailing

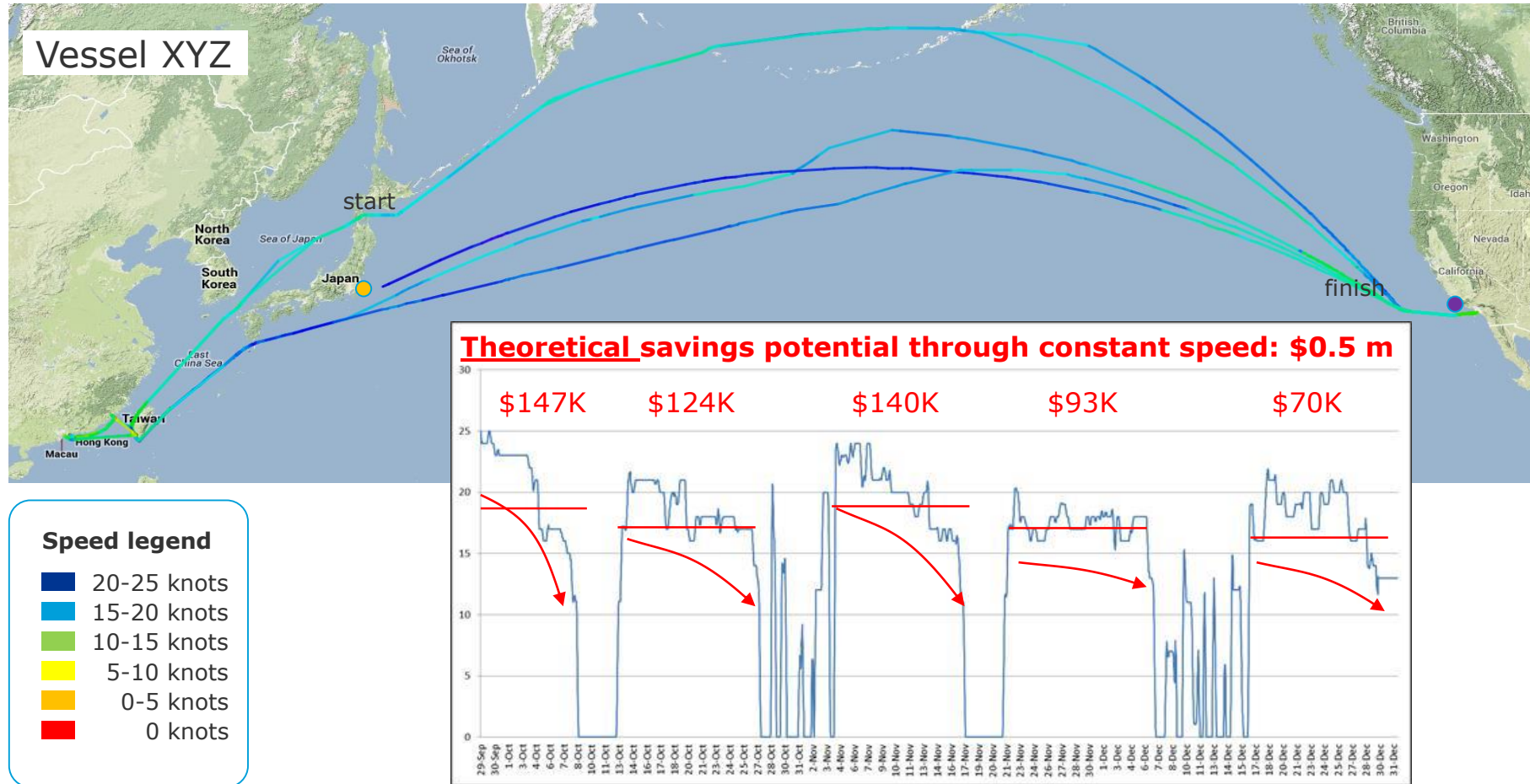
Time Spent in Operating Modes (%)

AIS Navigational ... ● 0 - unde... ● 1 - at a... ● 2 - not ... ● 3 - restri... ▶



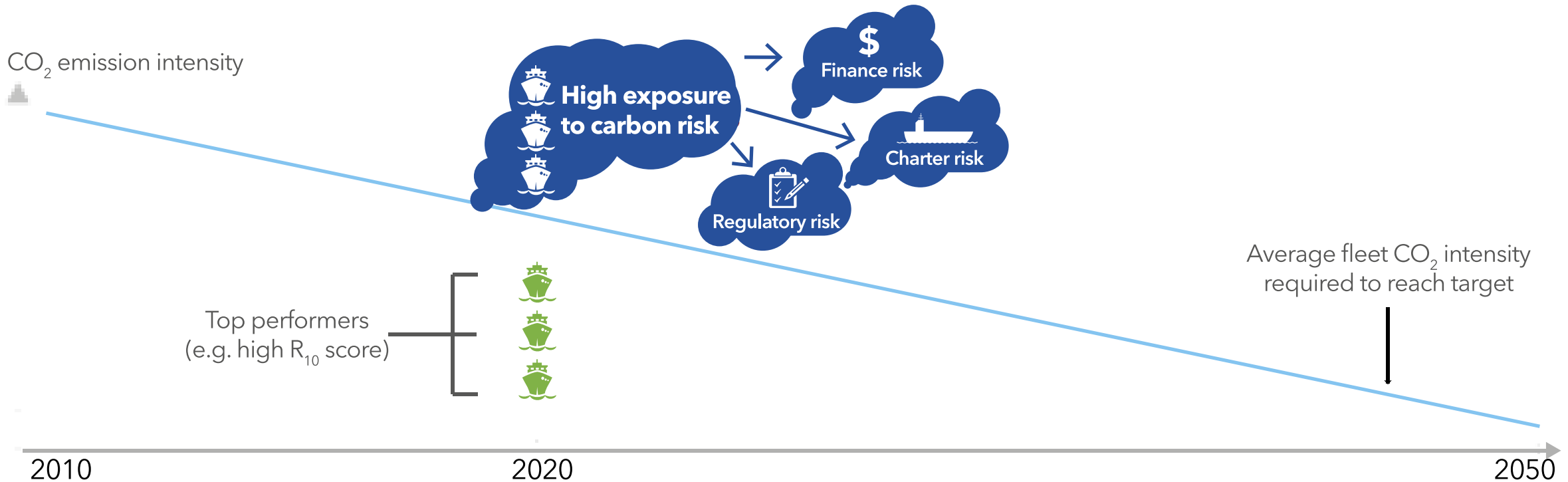
Irregular speed patterns resulted in USD 0.5m higher fuel bill for one vessel over CLIENT EXAMPLE period

Client example: Speed development of a 8,500 TEU container vessel



1. Caused either by weather or crew behaviour

What is the exposure to carbon risk under different scenarios?



The model also evaluates the **CO₂ emissions** of a design to that of the competing fleet.

It is possible to assess the **balance** between short-term cost reduction and long-term carbon-risk exposure.

CO₂ emissions could become an additional **differentiator**.

Key findings ETO

- Shipping decarbonization is off course
- Uptake of alternative fuels is picking up, but needs to breakthrough to the large ocean going ships
- In addition to LNG, carbon-neutral fuels will be needed towards 2050
- Bridging technologies and fuel flexibility can smooth the transition from traditional fuels
- Ships should be future proof in a changing environment, securing competitiveness and mitigating carbon risk
- We have provided tools to support policy makers, ship owners and other stakeholders



New ways of approaching the problem

- Norwegian Green Shipping Programme
- Commenced 2015/16
- In a nutshell.
 - We perform studies
 - We start pilots
 - We transfer knowledge between the two, between theory and practice
 - And last but not least, we facilitate dialogue and collaboration between all stake holders, authorities and politicians included



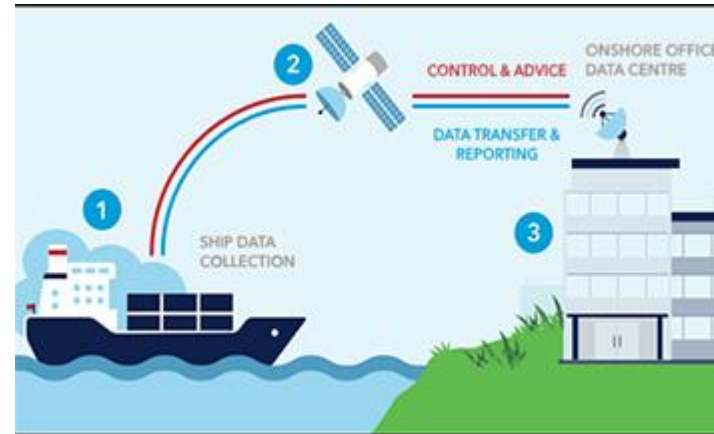
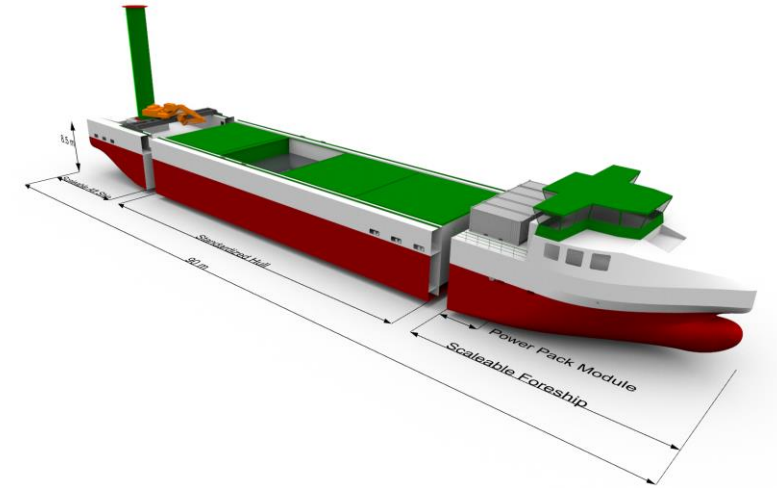
Briefly ...

- Paris goals primary driver led by Department of Environment
 - Coastal shipping sector much more practical
- Difficult to change international shipping significantly
 - Industry included ship owners, OEM, suppliers, charterers, operators, regulators, community businesses
 - Observers included NFP/NGO/Government
- Goal was to test new technology and export to other countries
 - Plus create local jobs
 - Plus removing cargo from roads
- Focus was on identifying any and all barriers and devising strategy to overcome and make things happen



Pilots ...

- Multiple ... simultaneous
 - Logistics and supply chain dynamics
 - Batteries for container ship
 - Fuel shift
 - Hydrogen bulker (deep sea), passenger boat (short sea)
 - Feasibility studies – short sea/coastal versus deep sea
 - Influence application to research
 - Plug in hybrid fishing
 - Bio diesel powered plug in hybrid ferry



Next stage – scale the solution

- Set clear goals
- Collaborate and engage
- Focus on policies that facilitate change
- Calculate
- Resolve barriers
- Pilot, pilot, pilot



Assess the Potential

2015/2016

Evaluate Business Cases

2016/2017

Remove Barriers

2018/2019

Scale the Solutions

2019/2030

Summing up



ECO POWER

RV segment ...

- Significant differences in operating profile
- Alternative drivers
- Growth margins non-existent for significant retro fit
- Long operational life

Thank you

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