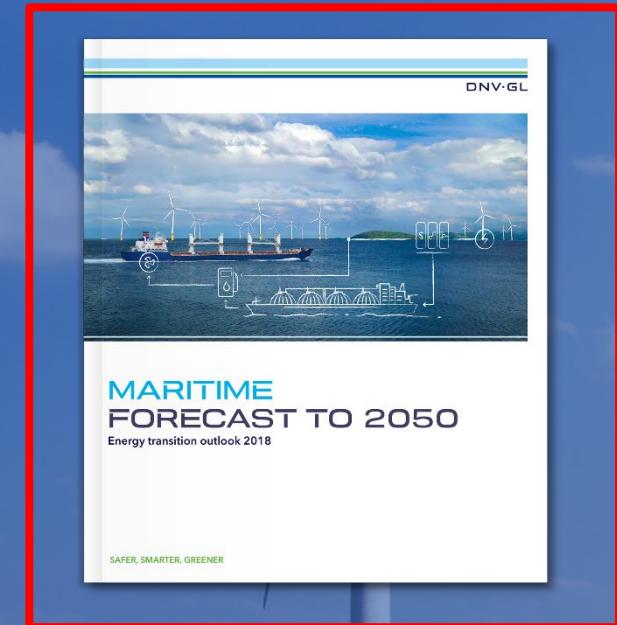
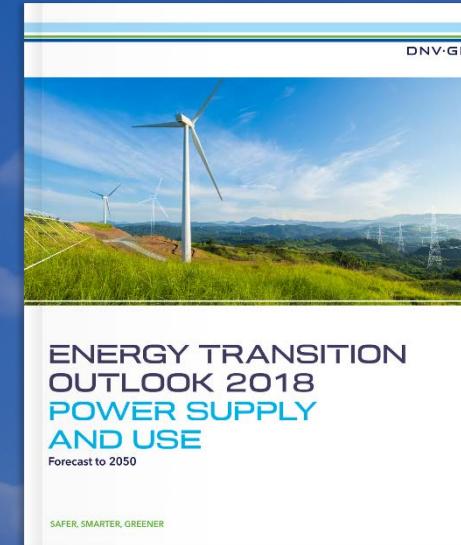
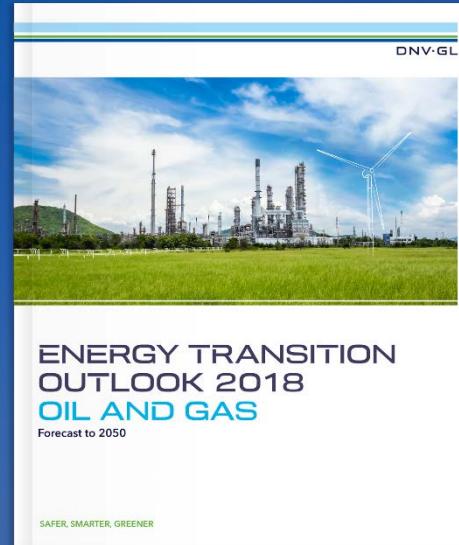
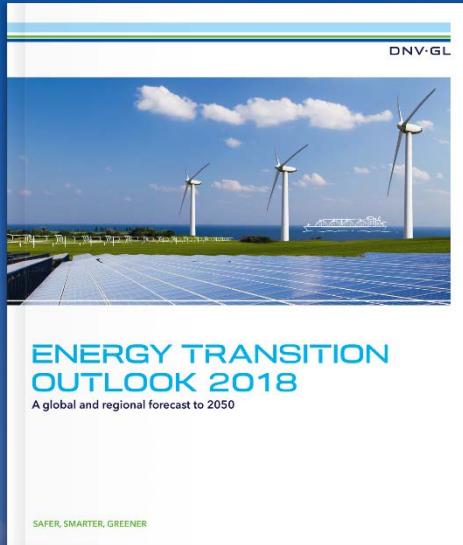




NTVA event - Nye klimakrav i skipsfarten

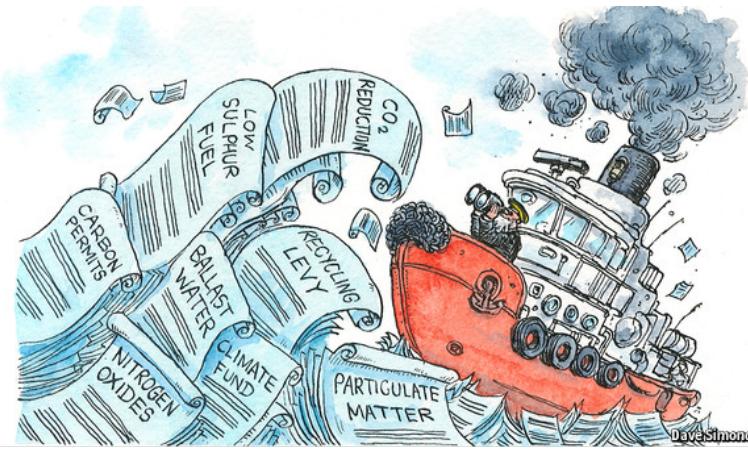
Kjetil Martinsen

DNV GLs utgivelser



Maritime forecast to 2050 gir en oversikt over hva som driver prosessene

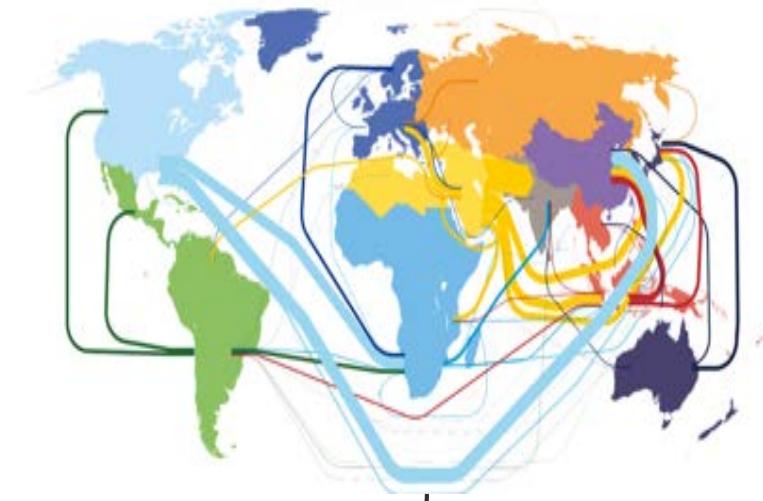
Regler og lovverk



Teknologi & drivstoff



Transportlinjer

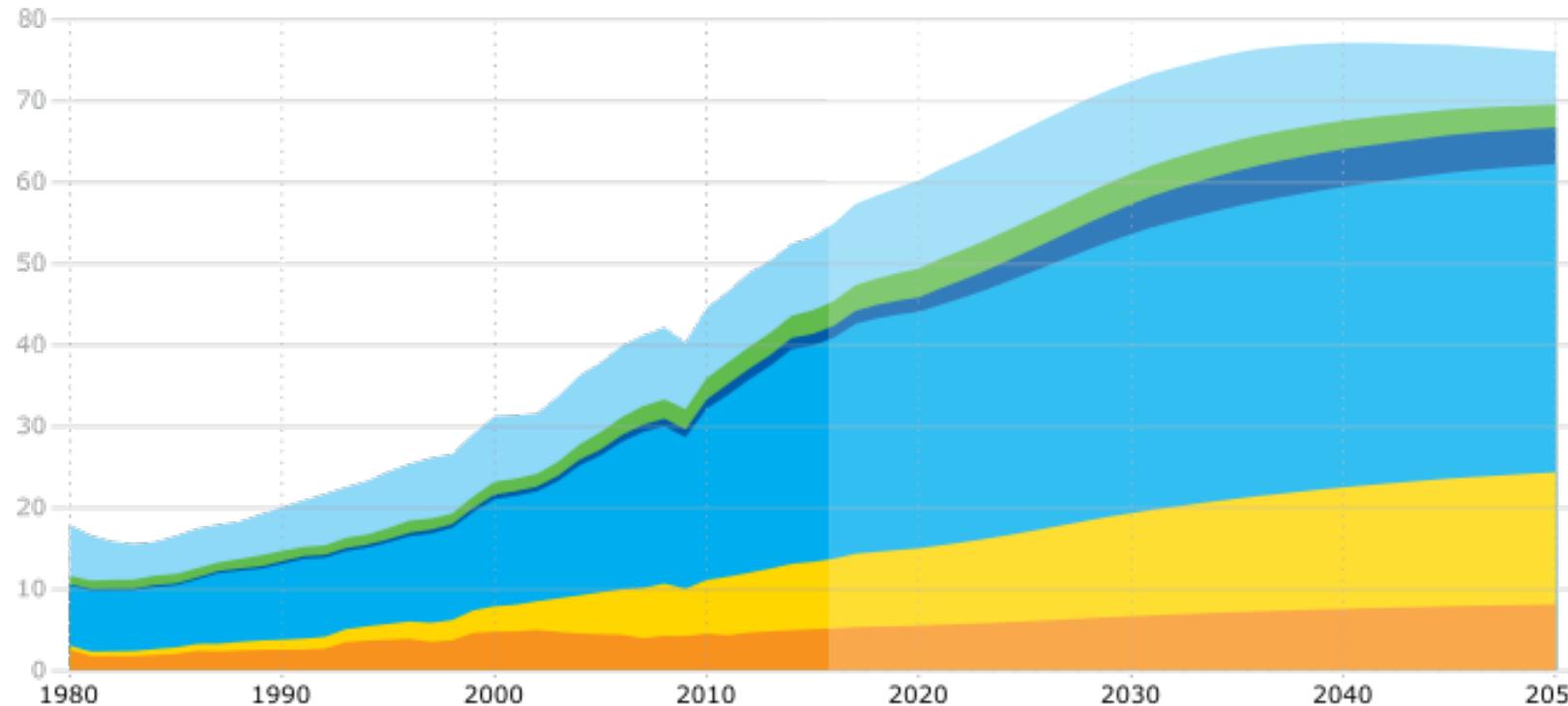


Behov for sjøtransport forventet å øke med 37% mot 2050

World seaborne trade: tonne-miles

Units: Tt-nm/yr

Crude oil Oil products Natural gas Bulk Container Other cargo



Sources: forecast - DNV GL; historical data - Clarkson Research, 2017

Gjennomsnittlig økning - 2%/år til 2030, så 0.2%/år mot 2050

Behov for sjøtransport forventet å øke med 37% mot 2050

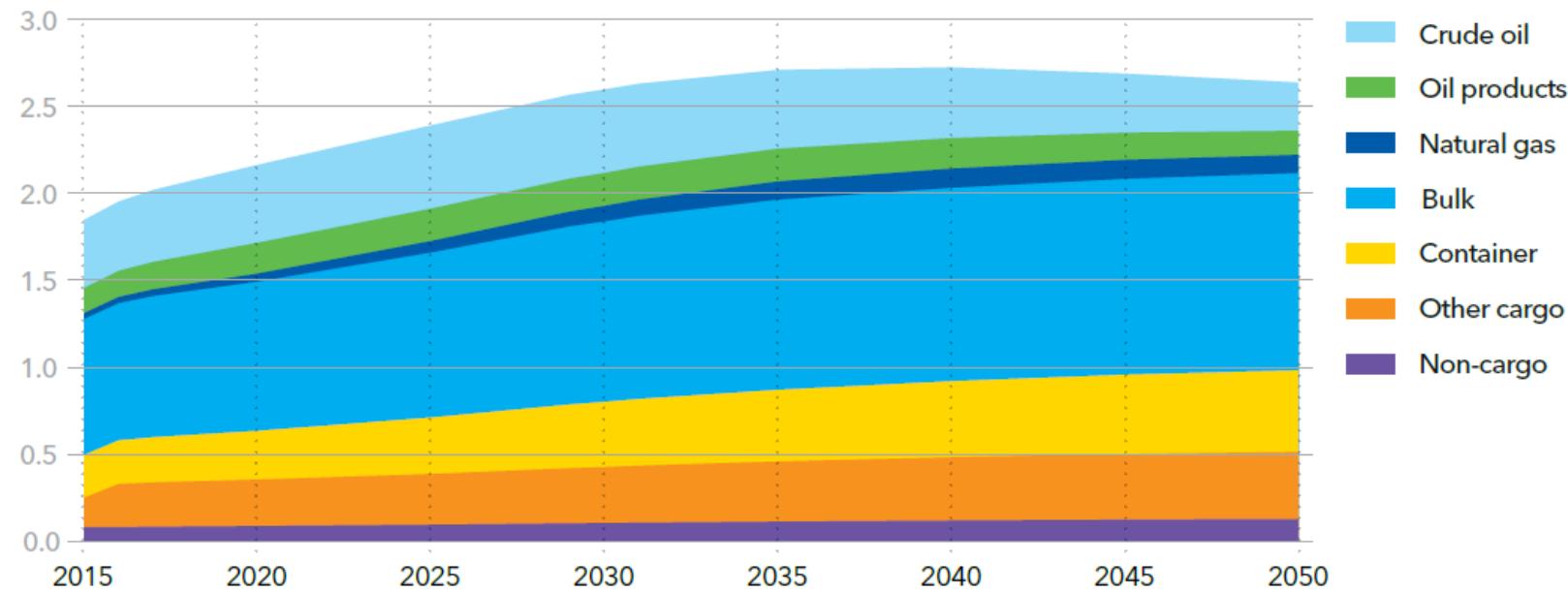
Forventet vekst i alle segmenter bortsett fra råolje og produkt.

Forventet for sekkmentene i 2050:

- Råolje: -30% (etter å ha vokst til pluss 20% i 2030)
- Olje produkt: -8%
- LNG tank: 190%
- Tørrbulk: 44%
- Container: 88%
- Andre: 55%

Fleet development by segment

Units: Billion dwt

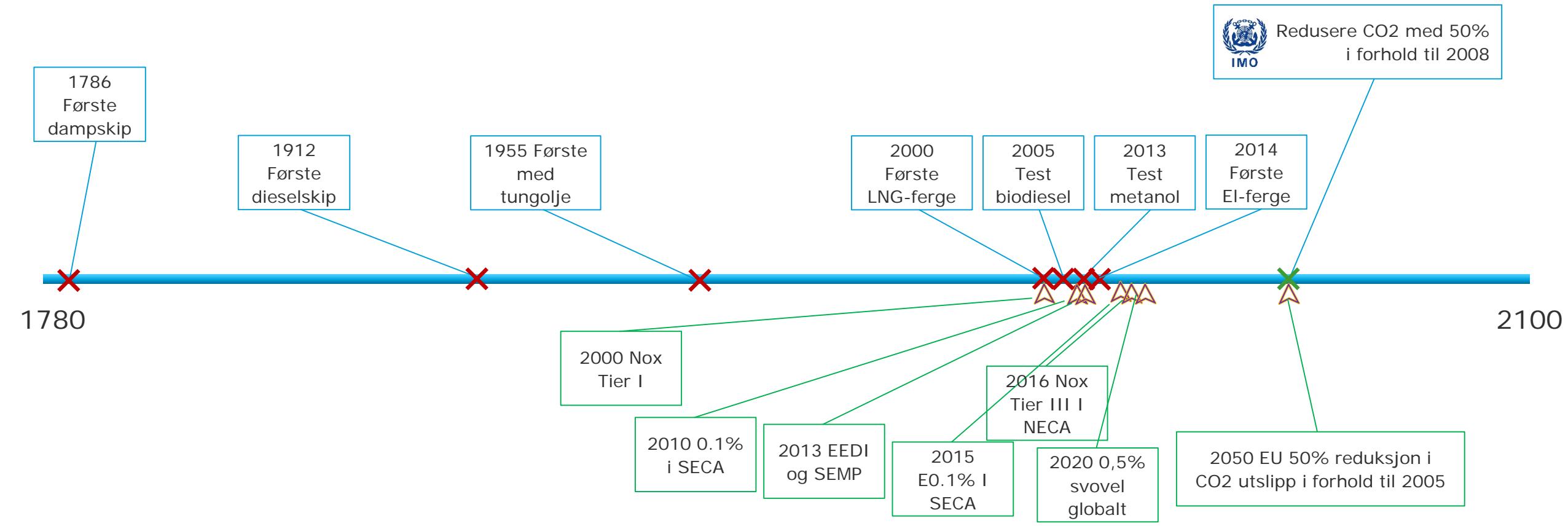


Historiske og framtidige overganger

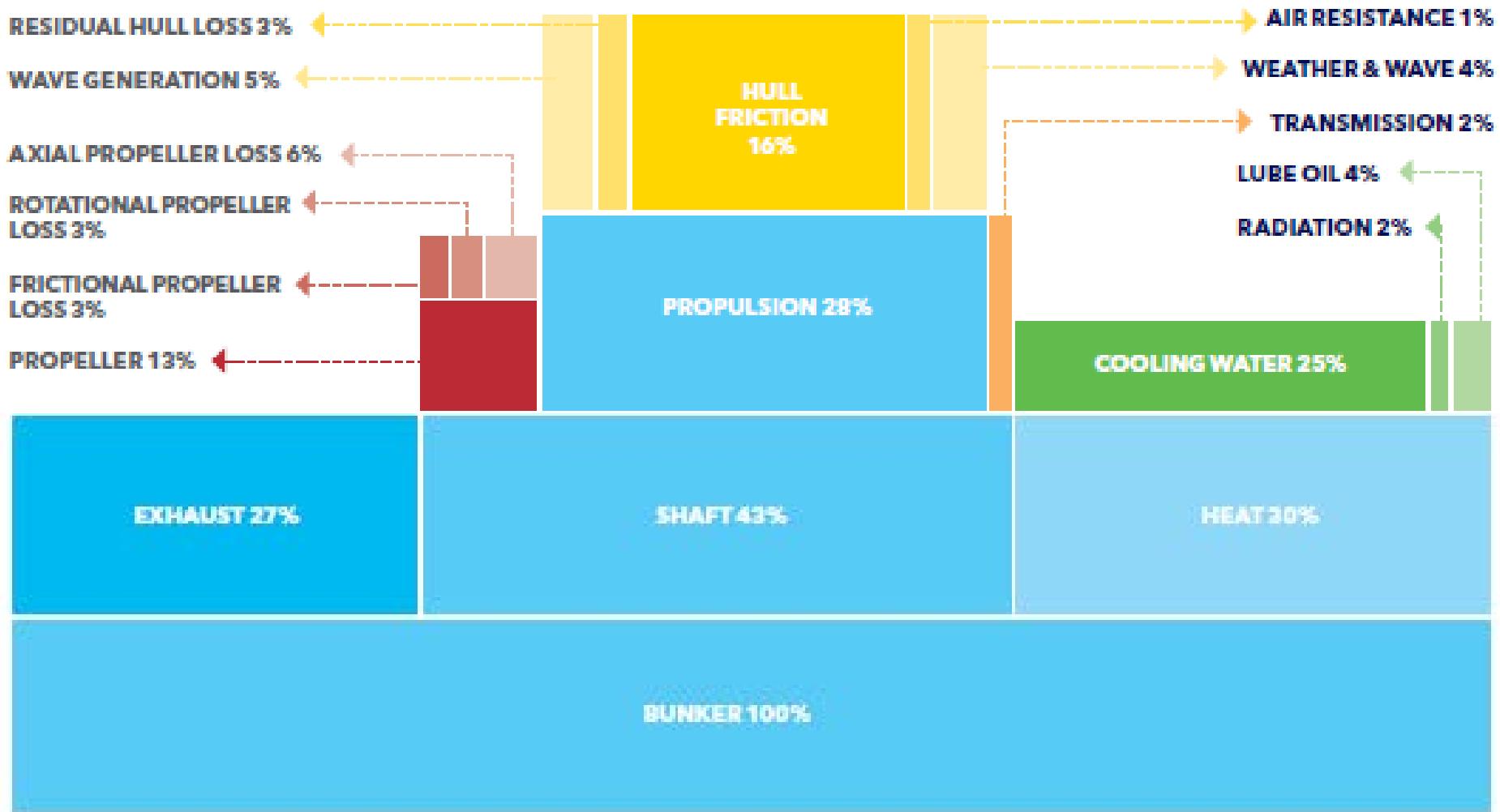
Overgang fra seil til damp

Overgang fra kull til olje

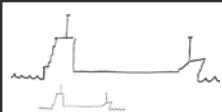
Overgang fra damp til diesel



Så mye hadde jeg



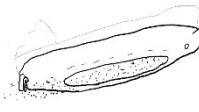
Mange mulige strategier for reduksjon av klimautslipp fra shipping



LOGISTICS & DIGITALIZATION

- Speed reduction
- Vessel utilization
- Vessel size
- Alternative routes

>20%



HYDRODYNAMICS

- Hull coating
- Hull form optimization
- Air lubrication
- Cleaning

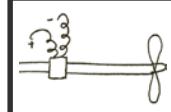
10-15%



MACHINERY

- Machinery improvements
- Waste heat
- Engine de-rating
- Battery hybridization

5-20%



FUELS AND ENERGY SOURCES

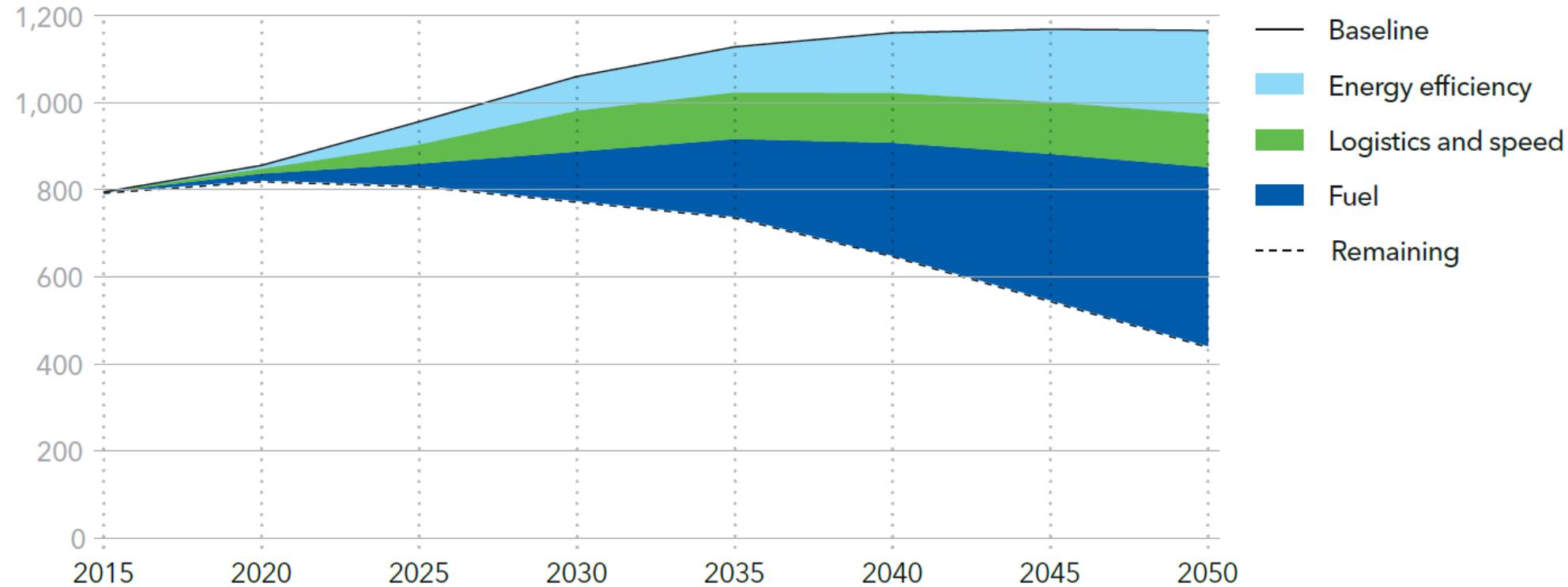
- LNG/LPG
- Electrification
- Biofuel
- Synthetic/hydrogen etc.

0-100%

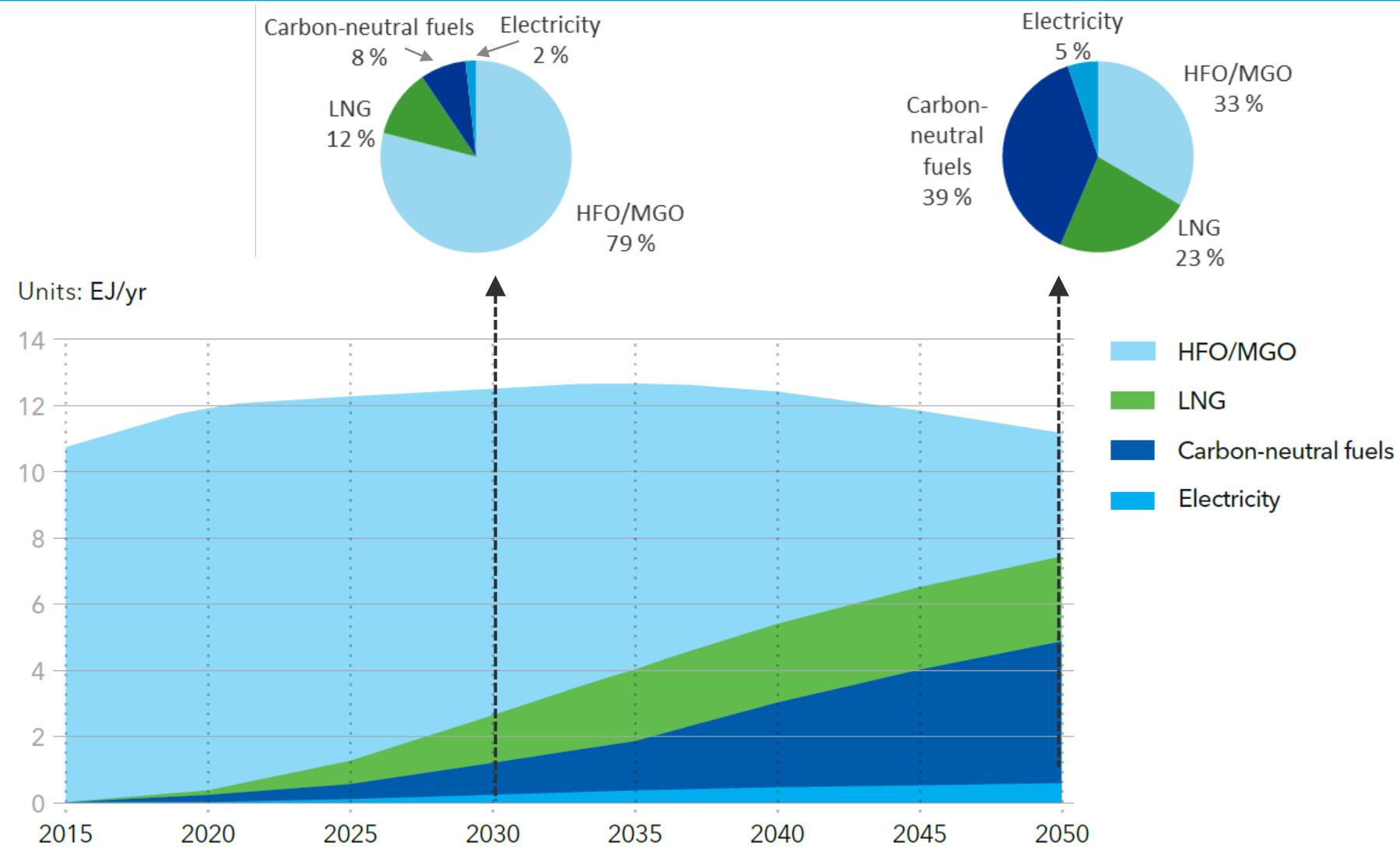
Reduksjon av klimagassutslipp vil være hovedutfordringen for shipping det neste decenniet

International shipping: emissions pathway 2015-2050

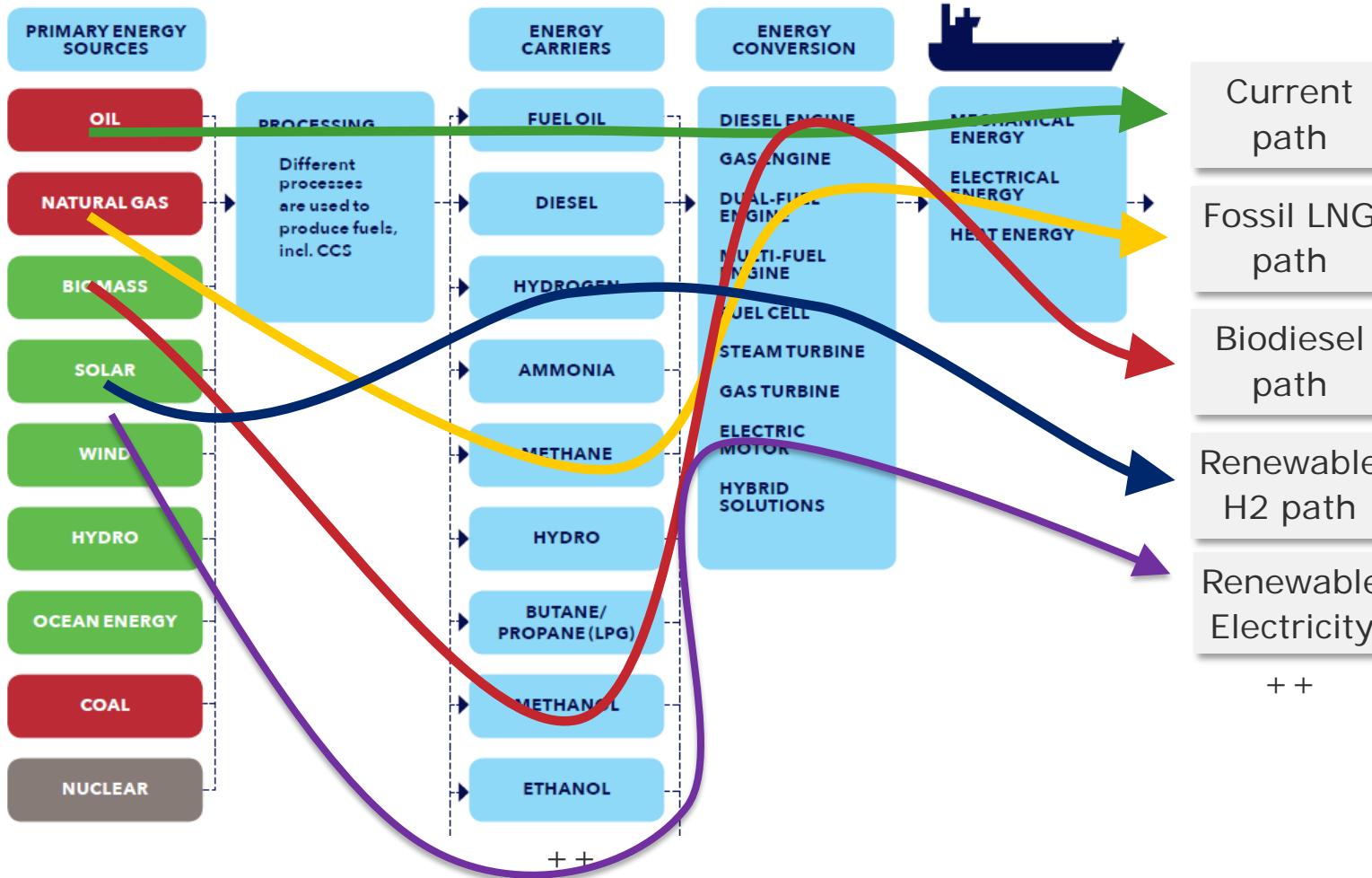
Units: MtCO₂/yr



2050 foventes 39% av energien i shipping å komme fra karbonnøytralt drivstoff – mer enn de tradisjonelle drivstoffene



Forskjellige veier til lav/nullutslipp – ingen soleklare vinnere



Inspired by Brynolf S. (2014), 'Environmental assessment of present and future marine fuels'

Nøkkelpunkter

Opprinnelsekilde:

- Fornybart, Kjernekraft?

Prosessering:

- Karbonfangst i produksjon av e-drivstoff?

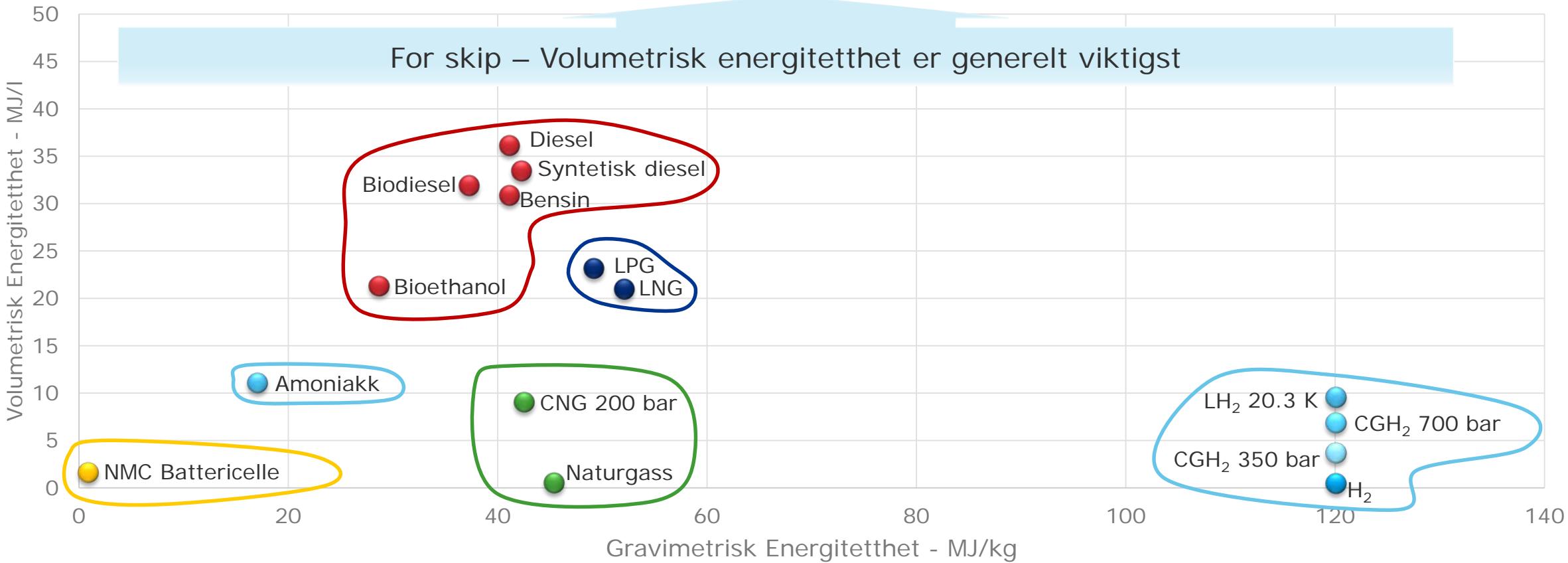
Hvilke energibærere:

- Veske, gass, hydrokarboner?

Hvilken energiveksler:

- Forbrenningsmotor, Brenselcelle, electromotor?

Energitetthet mellom forskjellige drivstoff



Evaluation of fuel paths – globally today

Fuel path	Primary source	Energy carrier	Energy converter	Scalability	Economy	Environment
Current	Oil	HFO/MGO	Diesel engine			
Fossil LNG/LPG	Gas	LNG/LPG	Gas/dual fuel engine			
Biofuels	Biomass	Diesel/LBG	Diesel/gas/dual fuel engine			
Electrofuels	Solar/wind/ hydro/nuclear	Diesel/LNG	Diesel/gas/dual fuel engine			
Electricity	Solar/wind/ hydro/nuclear	Battery	Electric motor			
Renewable H ₂ /NH ₃	Solar/wind/ hydro/nuclear	Hydrogen/ ammonia	Fuel cell			

Environment: air emissions, bunker spill. **Economy:** ship, infrastructure. **Scalability:** technical, applicability, availability

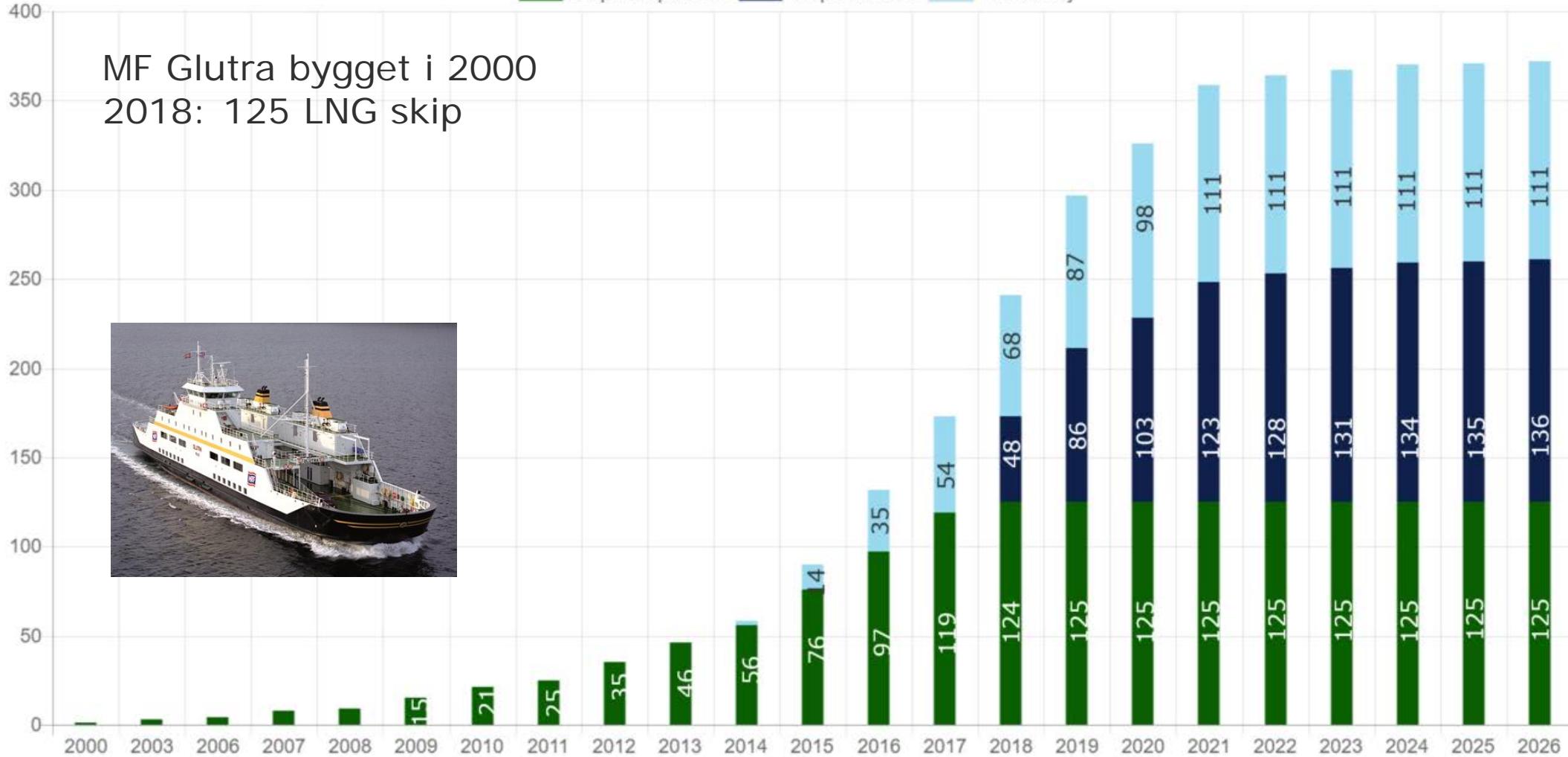
Biofuels: fuels based on carbon from biomass that would otherwise have been in circulation through natural cycles

Electro-fuels: carbon-based fuels such as diesel, methane, and methanol, produced from CO₂ and water using electricity as the source of energy

LNG-drevne ships

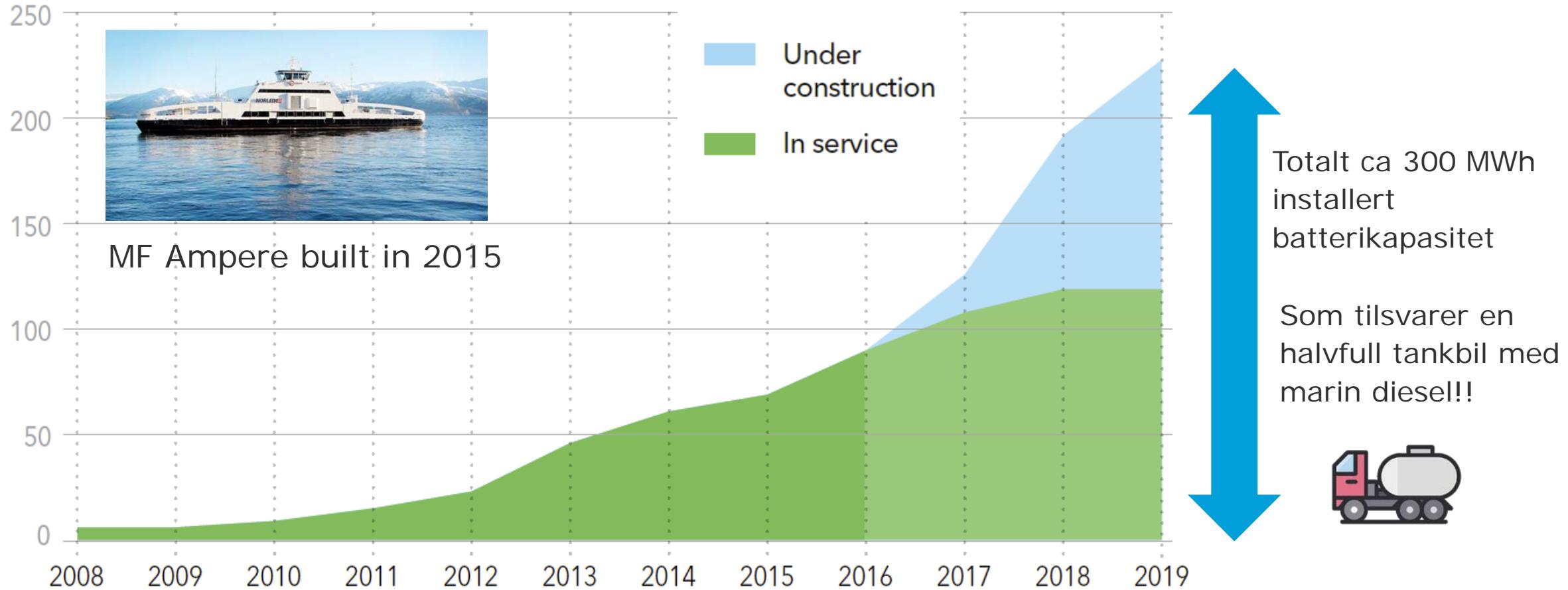
Units: Number of ships

 Ships in operation Ships on order LNG ready



Hel-elektrisk og batterihybride skip

Units: Number of ships

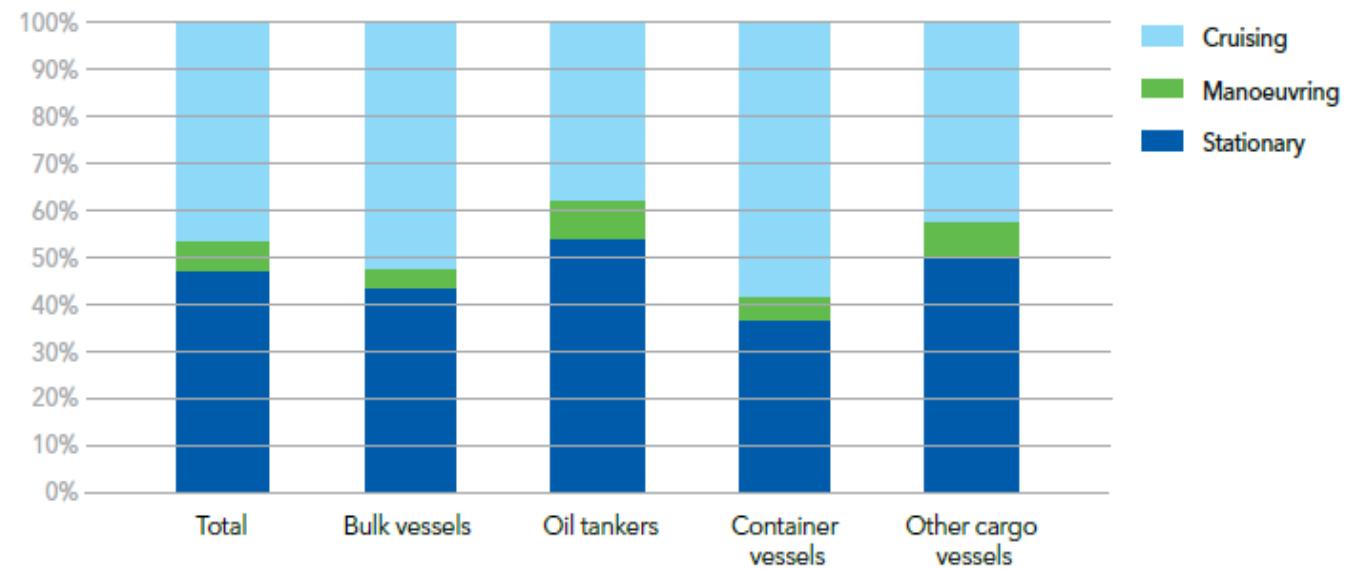


Digitalisering vil være en viktig nøkkel for effektivisering

- Forbedret koordinering og synkronisering mellom skip og havn
 - Optimalisering av rute og tilgjengelighet av havneressurser
 - Bedre samsvar mellom skip og havneinfrastruktur
 - Automatisert lastehåndtering
 - Innfasing av autonome skip
 - Automatisert dokking

Share of time per operation mode in 2017 by cargo vessel segment

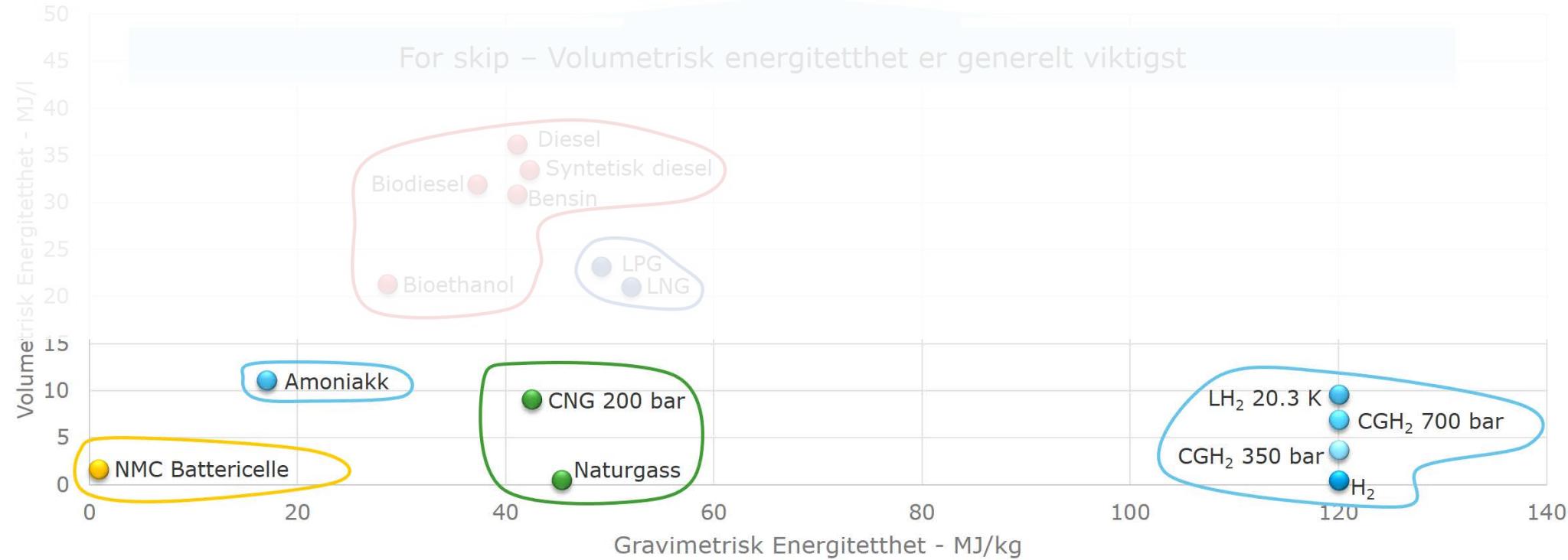
Units: Percentages



Time in the main operating modes:

- Stationary (0 knot, kn);
- Maneuvering (1–5 kn)
- Cruising (more than 5 kn)

Hva betyr dette i praksis?



Vi blir nødt til å ta i bruk «B-laget» blant energibærerne

Hva betyr dette for havnene?

- Behov for hyppigere bunkring
- Behov for større diversitet i tilbud i havnene
- Havnene som energihubber og lagre
- Lokal produksjon av drivstoff – i forbindelse med havner?



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