# MARITIME ENERGY SOURCES FOR THE FUTURE

**Tore Longva, 18 October 2019**

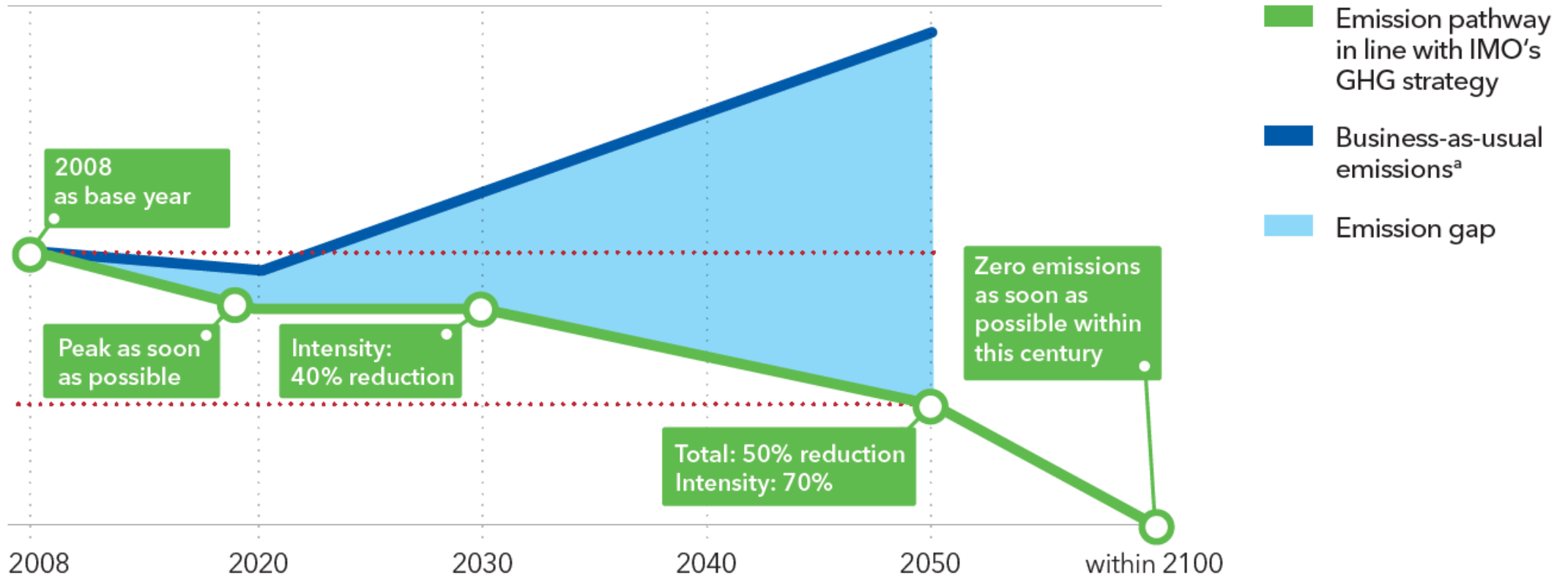DNV GL © 2019

**SAFER, SMARTER, GREENER**

# Content
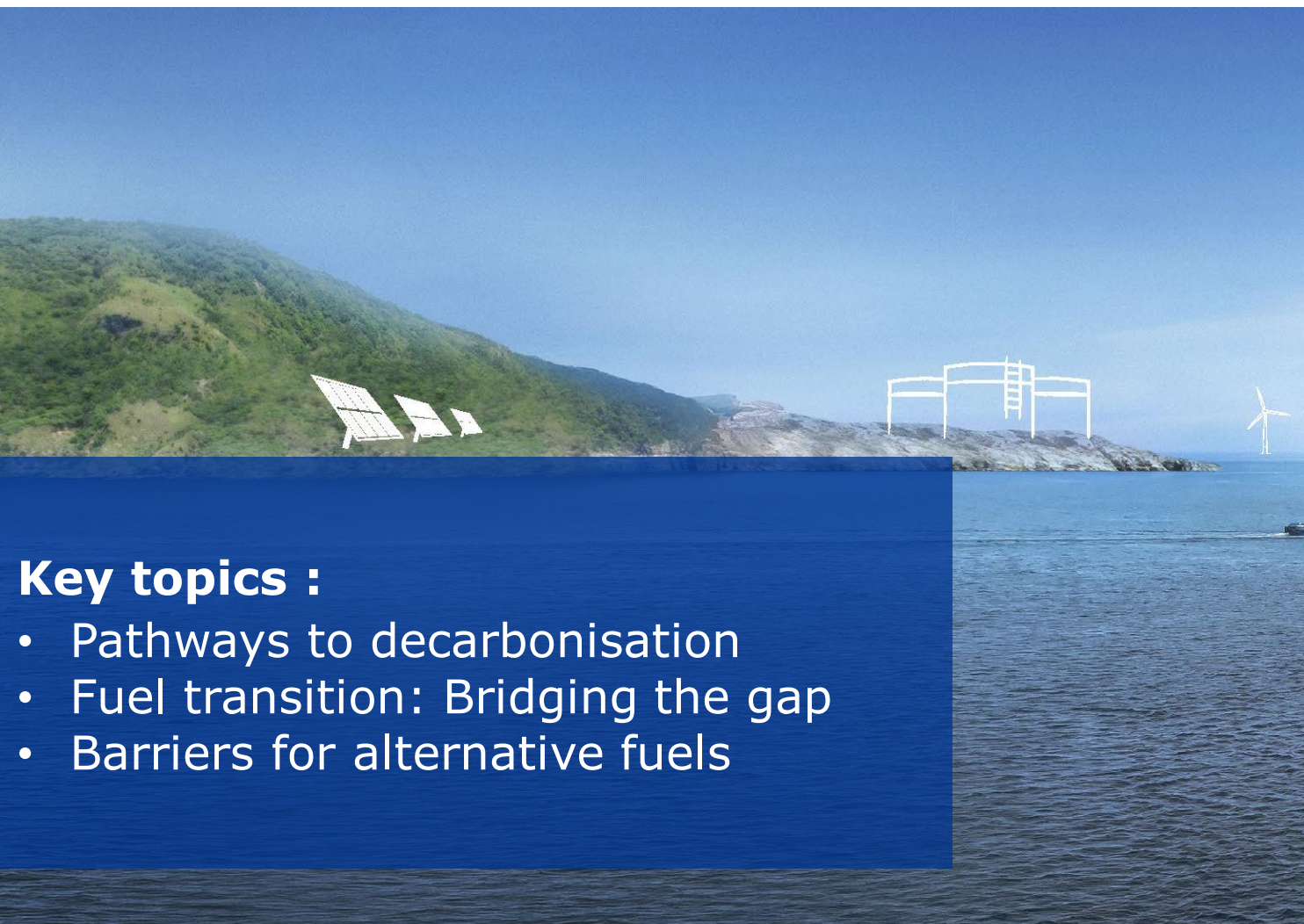
**Key topics :**
- Pathways to decarbonisation
- Fuel transition: Bridging the gap
- Barriers for alternative fuels



MARITIME FORECAST TO 2050
Energy Transition Outlook 2019
SAFER, SMARTER, GREENER
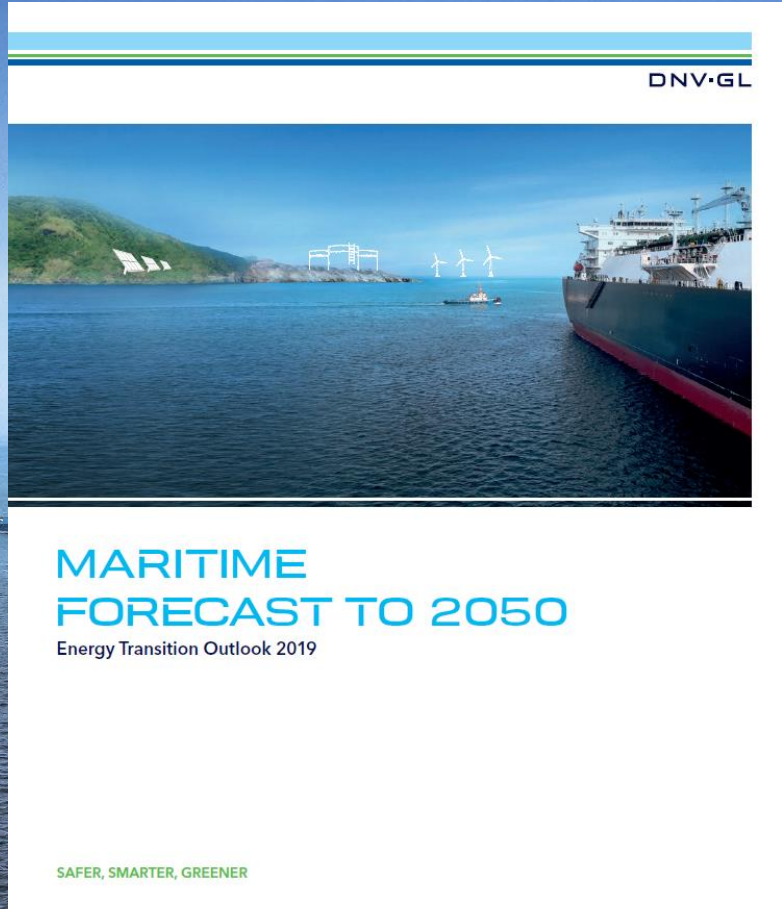
# The foundation for the outlook is the IMO GHG strategy



Units: GHG emissions

**Legend:**
- Emission pathway in line with IMO's GHG strategy
- Business-as-usual emissions[a]
- Emission gap

**Annotations on chart:**
- 2008 as base year
- Peak as soon as possible
- Intensity: 40% reduction
- Total: 50% reduction Intensity: 70%
- Zero emissions as soon as possible within this century
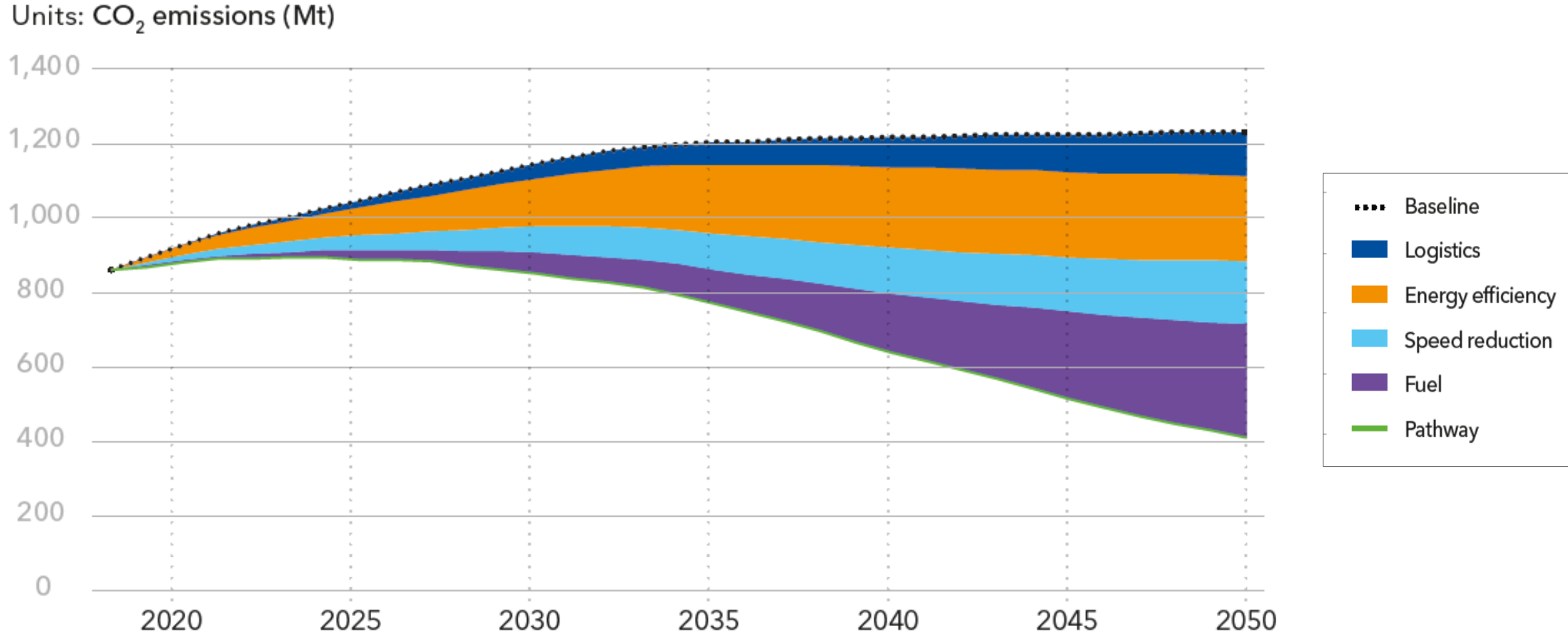
**X-axis:** 2008, 2020, 2030, 2040, 2050, within 2100

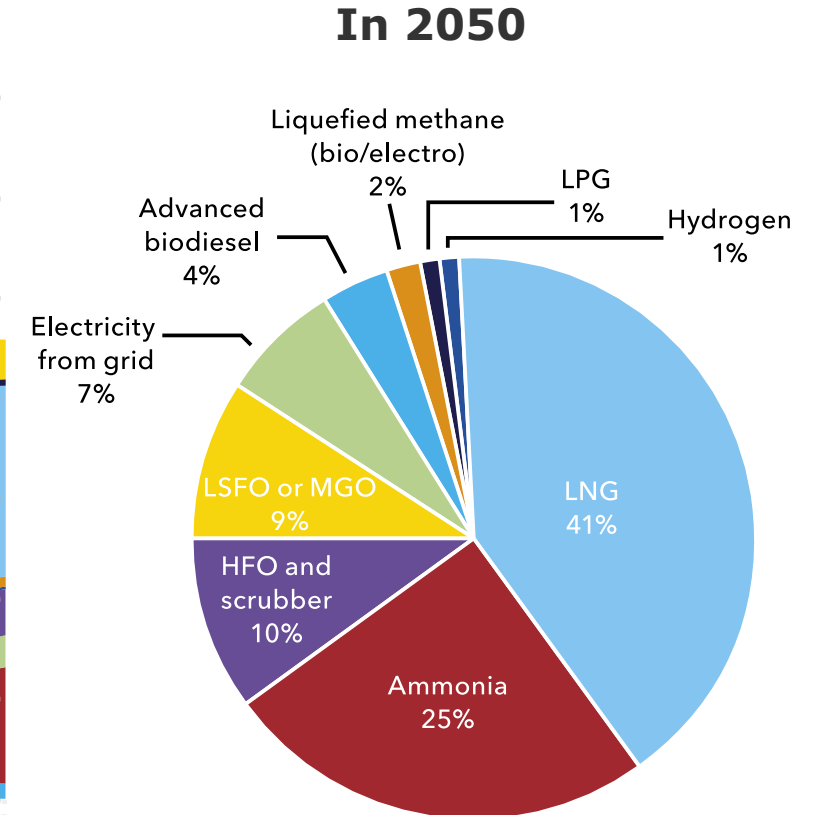Total: Refers to the absolute amount of GHG emissions from international shipping.
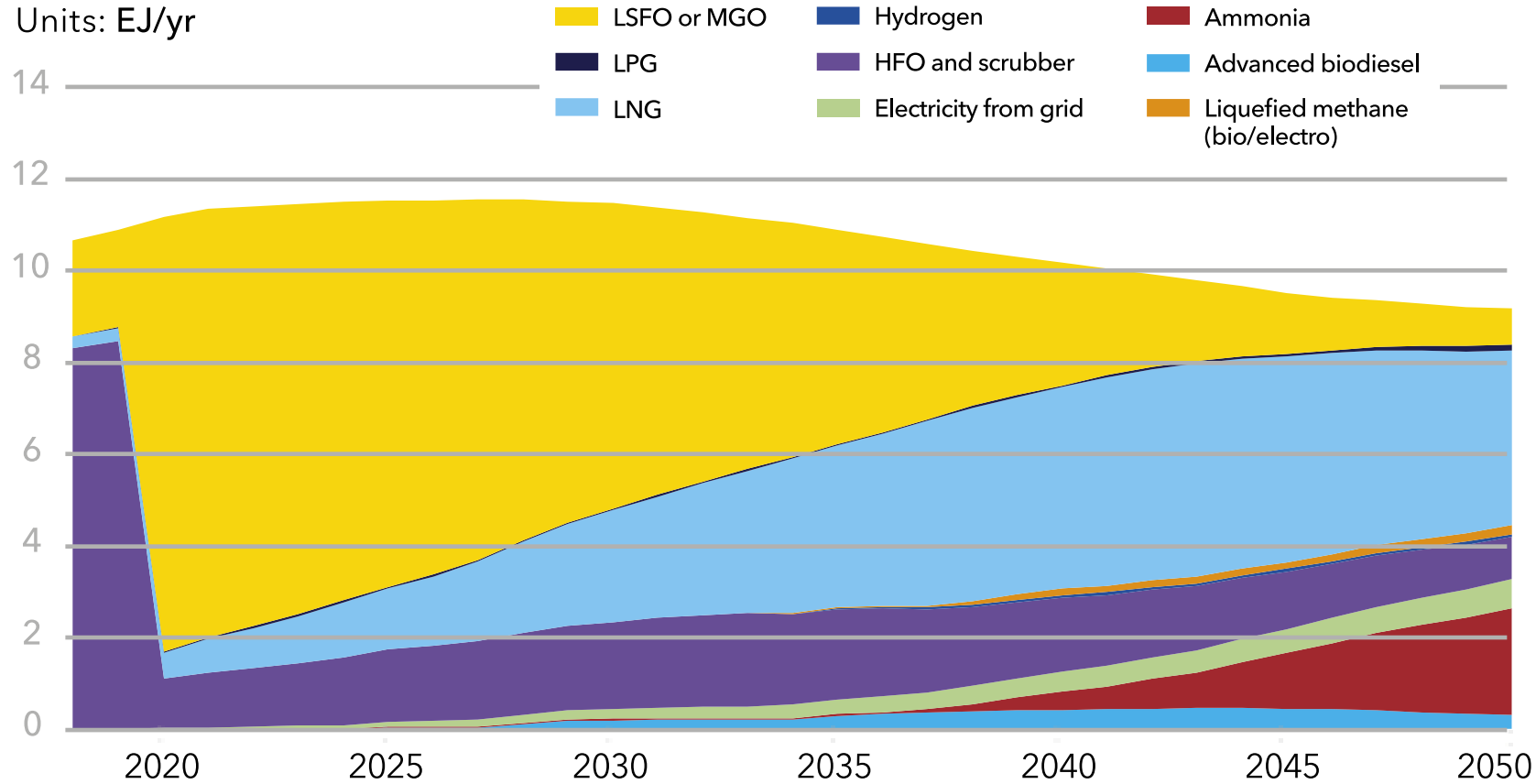Intensity: Carbon dioxide ($CO_2$) emitted per tonne-mile.
[a] Note that the the business-as-usual emissions are illustrative, and not consistent with the emissions baseline used in our modelling (Chapter 6).

DNV·GL

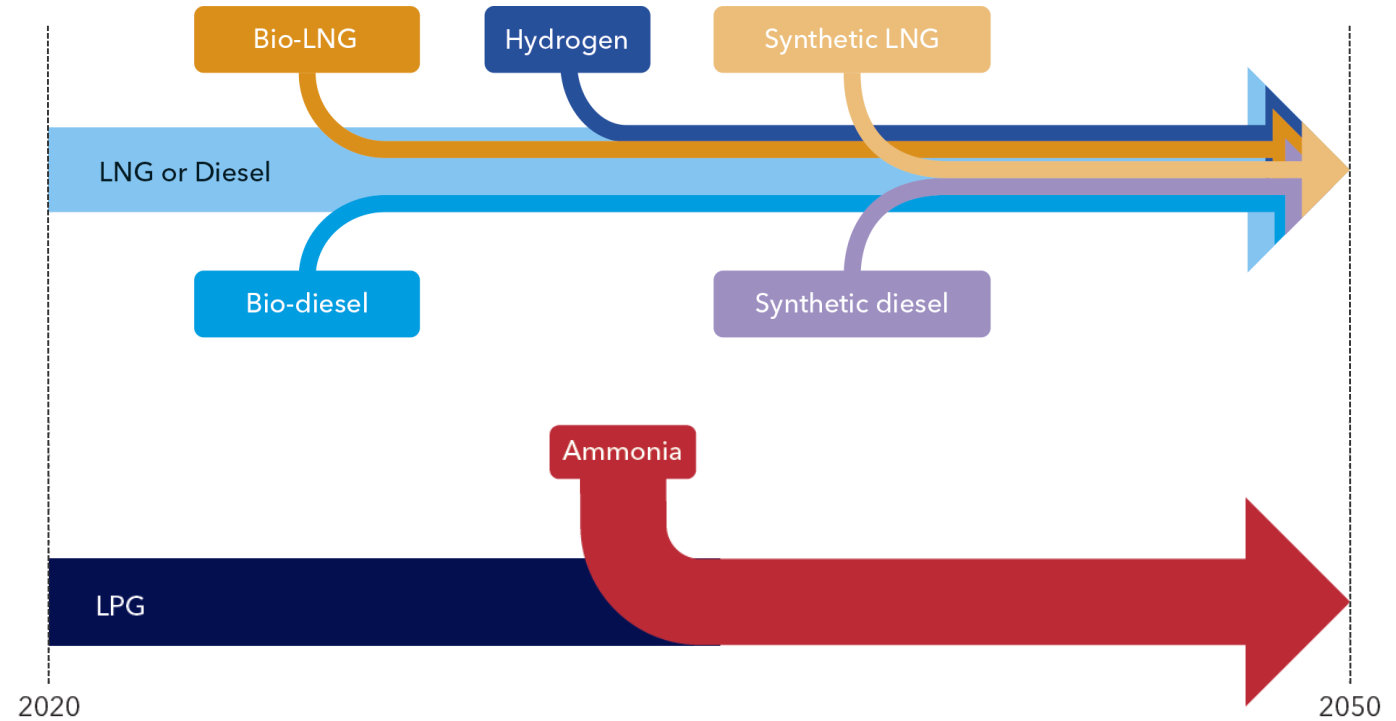# Carbon-neutral fuels need to supply 30%–40% of the total energy in 2050



Units: $CO_2$ emissions (Mt)

Legend:
- ···· Baseline
- Logistics
- Energy efficiency
- Speed reduction
- Fuel
- Pathway

# Fuel mix towards 2050 in the 'Design requirements' pathway



Units: EJ/yr

**In 2050**

Legend:
- LSFO or MGO
- LPG
- LNG
- Hydrogen
- HFO and scrubber
- Electricity from grid
- Ammonia
- Advanced biodiesel
- Liquefied methane (bio/electro)

Pie chart (In 2050):
- LNG 41%
- Ammonia 25%
- HFO and scrubber 10%
- LSFO or MGO 9%
- Electricity from grid 7%
- Advanced biodiesel 4%
- Liquefied methane (bio/electro) 2%
- LPG 1%
- Hydrogen 1%

DNV·GL

# Fuel flexibility and bridging technologies - the three pillars



Fuel-flexible energy converters

Fuel-flexible storage tanks and onboard systems

Fuel-flexible shore-side fuel infrastructure

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

Bio-LNG

Hydrogen

Synthetic LNG

LNG or Diesel

Bio-diesel

Synthetic diesel

Ammonia

LPG

2020

2050

# The Alternative Fuel Barrier Dashboard:
# Indicative status of key barriers for selected alternative fuels

Barriers exists 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
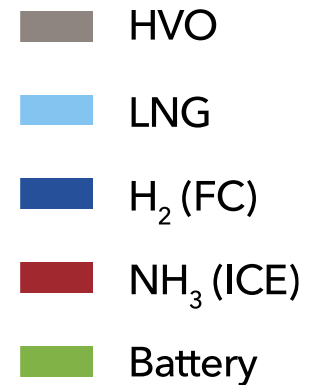
IMO, Class, regional, national

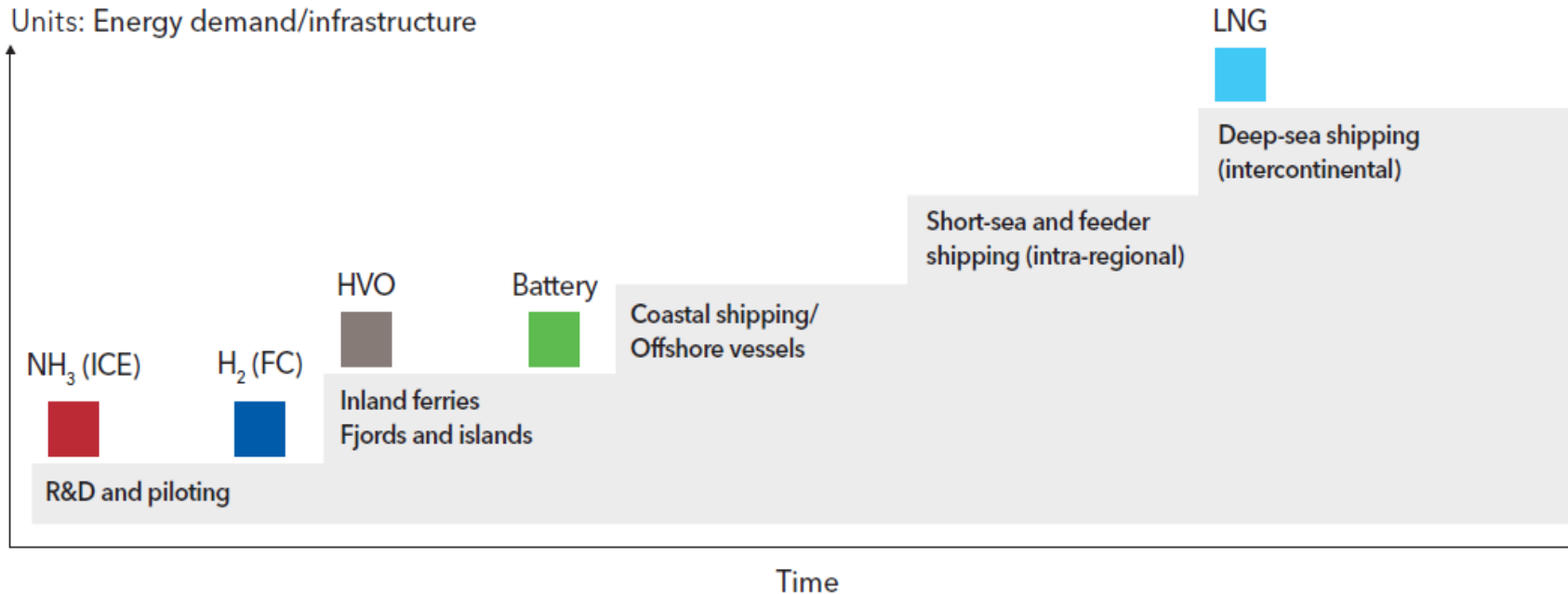Equipment supplier, designer, yard, incentive schemes

Feedstock supplier, fuel suppliers, competition authorities

R&D, designer

HVO

LNG

$H_2$ (FC)

$NH_3$ (ICE)

Battery

DNV·GL

# Alternative fuels must evolve over time to increase marked penetration

Units: Energy demand/infrastructure



Time

**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!

DNV·GL

# Key findings

Carbon-neutral fuels need to supply at least 30%–40% of the total energy in 2050.

Bridging technologies and fuel flexibility can prepare the fleet for future fuels, smoothing the transition from traditional fuels.

It took LNG around 20 years to mature for deep-sea ships. To reach the IMO ambitions, carbon-neutral fuels must mature faster.

DNV·GL