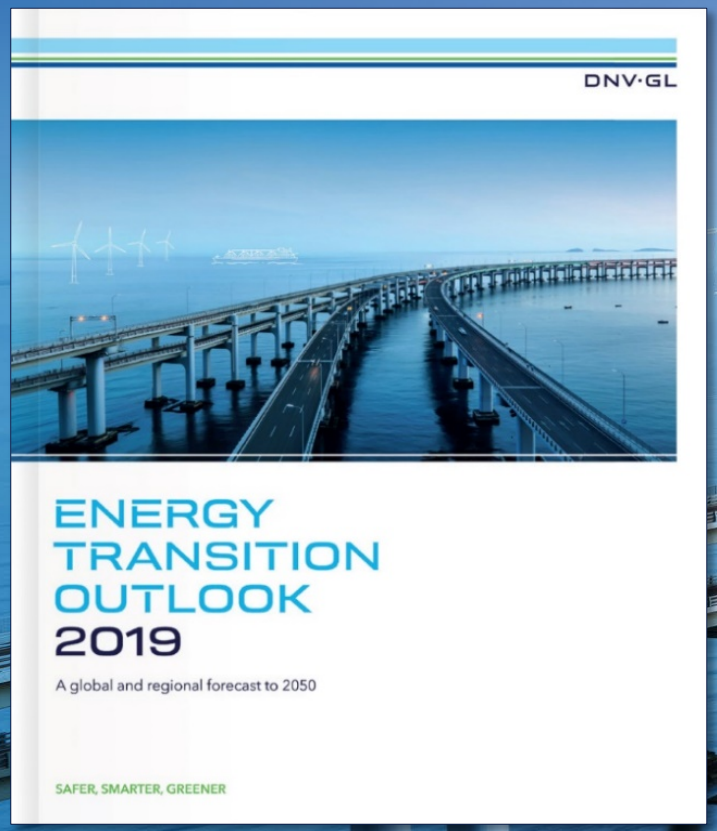
MARITIME FORECAST TO 2050

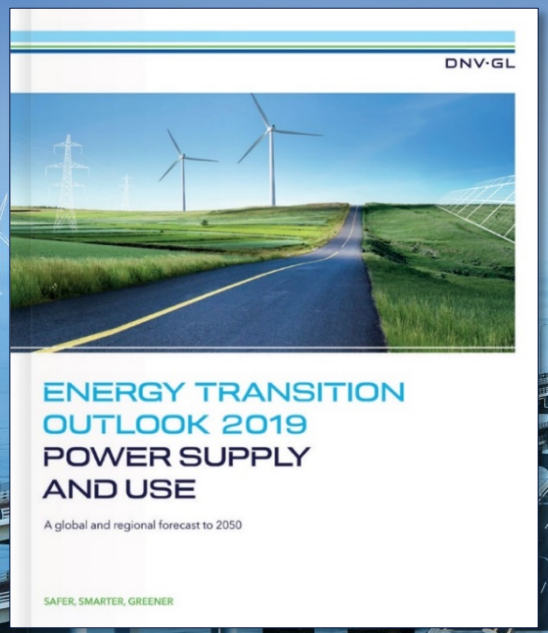
As part of Energy Transition Outlook 2019

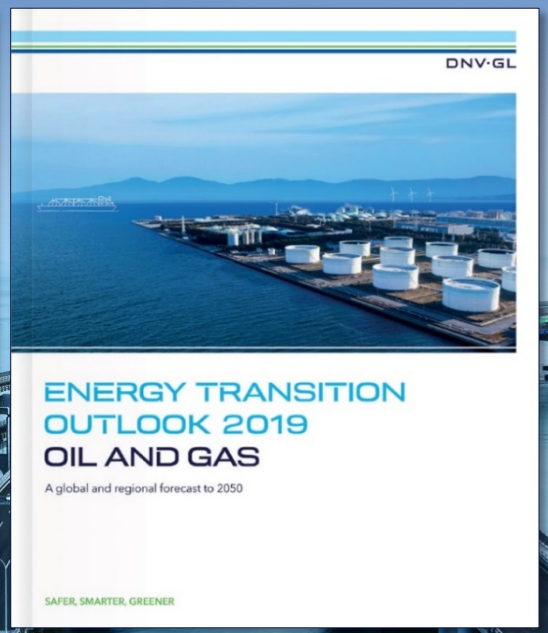
11th Annual Capital Link New York Maritime Forum – October 15th, 2019

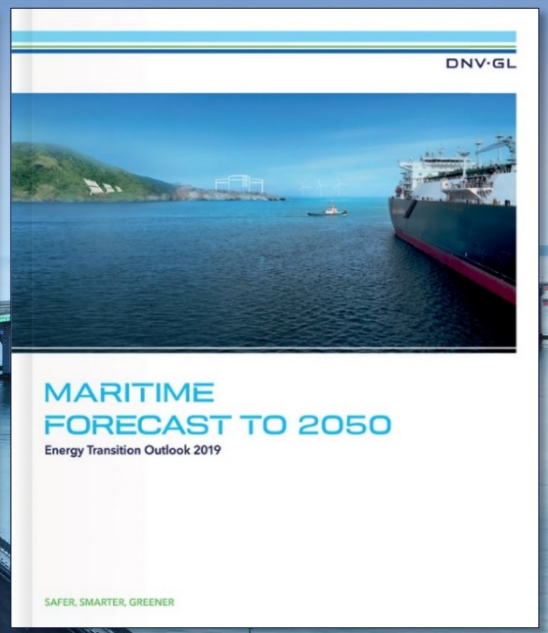
DNV GL © 2019

Suite of publications available on eto.dnvgl.com

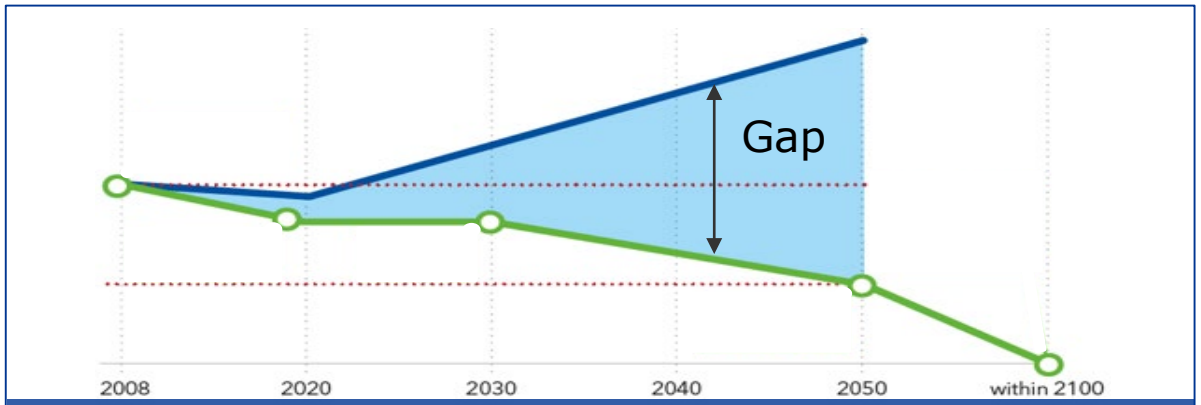




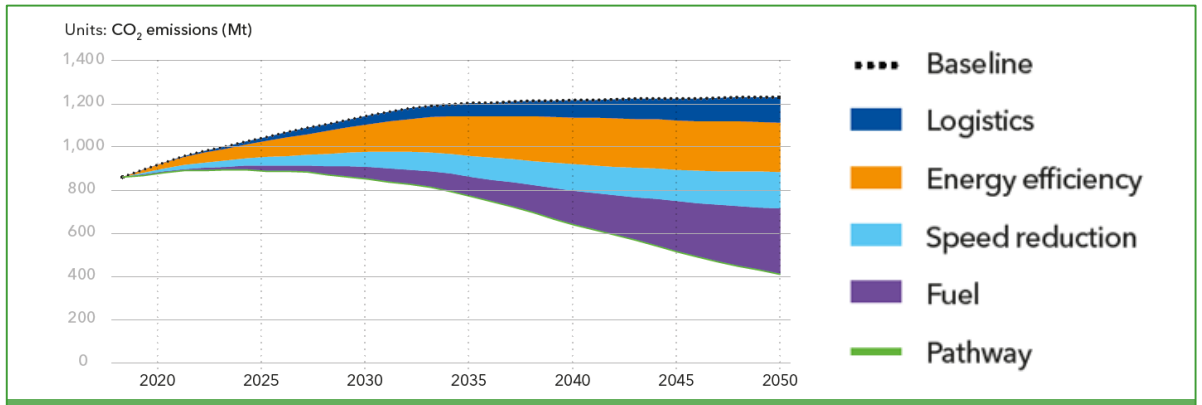




Maritime Forecast to 2050 in a nutshell



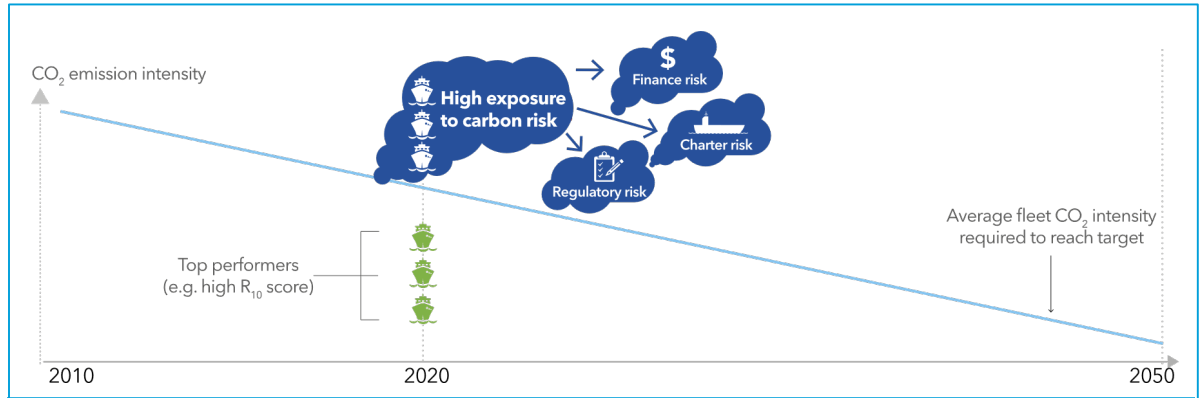
GHG regulation



World fleet CO_2 outlook

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	Cleaning	Battery hybridization	Hydrogen etc.

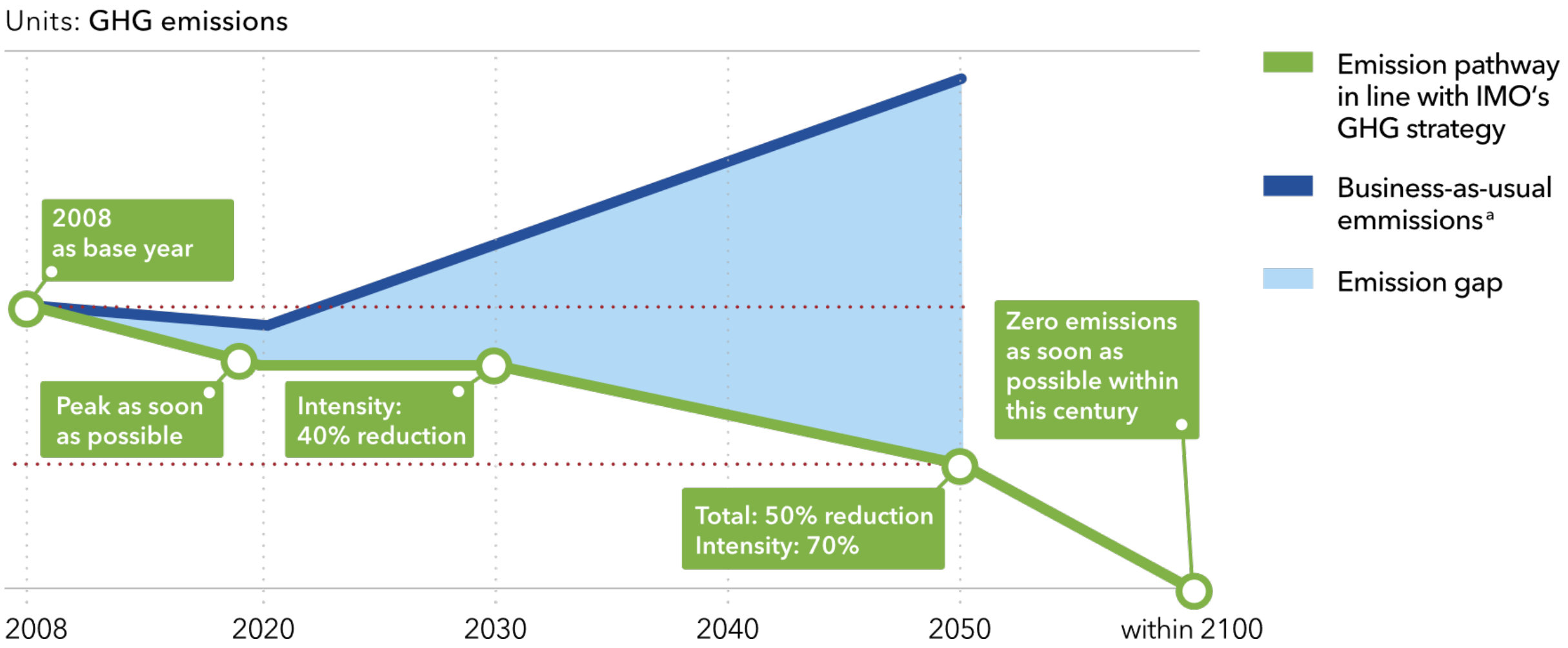
Decarbonization options



Ship design performance

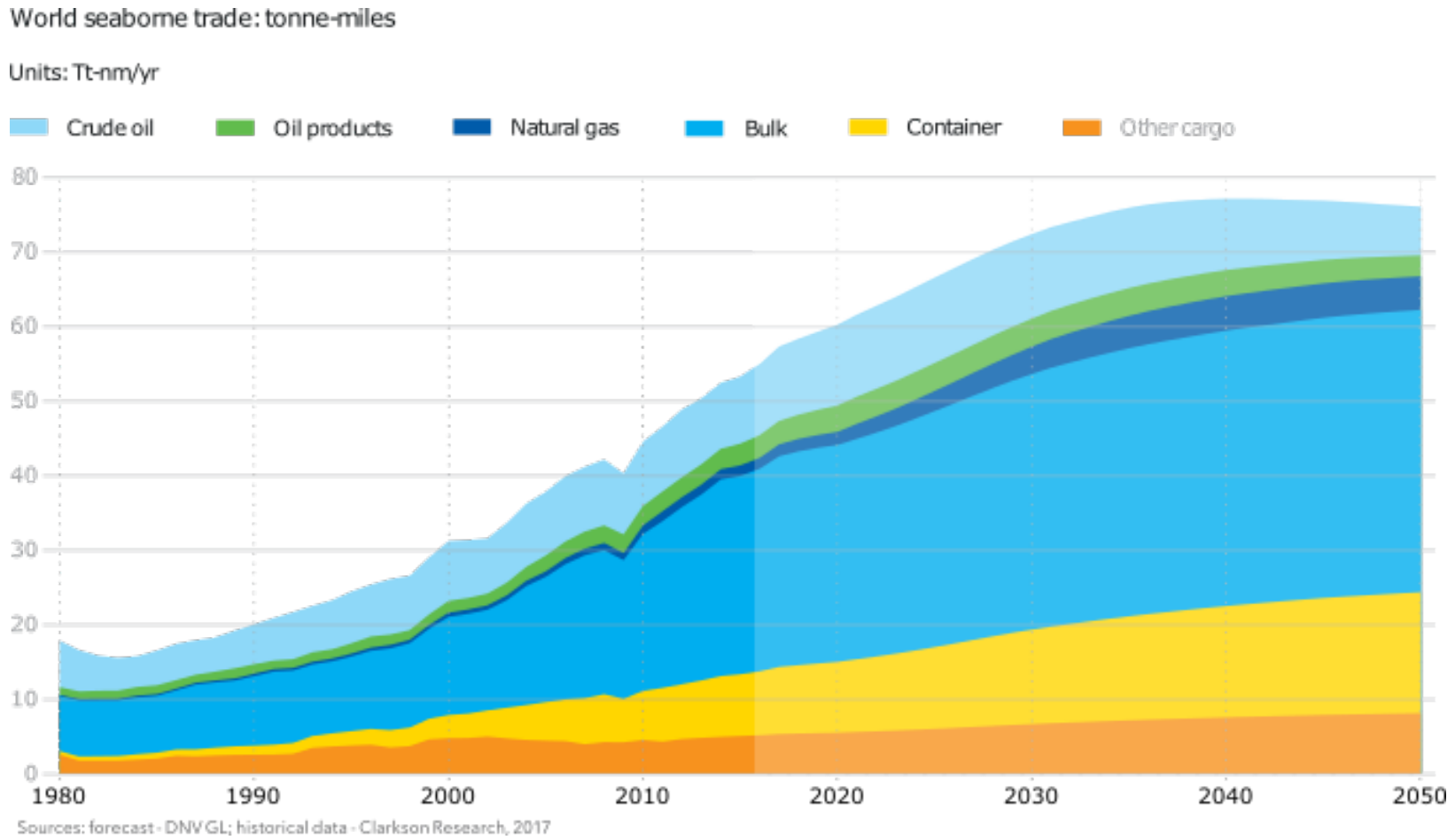
DNV GL © 2019

The foundation for the outlook is the IMO GHG strategy



DNV GL © 2019

Demand for seaborne transport will grow 39% by 2050



Average growth of 2.3%/yr to 2030, then 0.3%/yr towards 2050

DNV GL © 2019

Source: Maritime Forecast to 2050, DNV GL 2018

New 'CO_2 Barometer' signals shipping decarbonization is off course

Indicators

1. World fleet CO_2 emissions

- Slight increase in CO_2 emissions in recent years

2. Alternative fuels uptake

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

3. Regulation

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

The **CO_2 Barometer** provides a high-level decarbonization status in the form of a '**transition pressure level**'

DNV GL © 2019

Decarbonization options for shipping

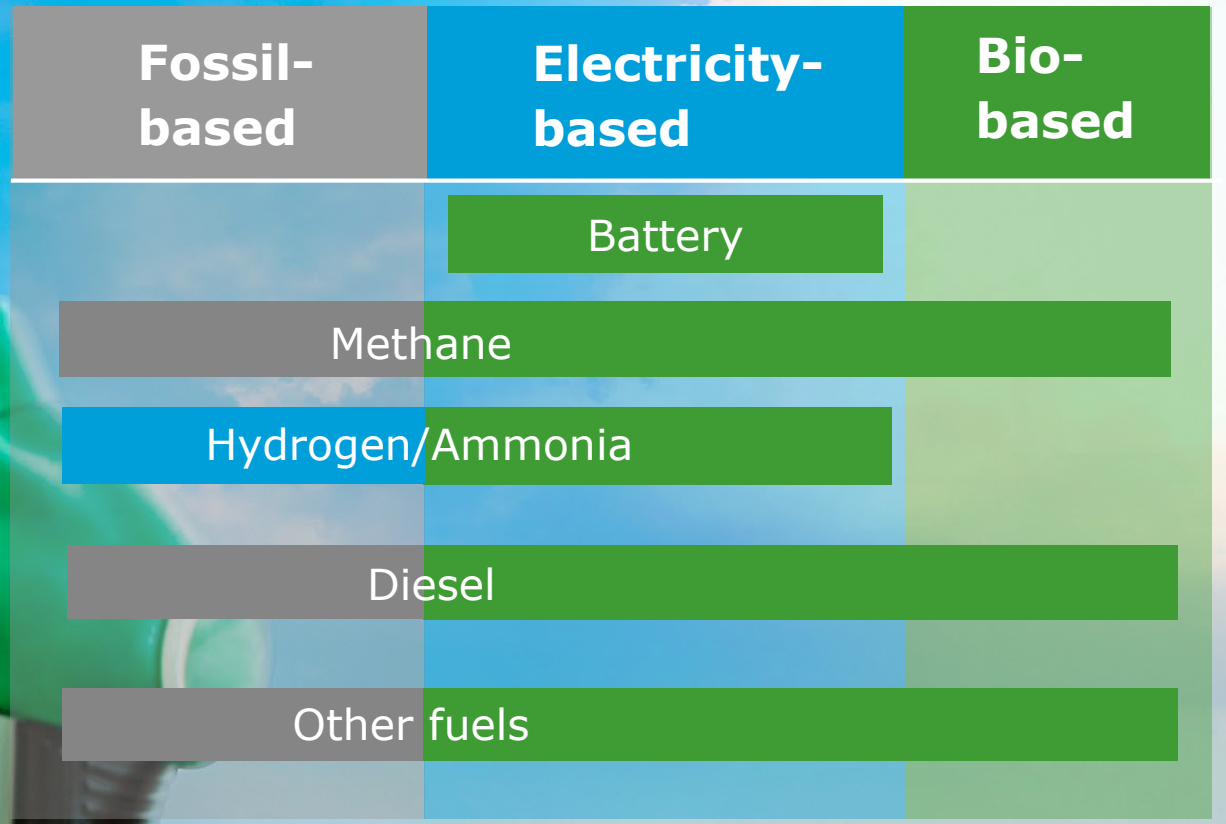
- Significant **GHG reduction** can be achieved by technical and operational measures

- **Up to 100%** GHG reduction can only be achieved with alternative fuels. Barriers to implementation includes:
  - Cost
  - Availability and infrastructure
  - Onboard storage

DNV GL © 2019

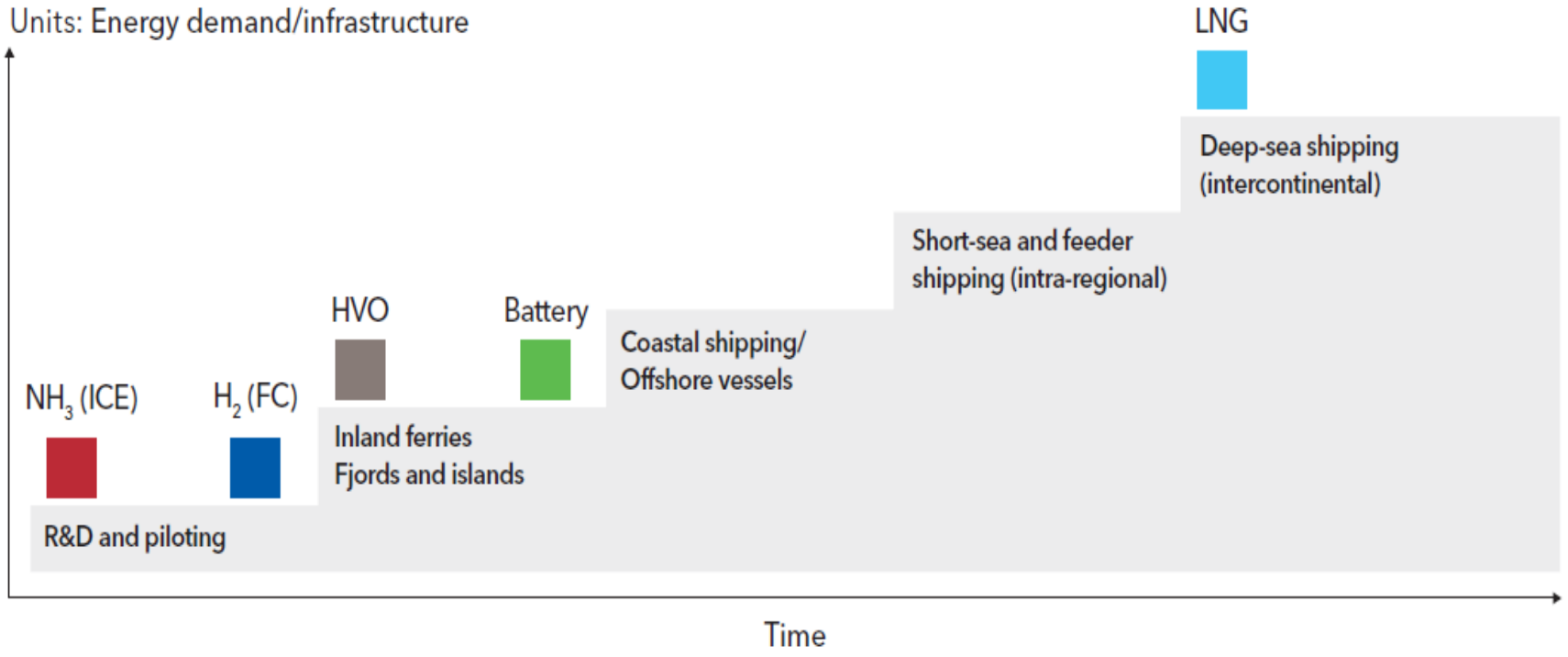
Decarbonization options for shipping - alternative fuels and energy sources

- **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



DNV GL © 2019

Alternative fuels must evolve over time to increase marked penetration



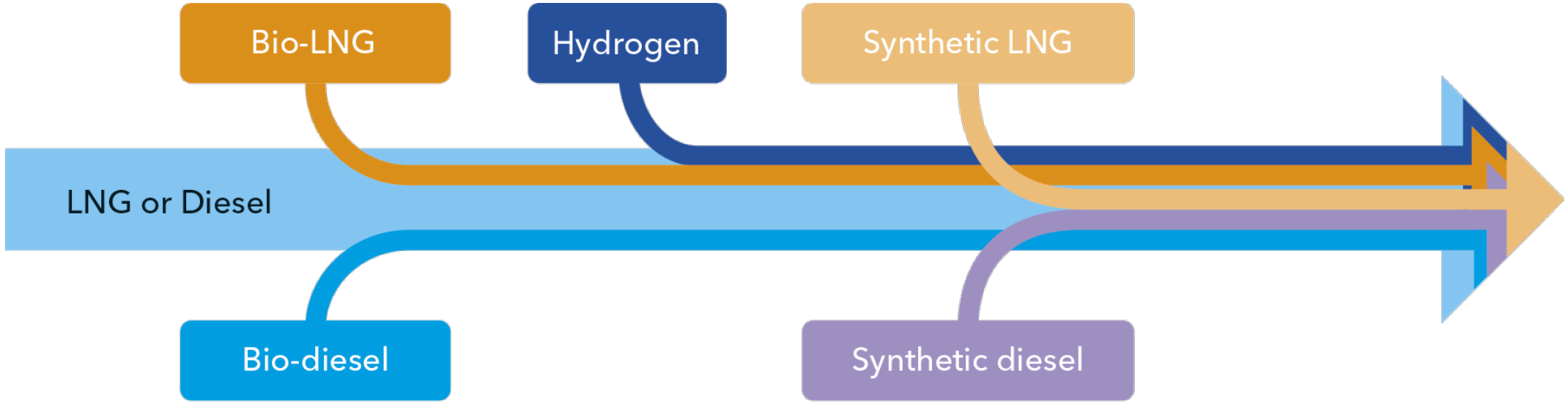
Gradual steps allow for:
- **maturing** of technology
- scaling of supply and **infrastructure**

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!

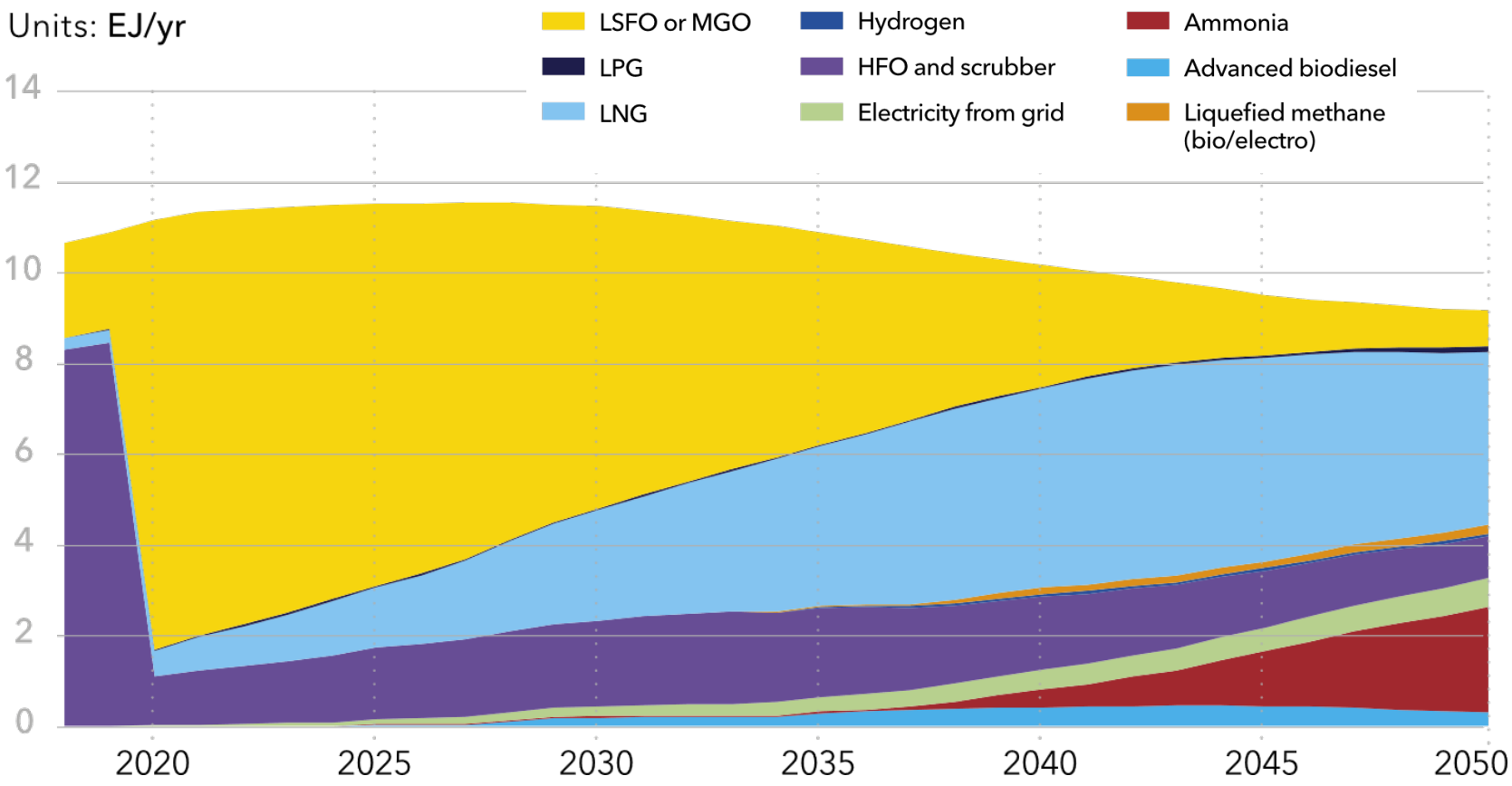
Fuel flexibility and bridging technologies – the three pillars

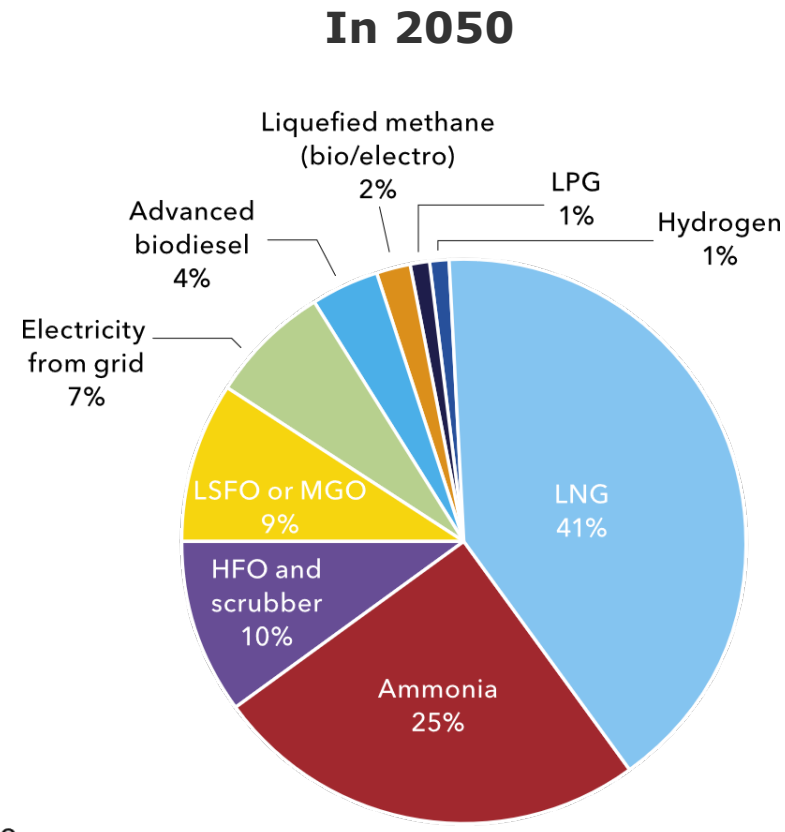
Bridging technologies can facilitate the transition from traditional fuels, via fuels with lower carbon footprints, to carbon-neutral fuels



DNV GL © 2019

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.

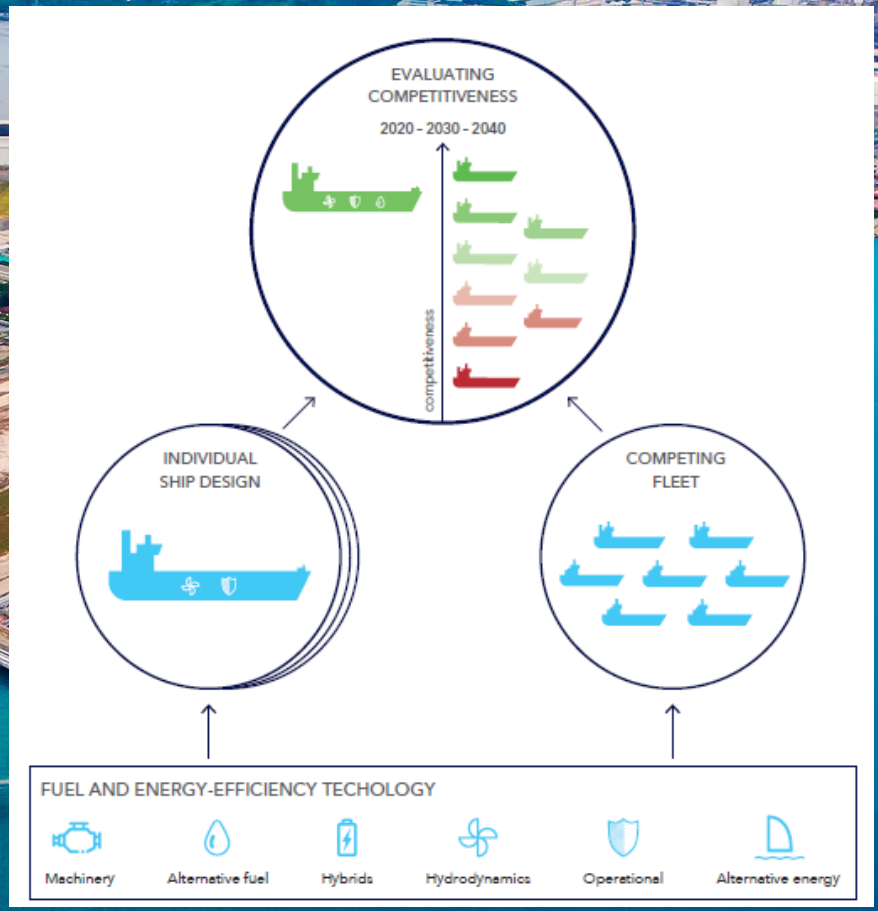
What is the future competitiveness of your ship?

DNV GL has developed a model to test **competitiveness** under different scenarios – taken into account:

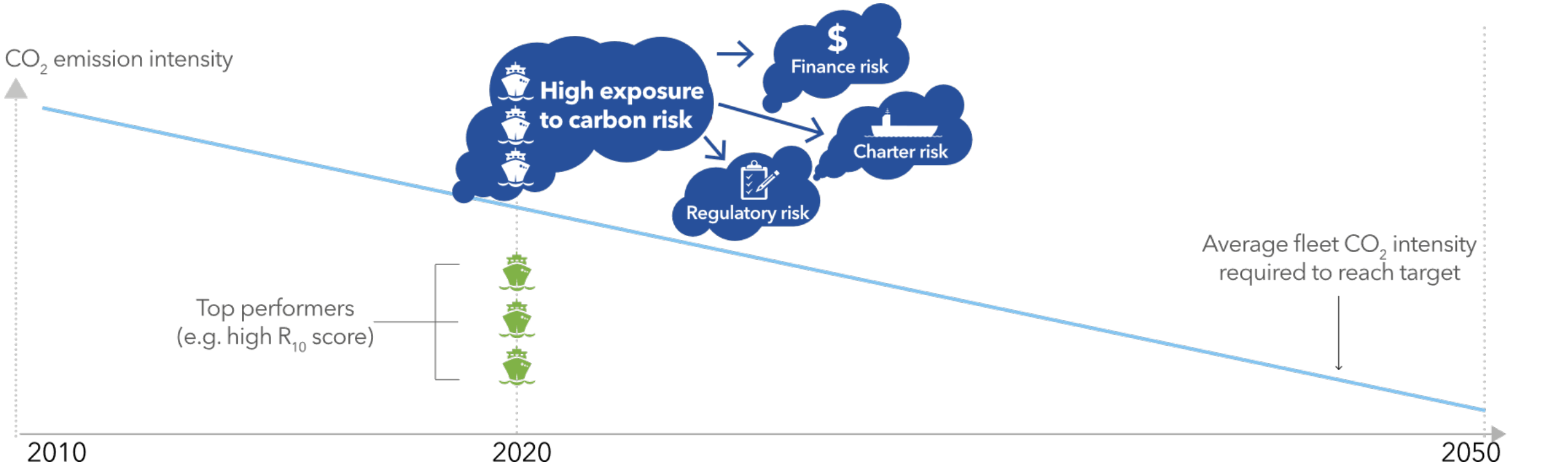
- Fuel & technology
- Regulations
- Risks related to the market

Competitiveness of individual **ship designs** is assessed using:

- Break-even cost
- CO_2 emissions



What is the exposure to carbon risk under different scenarios?



The model also evaluates the **CO_2 emissions** of a design to that of the competing fleet.

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

CO_2 emissions could become an additional **differentiator.**

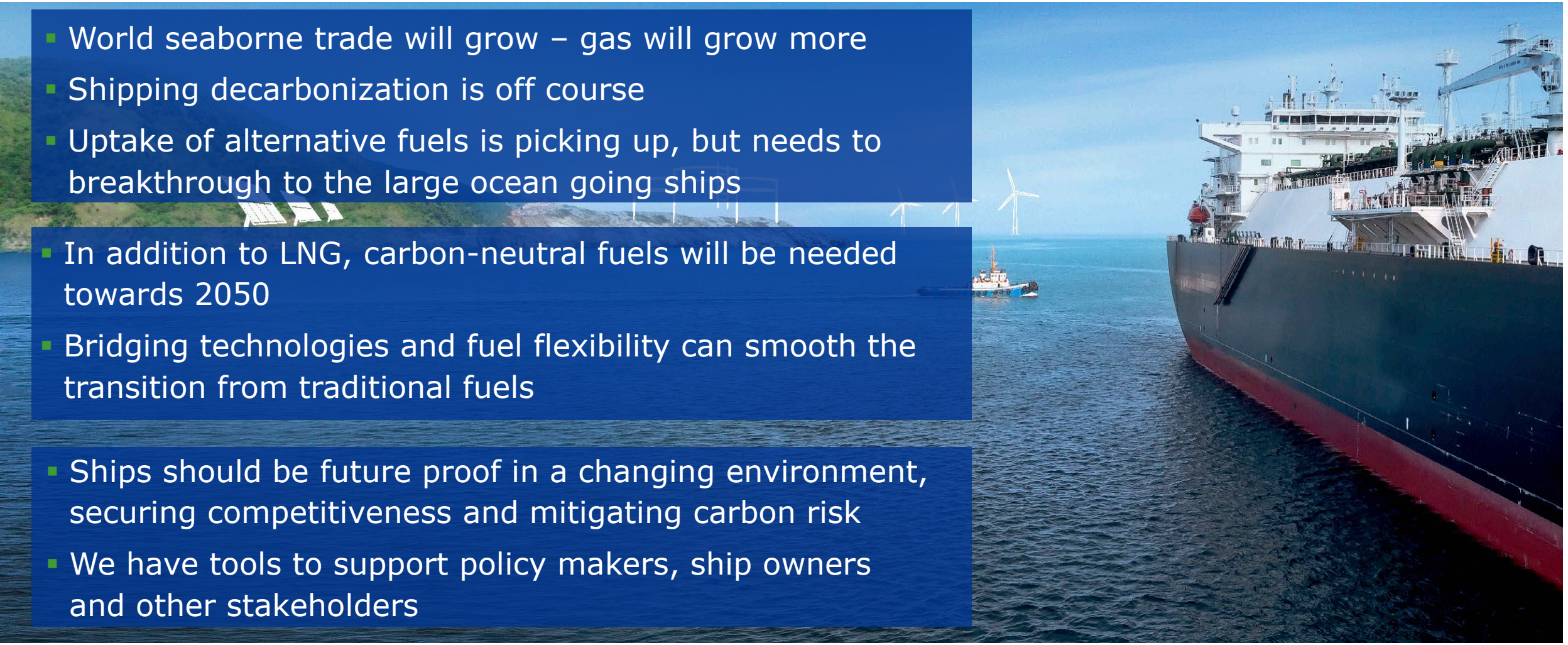
DNV GL © 2019

Key findings

- World seaborne trade will grow – gas will grow more
- 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 tools to support policy makers, ship owners and other stakeholders



DNV GL © 2019

Thank you for your attention

Sergio Garcia

Regional Business Development Manager – Maritime Americas
Sergio.garcia@dnvgl.com
+1 832 392 0030

www.dnvgl.com

SAFER, SMARTER, GREENER

The trademarks DNV GL®, DNV®, the Horizon Graphic and Det Norske Veritas®
are the properties of companies in the Det Norske Veritas group. All rights reserved.