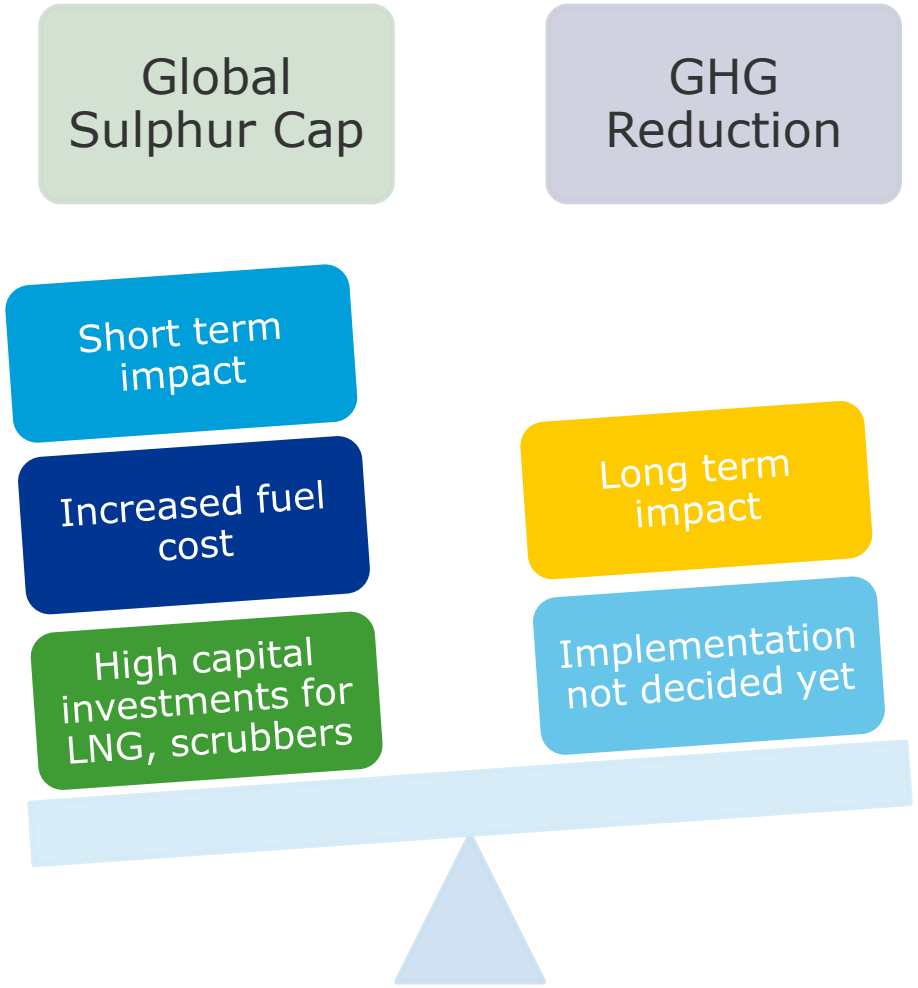
Deep sea shipping on the way to decarbonization

Christos Chryssakis

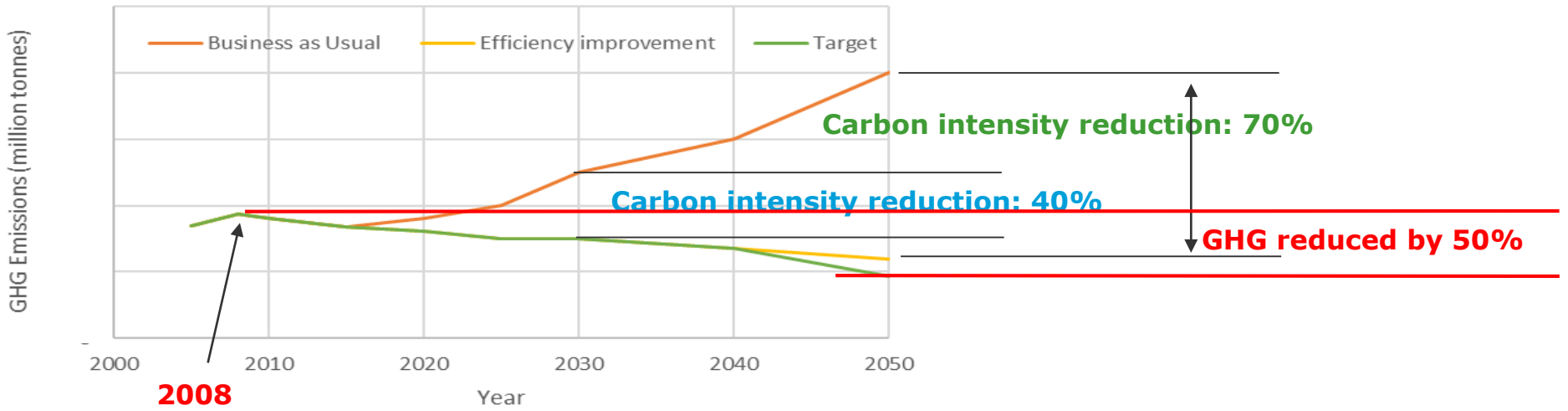
14 June 2018

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



IMO Greenhouse Gas Reduction Strategy

IMO GHG timelines, including possible key measures



Initial GHG strategy

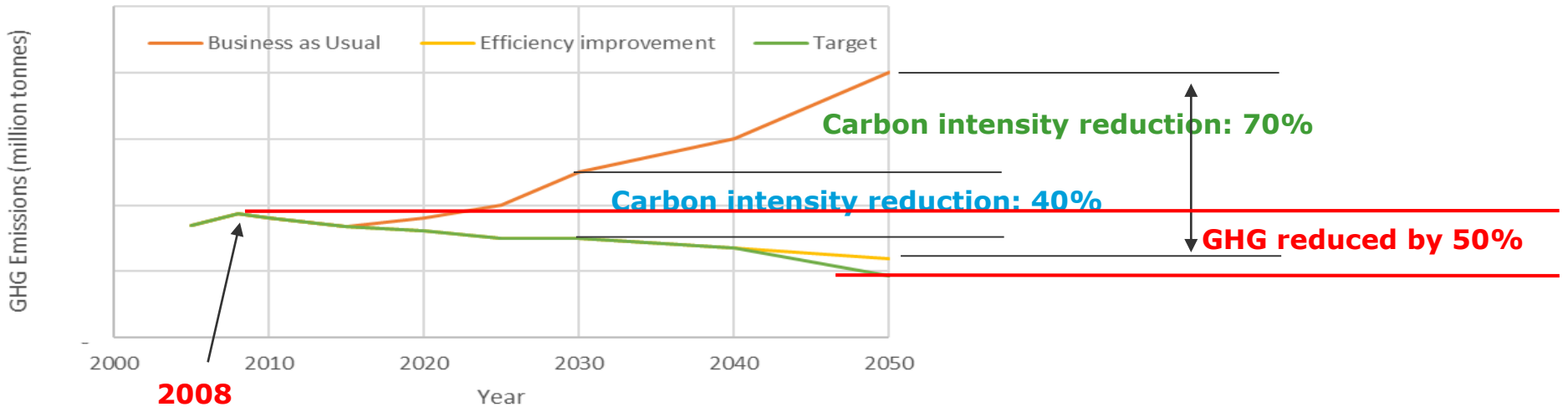
- 2008: Base year
- 2030: 40% carbon intensity improvement
- 2050:
  - 70% carbon intensity improvement
  - GHG reduced by 50%

Short-term measures: 2018 – 2023

Mid-term measures: 2023 – 2030

Long-term measures: 2030 – 2050

IMO GHG timelines, including possible key measures



Short-term 2018 – 2023

- Tighter EEDI & SEEMP
- Energy efficiency indicators
- Speed reduction
- National Action Plans

Mid-term 2023 - 2030

- Energy efficiency measures for new and existing ships, using new indicators
- Carbon pricing / MBM
- Plan for low carbon fuels

Long-term 2030

- Development of zero carbon fuels
- New/innovative emission reduction mechanisms

Global Sulphur Cap

What are the options?

2020-01-01

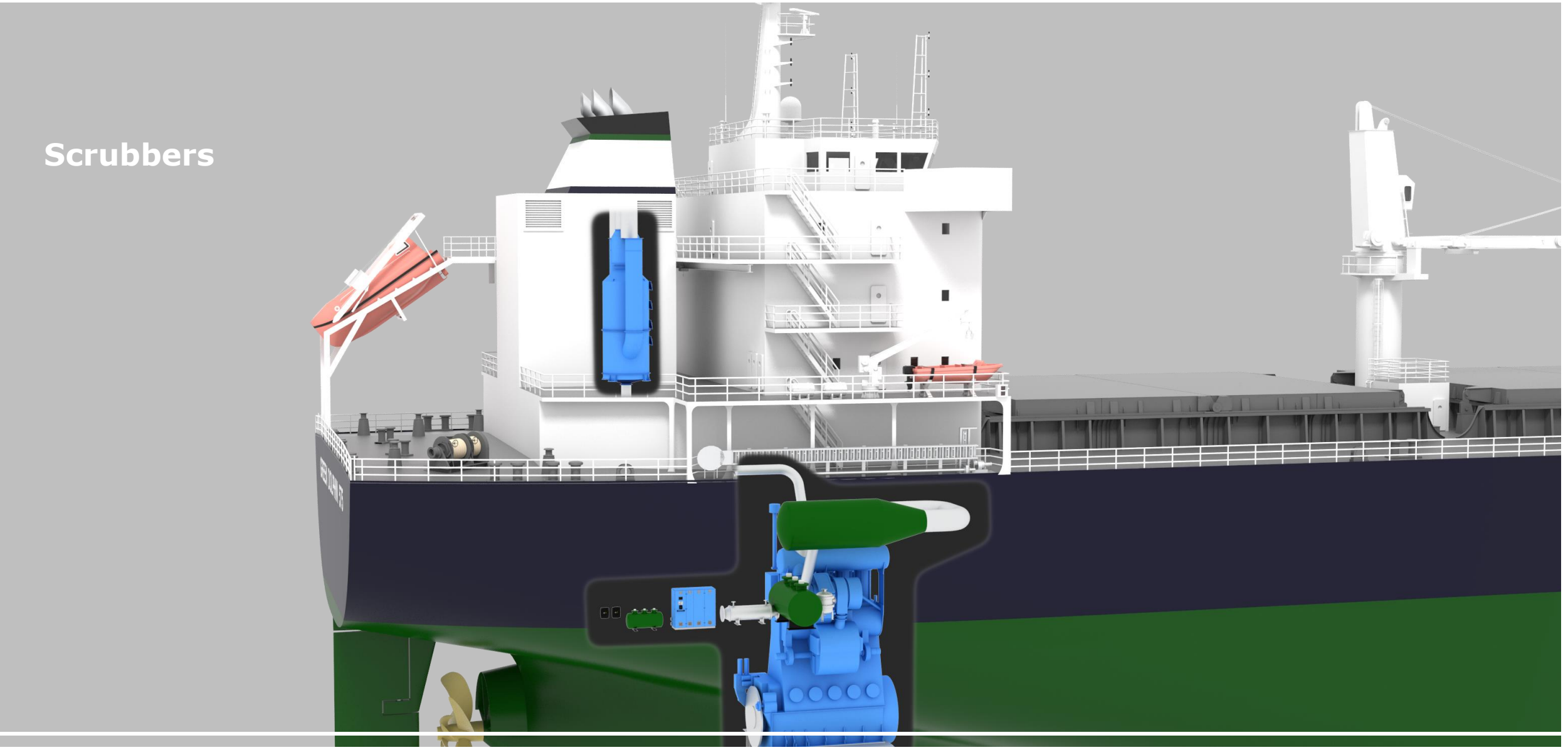
0.5% S

Compliance options:

- MGO / Distillates
- New Compliant Fuel Blends (0.5%S)
- HFO +Scrubber
- Alternative Fuels (LNG, LPG, Methanol, etc)

To prepare for 2020, options should be evaluated and strategies put in place to order to have the best competitive edge in the market

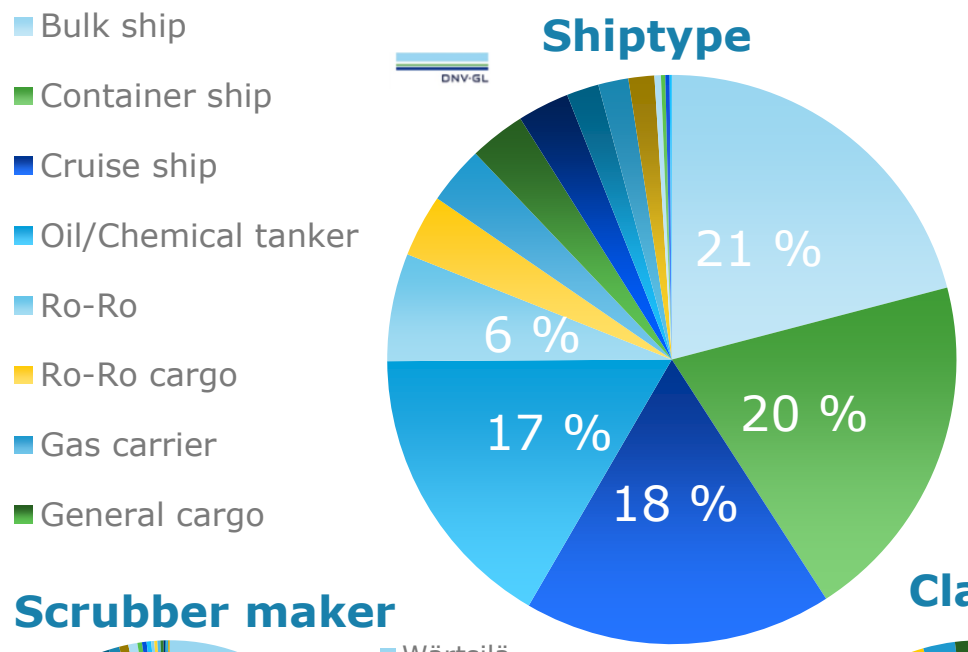
Scrubbers



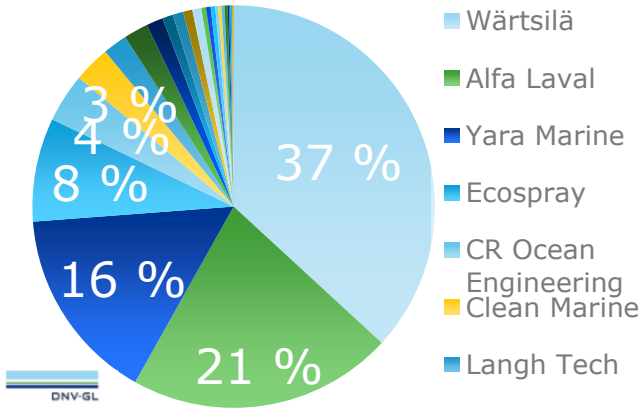
Source: https://lngi.dnvgl.com/

Total scrubber projects (as of 1st June 2018): 817

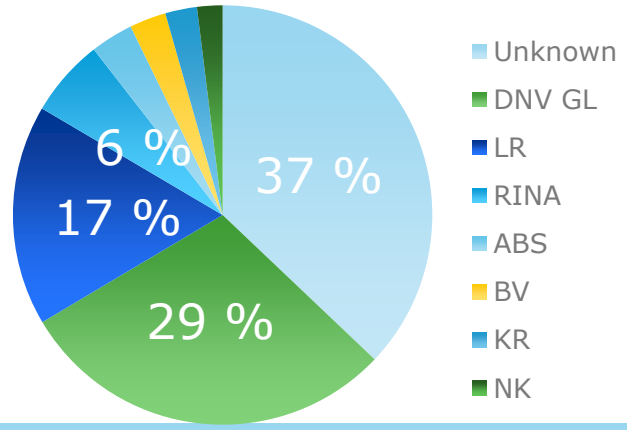
Shiptype



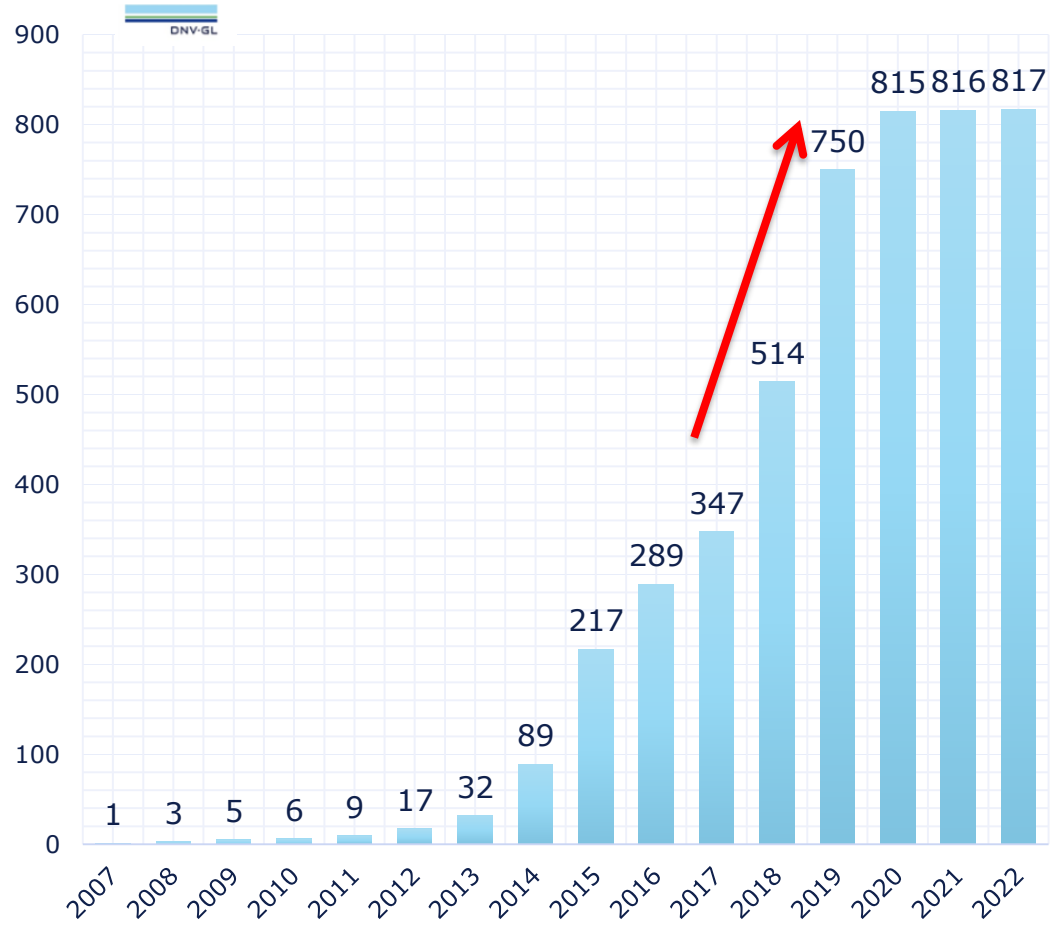
Scrubber maker



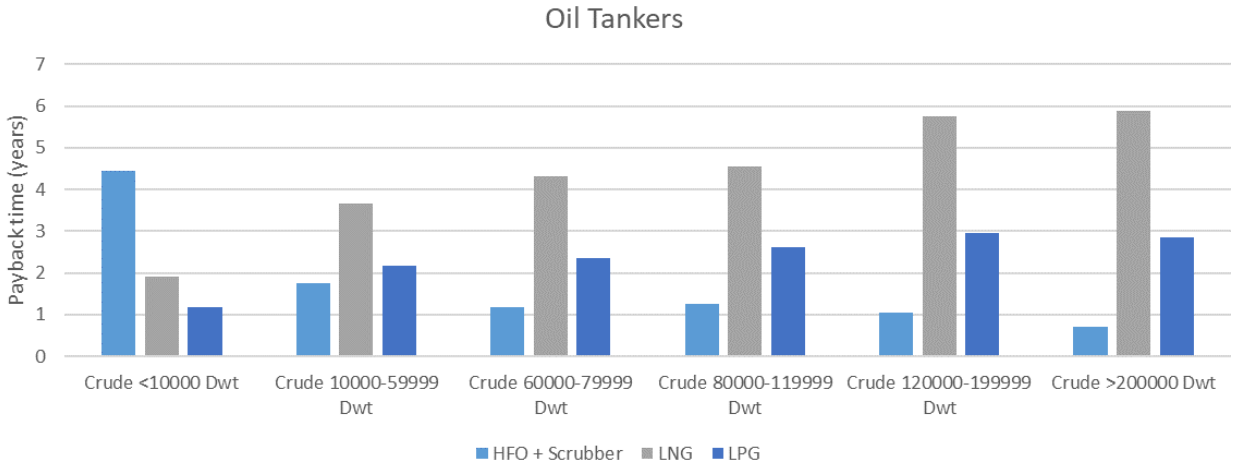
Class

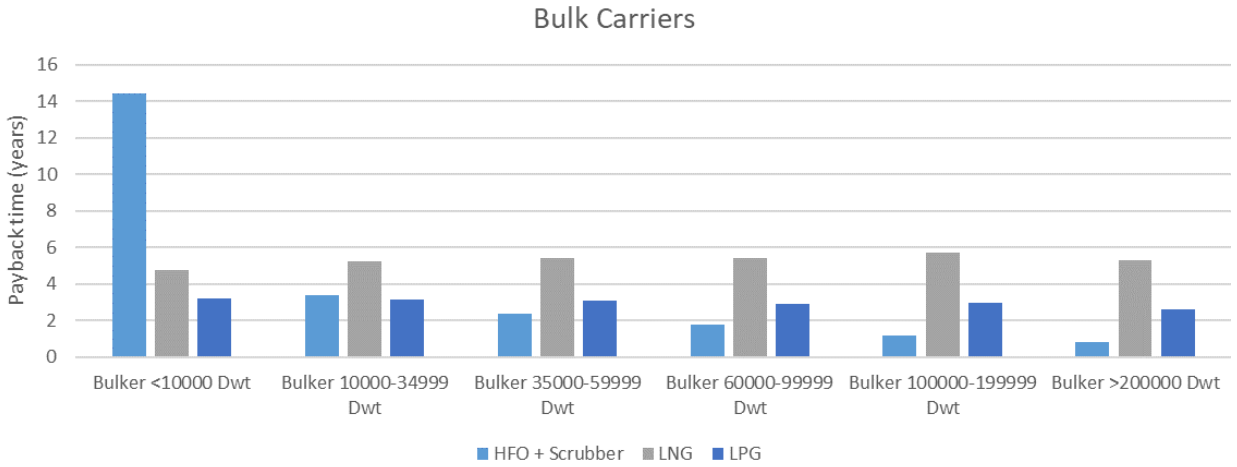


Scrubbers installed cummulative



Business Cases



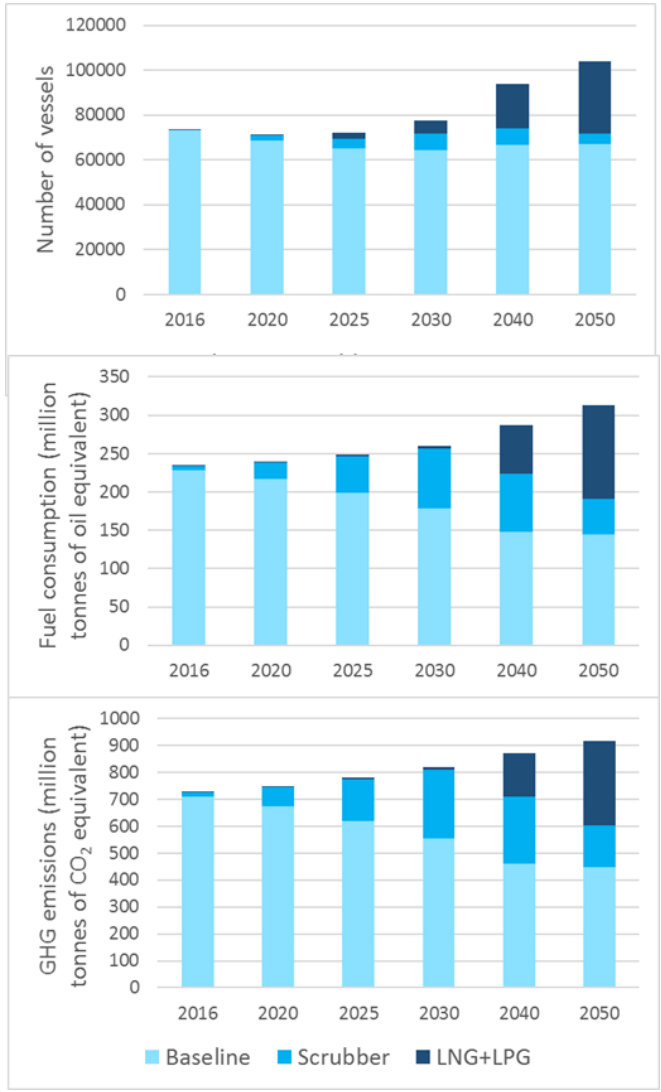


Disclaimer: Graphs for illustration purposes only, it should not be used as a basis for investment decisions.

Impact of scrubbers on GHG reduction

- Assumptions
  - Moderate trade growth
  - Scrubbers installed until 2030
  - No speed reduction
  - No energy efficiency measures
  - Short investment horizon
  - Low Carbon Fuels: high cost

- Scrubbers are attractive for large ships



Source: Low Carbon Shipping Towards 2050, DNV GL, 2017

Assessment of Selected Alternative Fuels & Technologies

Guidance for decision support over the next 5-10 years

List of fuels covered and content

Fuels

- HFO / MGO
- LNG
- LPG
- Methanol
- Biofuels
- Hydrogen

Technologies

- Wind-assisted propulsion
- Batteries
- Fuel cells

To assess all fuels or technologies in a comparable manner, the information is categorized as follows:

1. Price: Accounts for production process, raw materials, market price and the reasoning behind it, current/foreseeable (five years) price/expected price (beyond five years)

2. Infrastructure: Current/future distribution network, bunkering, availability

3. Regulation: Existing/expected regulations, consequences

4. Availability: Current / possible future production as related to the requirement in shipping

5. Environmental impact: CO_2, NO_X, SO_X, particulate matter (PM) and others

6. Technology: Availability of current/future technology, foreseeable changes

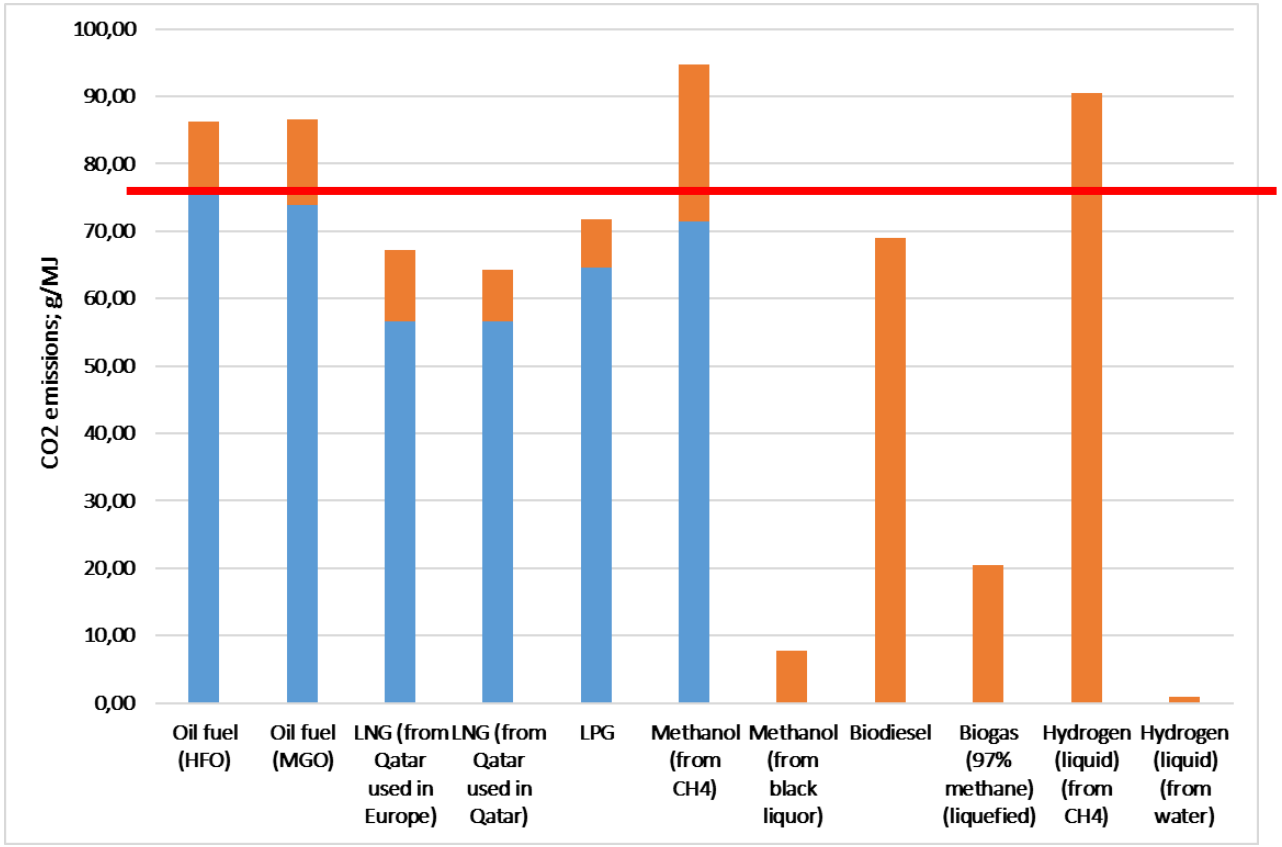
7. CAPEX: Engines, storage, processing, retrofitting

8. OPEX: Exhaust cleaning, scrubber, additional costs for fuel change

Please note that the following gives a brief overview only. For additional information, please refer to our Web platform on alternative fuels, which will be launched later this year.

https://www.dnvgl.com/news/dnv-gl-launches-alternative-fuels-white-paper-116424

CO_2 emissions of fuel alternatives in shipping



- For TTP no CH_4 slip effects considered
- For WTT CH_4 slip is considered

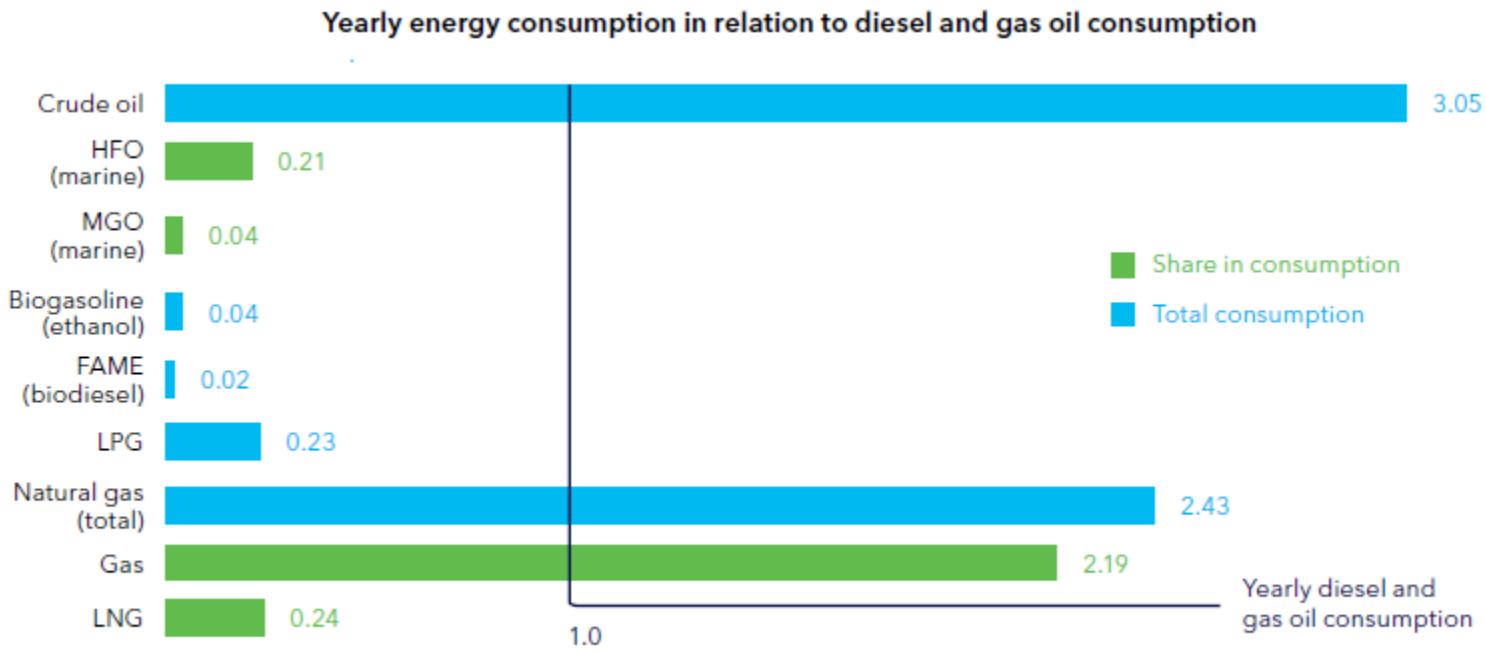
WTT

TTP

TTP= Tank To propeller

WTT=Well To Tank

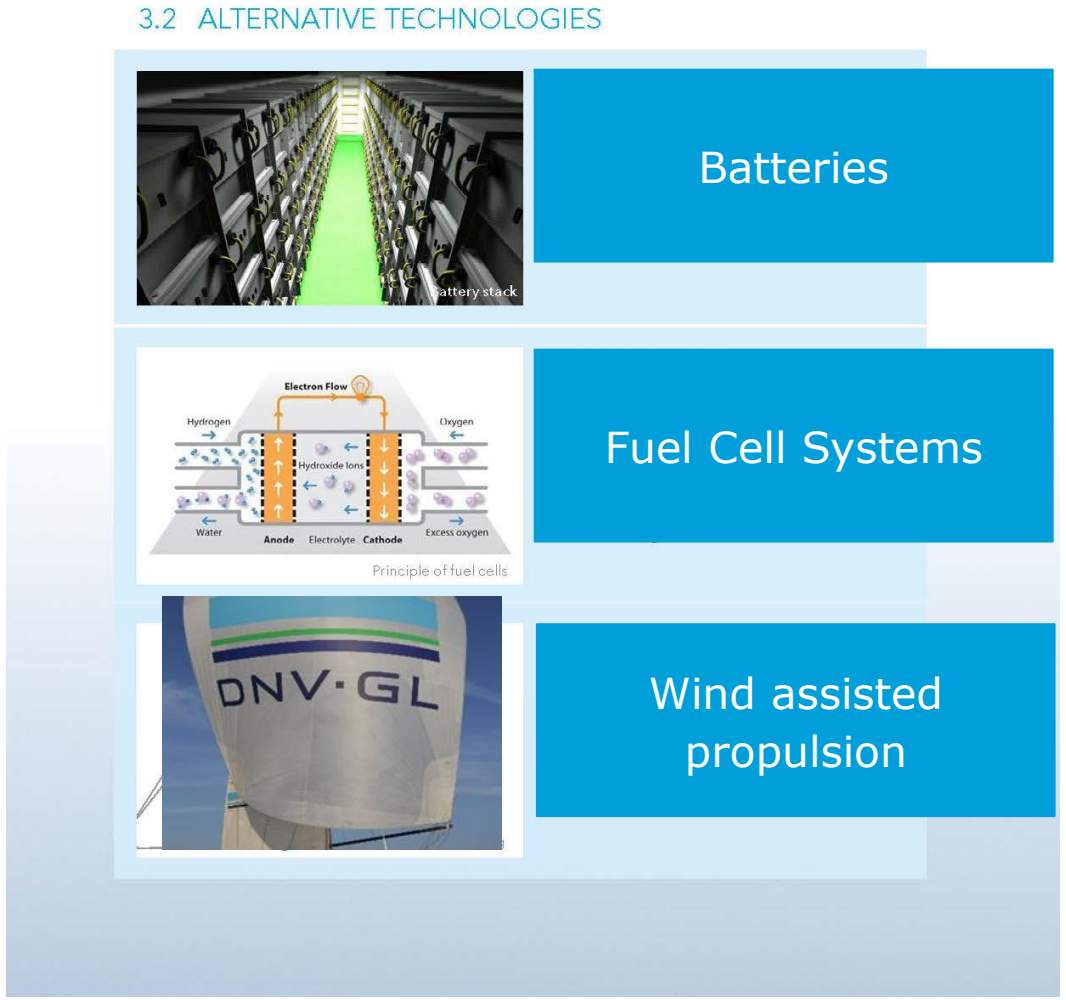
Availability of alternative fuels



Source: Figures represent 2016 statistics. Compiled form "bp-statistical-review-of-world-energy-2017-underpinning-data.xlsx" and "BWK, Bd 69(2017), No 5"

Batteries, Fuel Cell Systems and wind assisted propulsion

- **Batteries** as an 'alternative fuel' have major potential **for ships running on short distances**, and for any ship when used to **increase the efficiency** of the propulsion system. They **cannot substitute fuel** in deep-sea shipping.
- Ship applications of **fuel cell technology** are still in their **infancy**.
- **Wind**-assisted propulsion **has** a certain **potential** to reduce fuel consumption when used on slow ships, but the **business case** remains **difficult.**

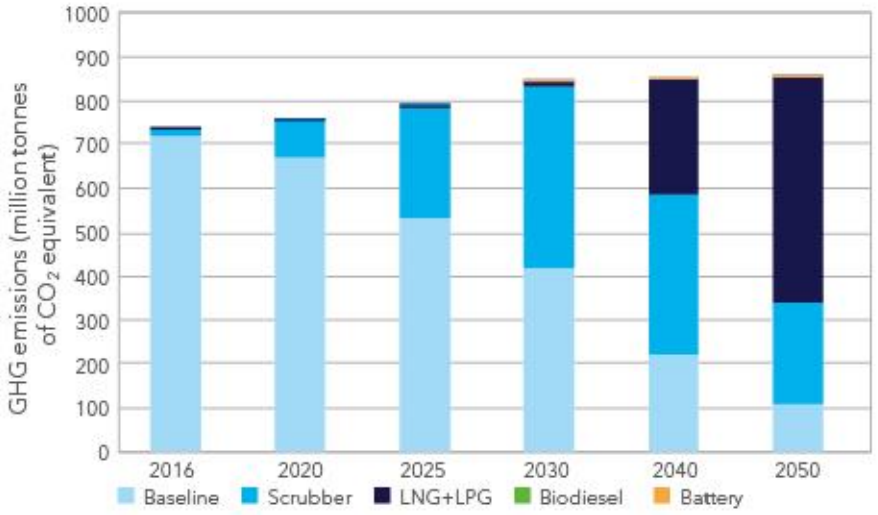


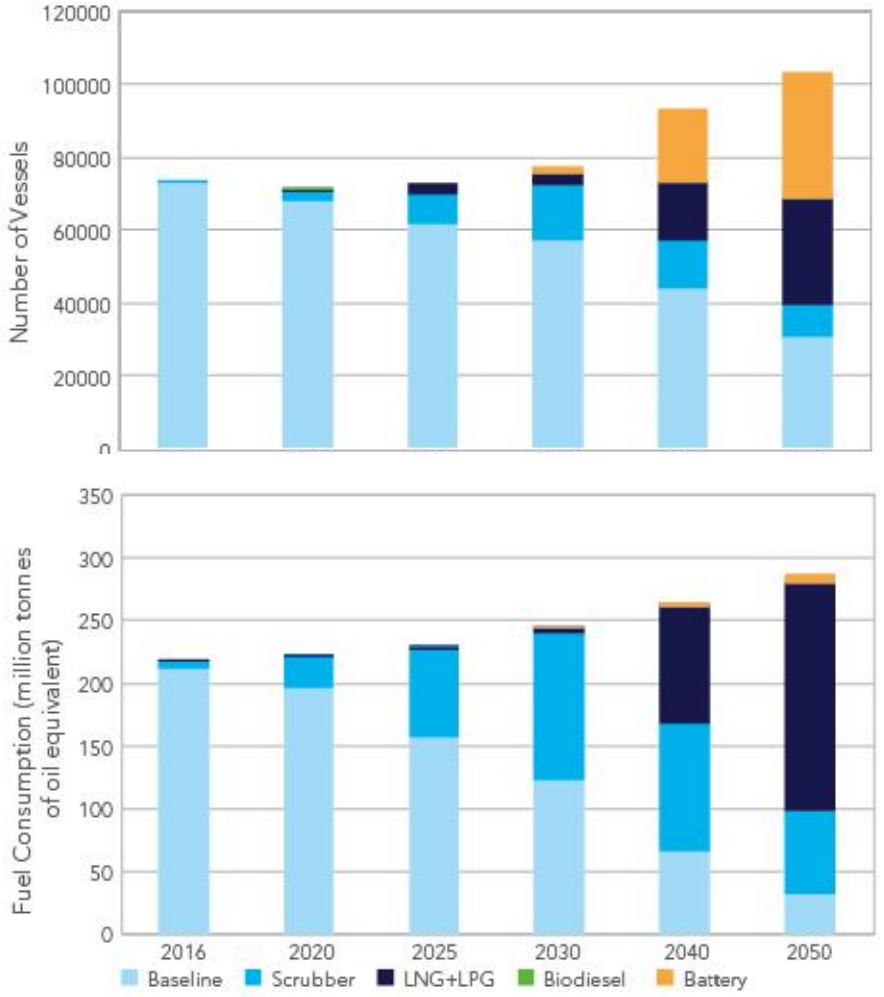
Potential impact of batteries and fuel cells

- Key Assumption:
  - Quick uptake of fully electric ships after 2030

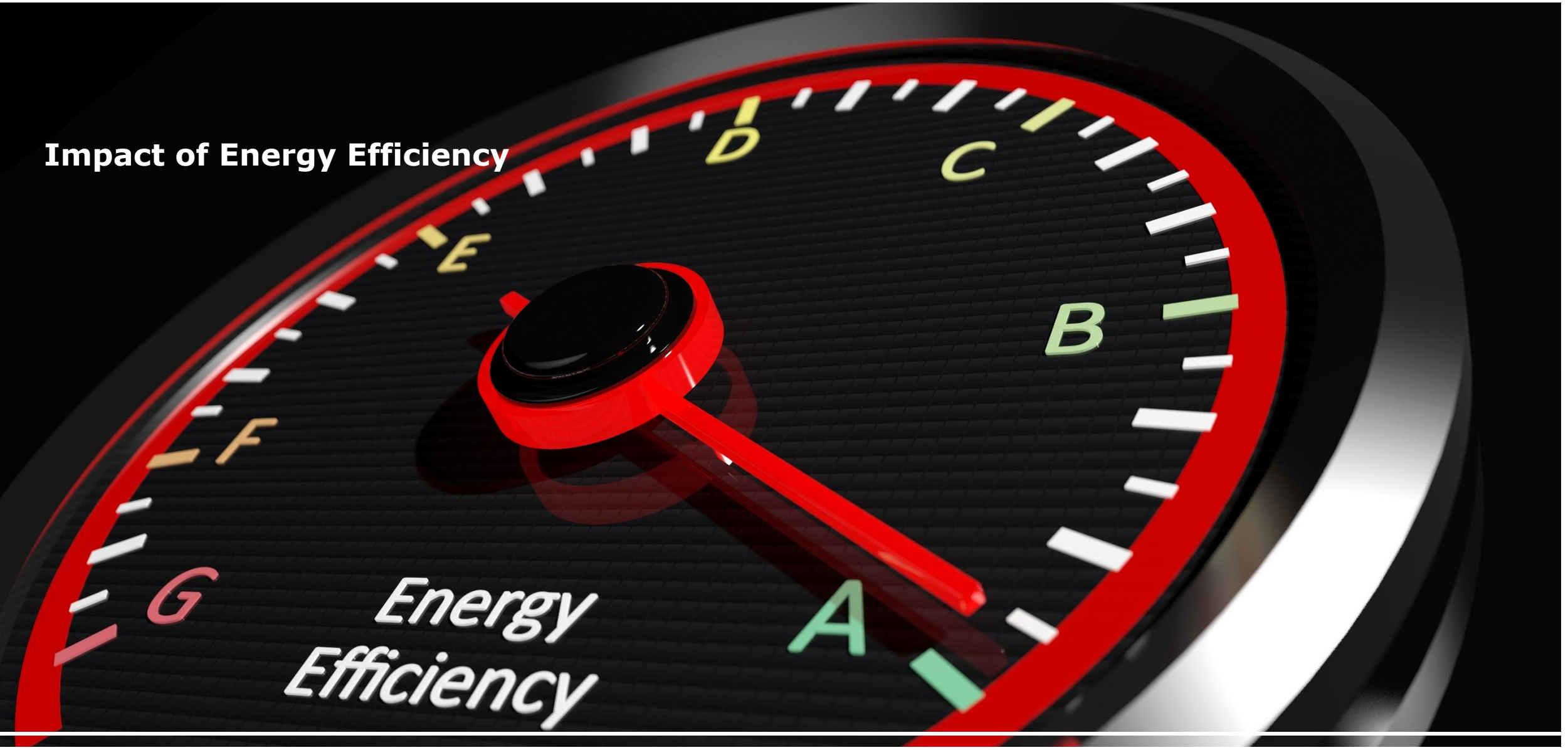
- 1/3 of ships sailing in 2050 fully battery powered
- Fuel consumption corresponds to ≈3% of total fuel consumption in 2050

⇒ **Liquid / Gaseous low carbon fuels are required**





Impact of Energy Efficiency



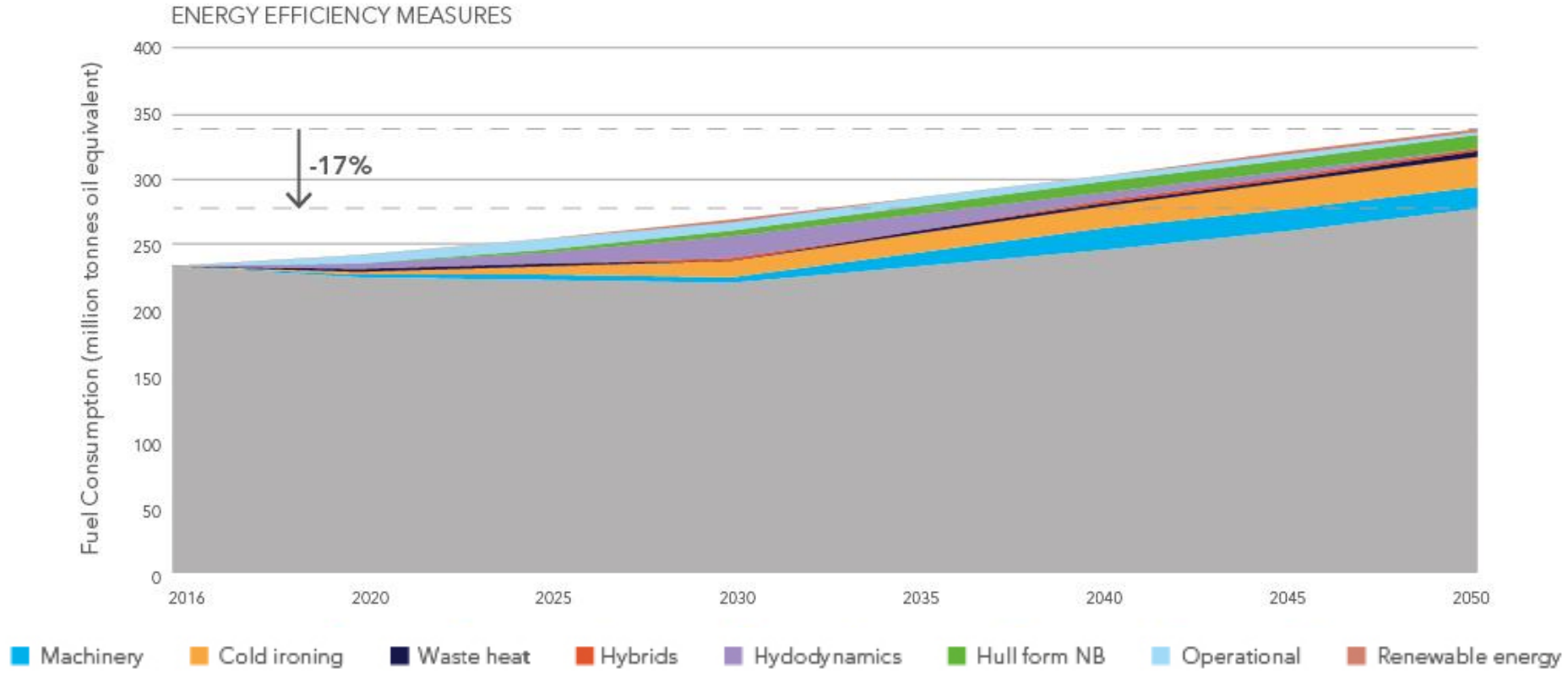
Energy Efficiency Measures

ENERGY EFFICIENCY	FUEL SAVINGS (DEPENDING ON SHIP TYPE AND SIZE)	
	MAIN ENGINE	AUXILIARIES
Hull Form – New buildings	12-17%	-
Hydrodynamics – Retrofit	13-20%	-
Machinery improvements	4-8%	12-23%
Waste Heat Recovery	0-8%	-
Hybridization	3-15%	
Operational measures	3-11%	-
Cold Ironing	-	30-70%
Renewable Energy (Solar, Wind)	0-10%	0-2%
Air Lubrication	3-5%	-
CUMULATIVE PER VESSEL	21-37%	
Speed reduction	Fuel savings depend on % of speed reduction. New vessels may have to be used to cover transport demand, therefore reducing the overall savings.	

Source: Low Carbon Shipping Towards 2050, DNV GL, 2017

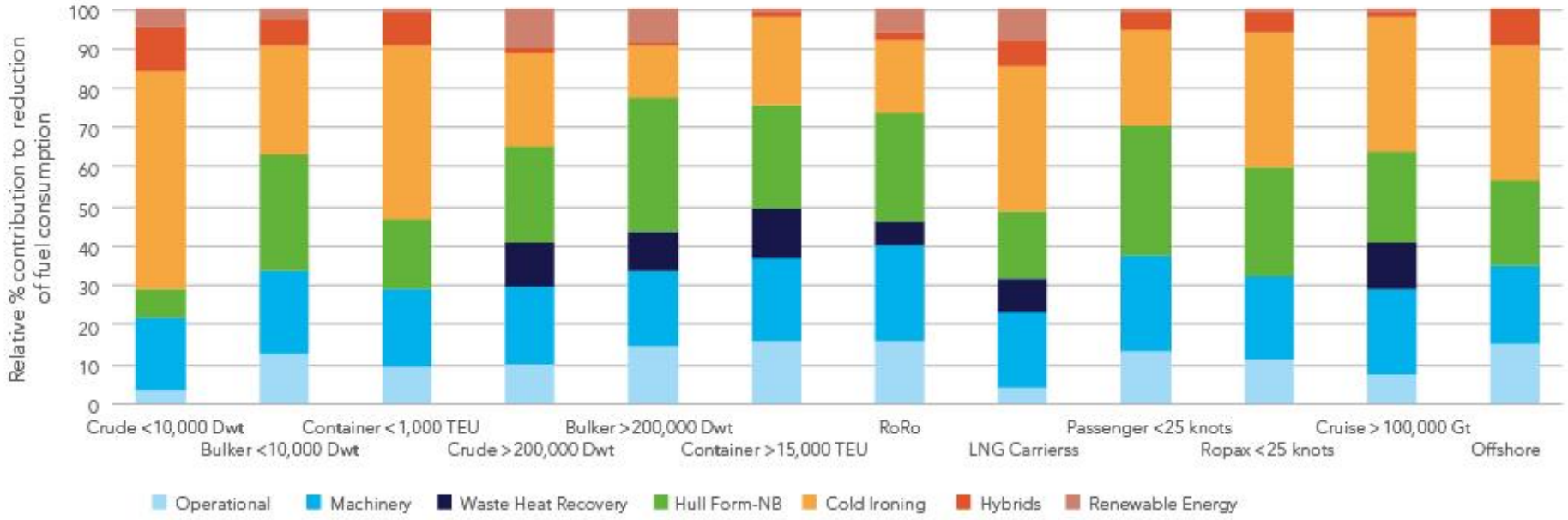
Energy efficiency potential

Source: Low Carbon Shipping Towards 2050, DNV GL, 2017



Moderate growth, short investment horizon

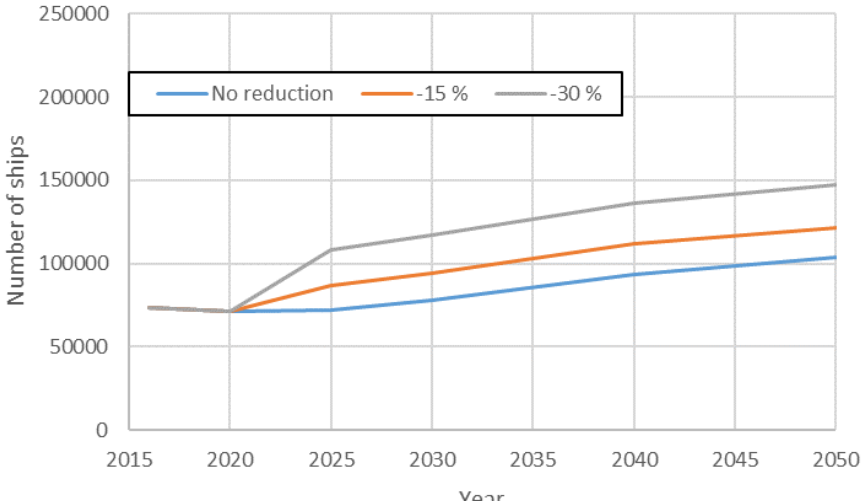
Impact of ship type and size

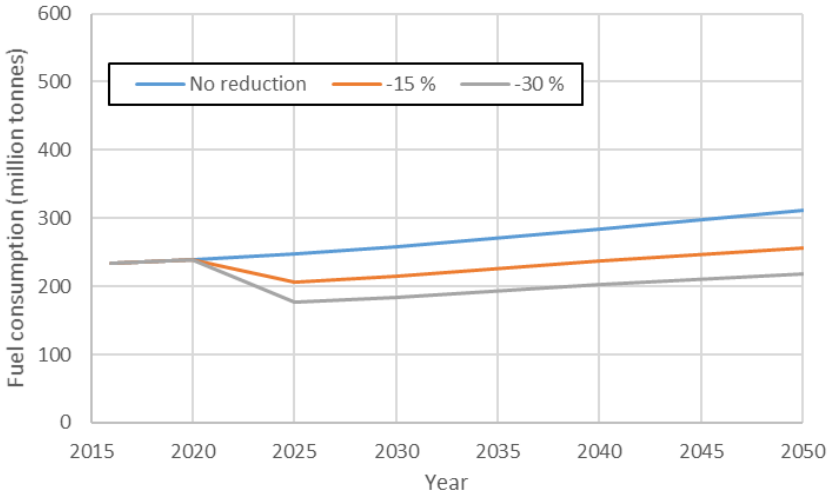


Source: Low Carbon Shipping Towards 2050, DNV GL, 2017

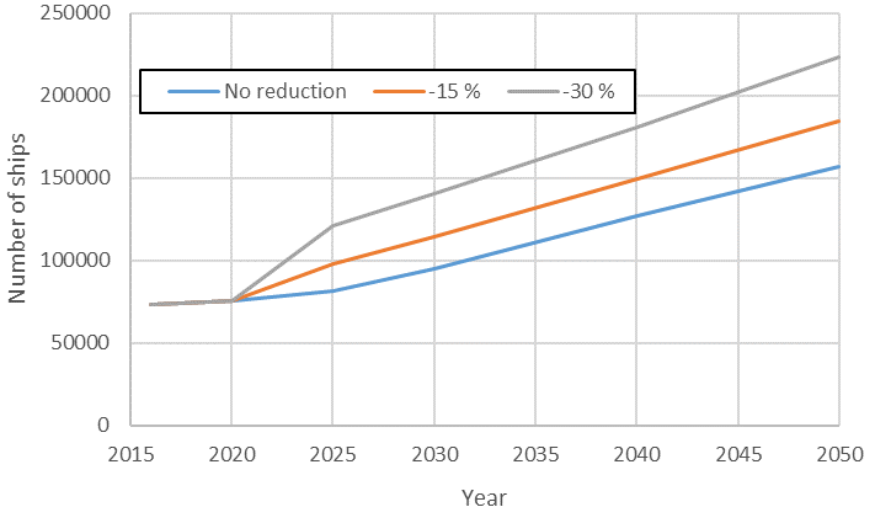
Speed Reduction

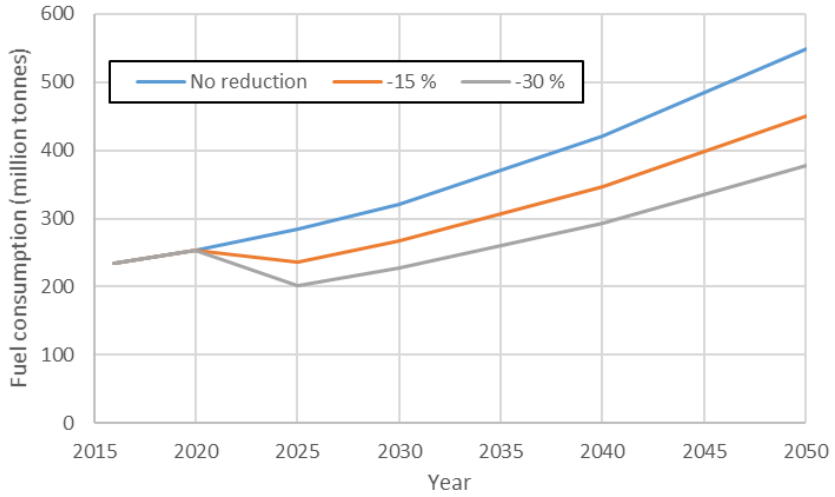
Moderate Growth



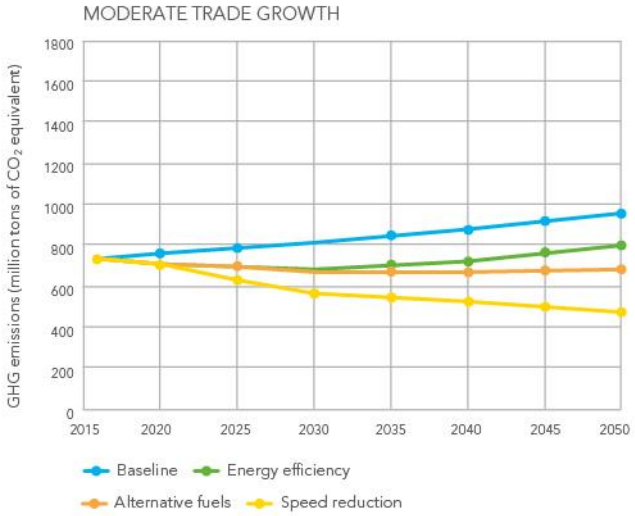


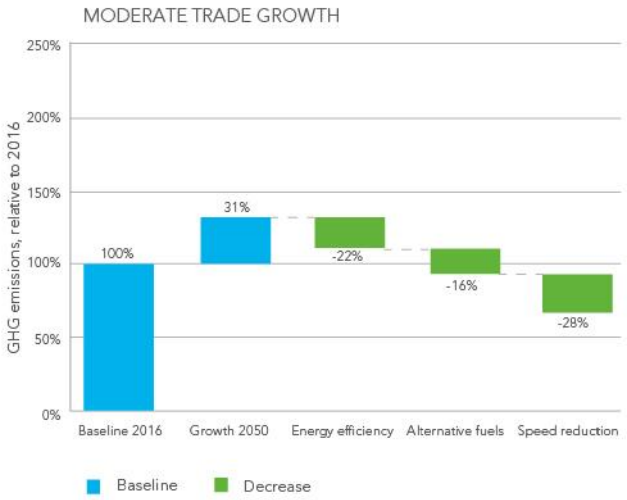
High Growth

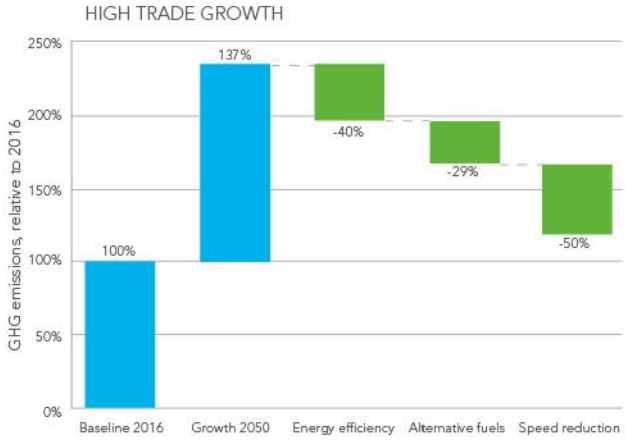




Impact of trade growth



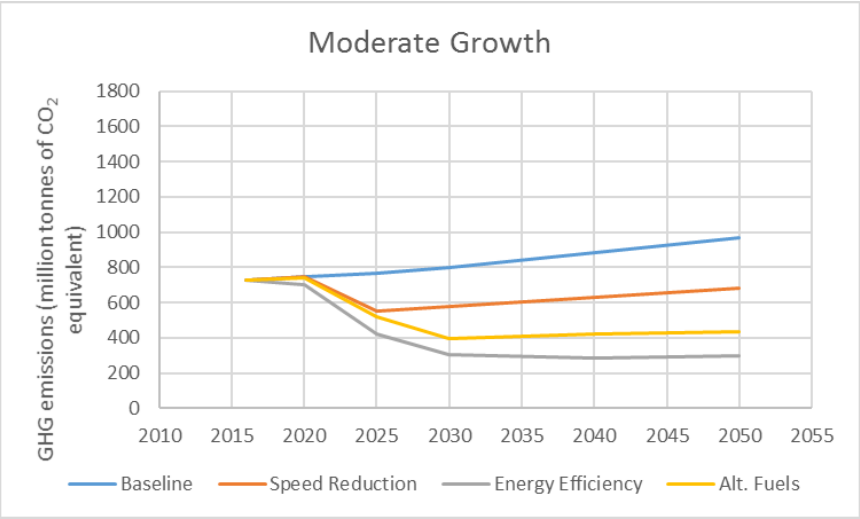


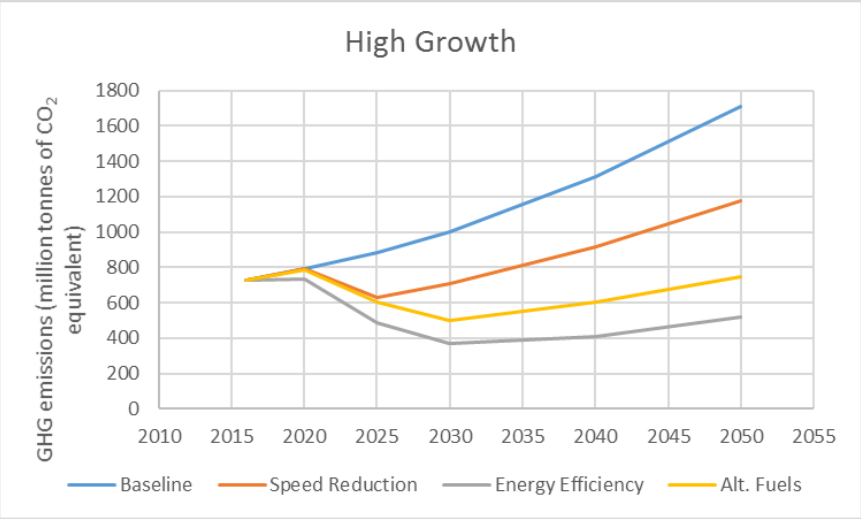


Source: Low Carbon Shipping Towards 2050, DNV GL, 2017

How far can we go?

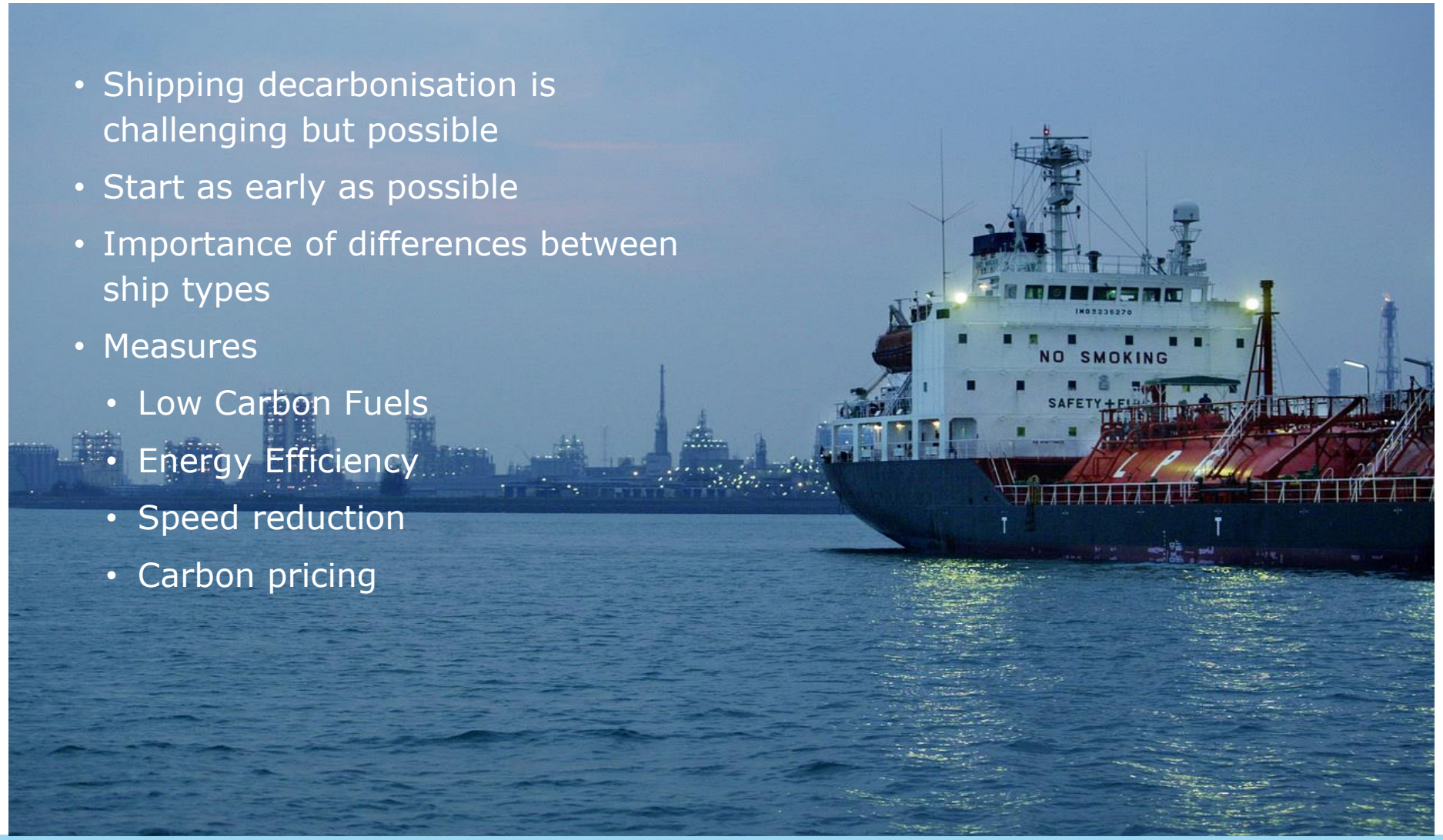
- Strong uptake of
  - Biofuels
  - Energy efficiency measures
- Speed reduction 30%





Source: Low Carbon Shipping Towards 2050, DNV GL, 2017

Moving Forward



- Shipping decarbonisation is challenging but possible
- Start as early as possible
- Importance of differences between ship types
- Measures
  - Low Carbon Fuels
  - Energy Efficiency
  - Speed reduction
  - Carbon pricing

Thank you for your attention

Christos Chryssakis, Business Development Manager
christos.chryssakis@dnvgl.com
+47 915 54 678

www.dnvgl.com

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