



Norges
Rederiforbund
Norwegian
Shipowners'
Association

Shipping worldwide and in the Arctic

Gunnar Malm Gamlem, Fagsjef Miljø / Environmental Director
4 February 2019

Shipping's environmental agenda



Land to sea



Global warming



Alternative fuels



Local air pollution



Discharge to sea



Oil spills



Garbage



Recycling



Green finance



Marine Protection



Arctic shipping



Seabed mining



Shipping's environmental agenda: Focus on Arctic / high north



Land to sea



Global warming



Alternative fuels



Local air pollution



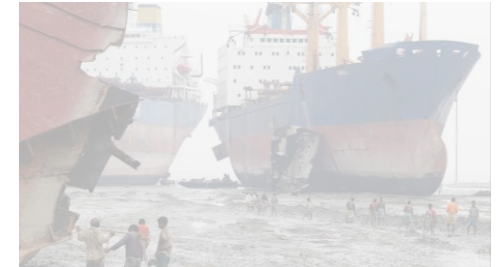
Discharge to sea



Oil spills



Garbage



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Arctic shipping



Seabed mining



Limited focus / mental capacity?

Shipping's environmental agenda



Land to sea



Global warming



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Arctic shipping



Seabed mining

GHG

CO2

Methane

NOX

SOX

PM

BC



Drivers for shipping in the Arctic



Drivers: Exports of metals and energy



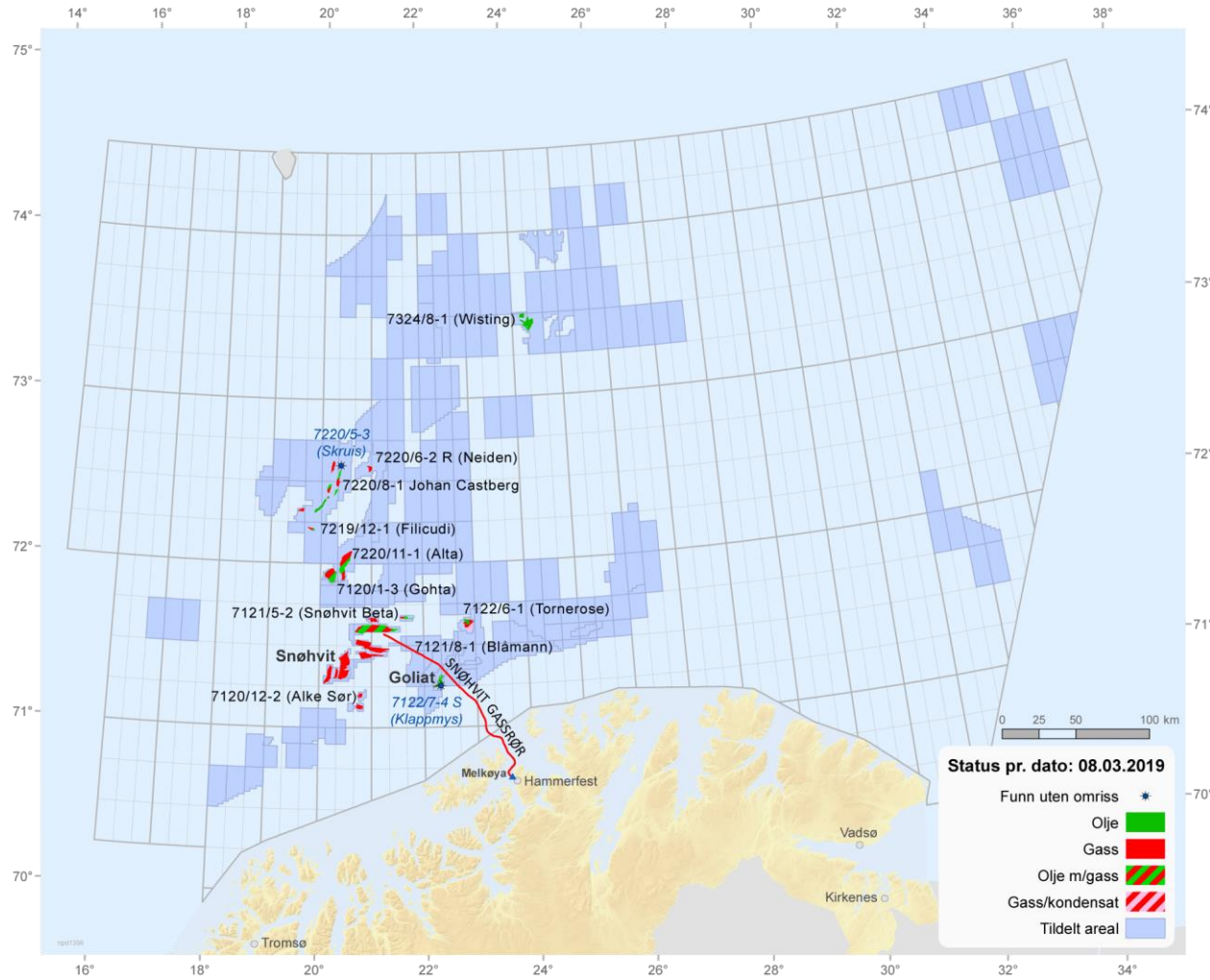
Oil & gas exports: Yamal LNG



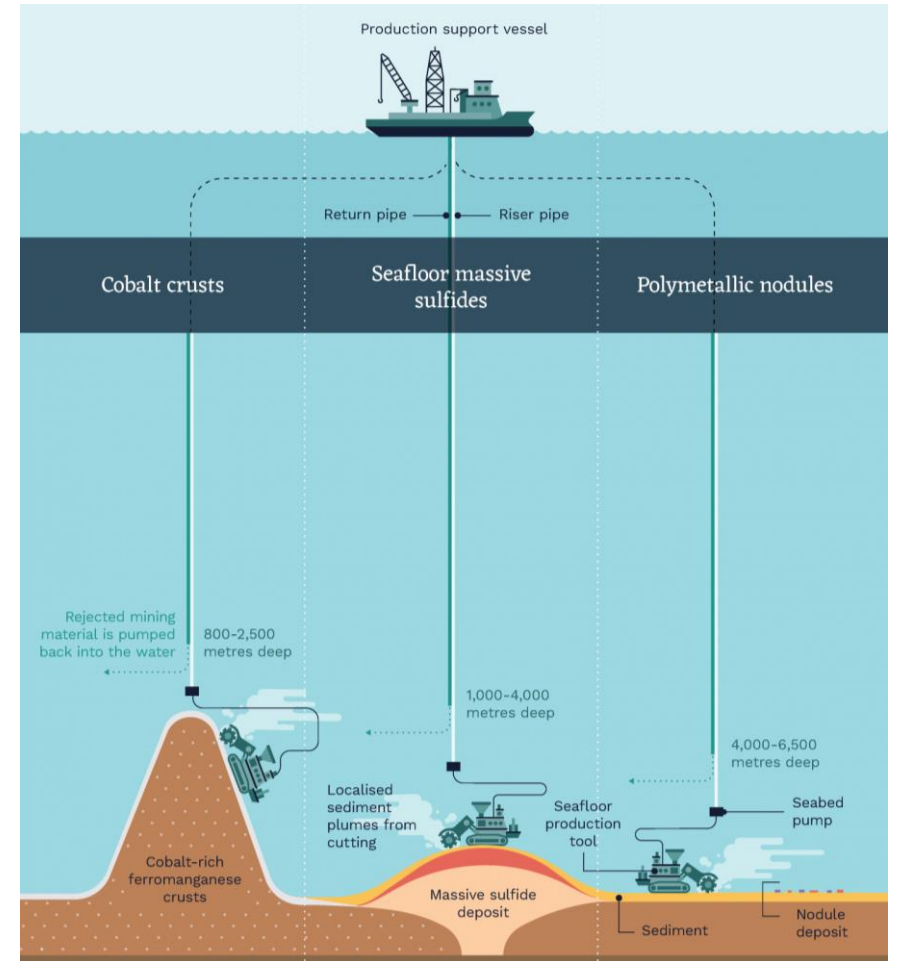
Exports of metals: Norilsk Nickel



Drivers: Offshore oil & gas (current) and mining (future)

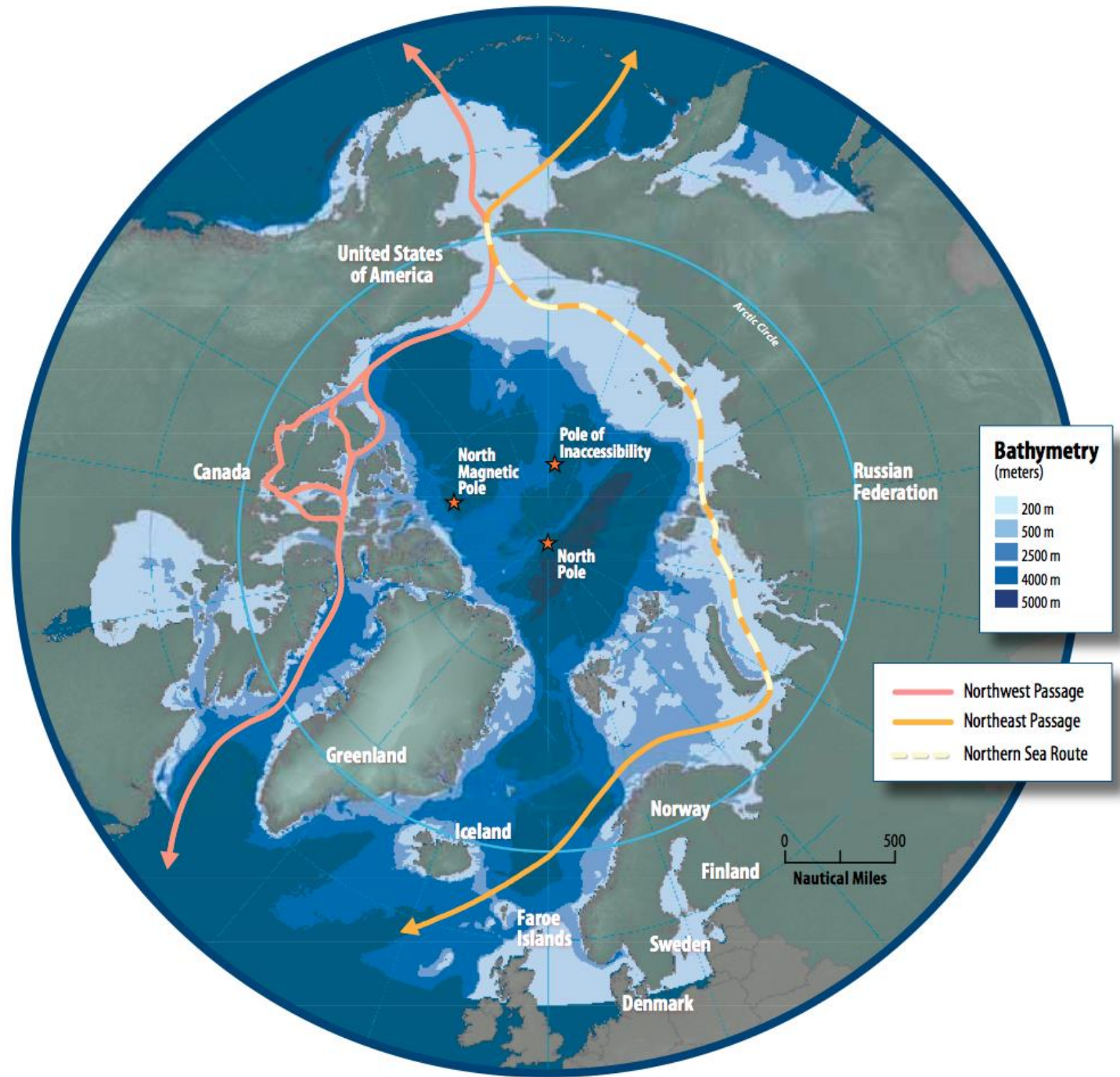
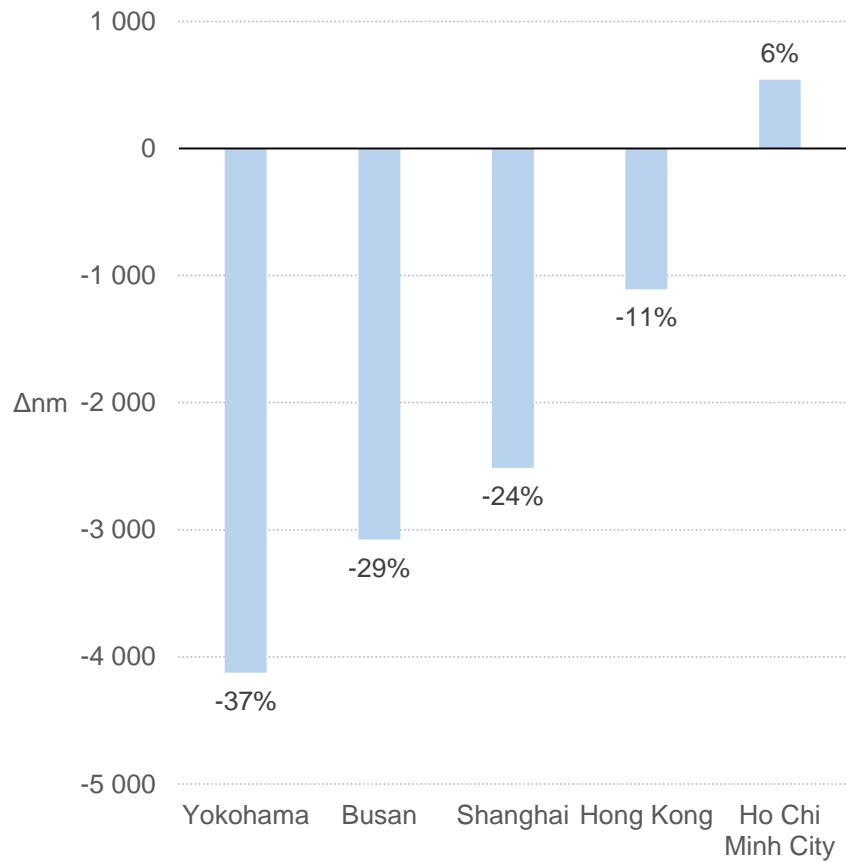


Oil & gas

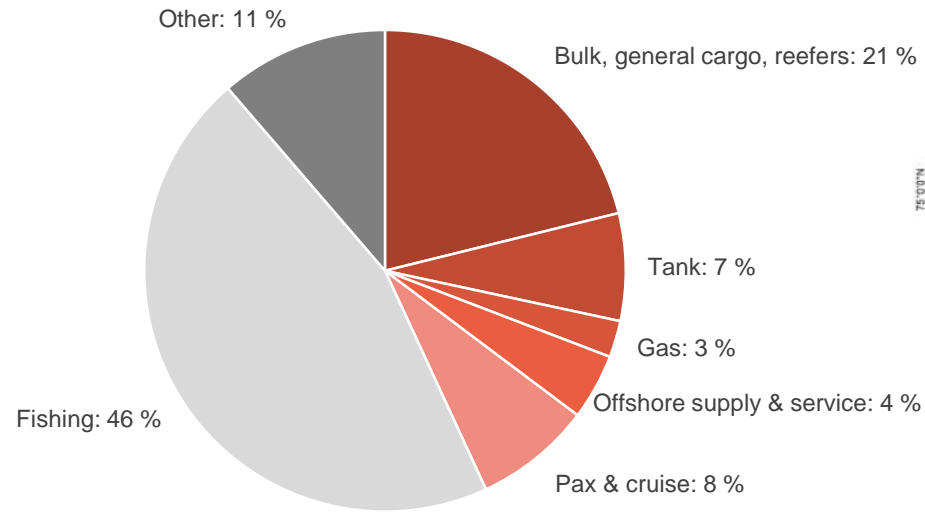


Sea bed mining (future)

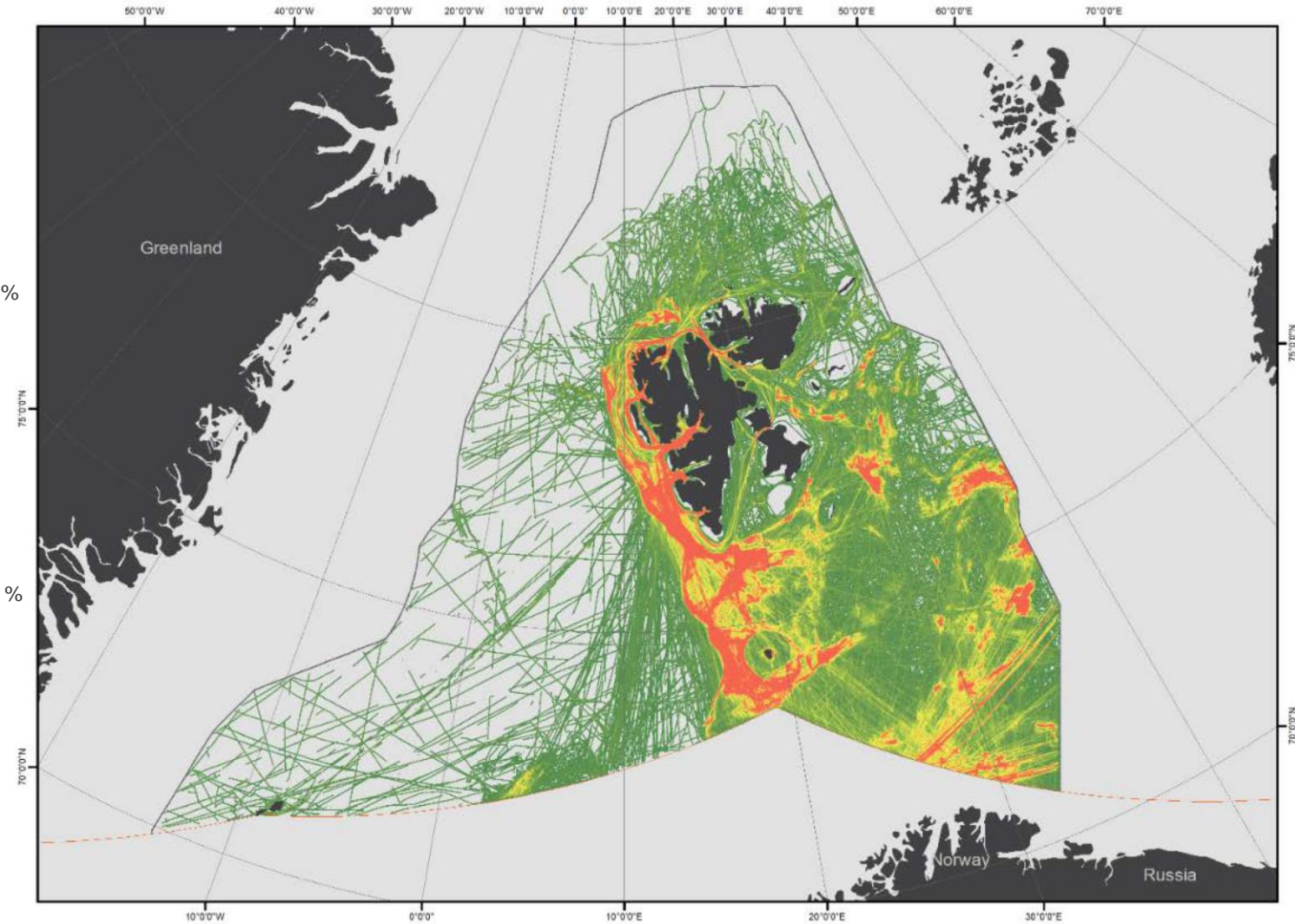
Drivers: The Northern Sea route



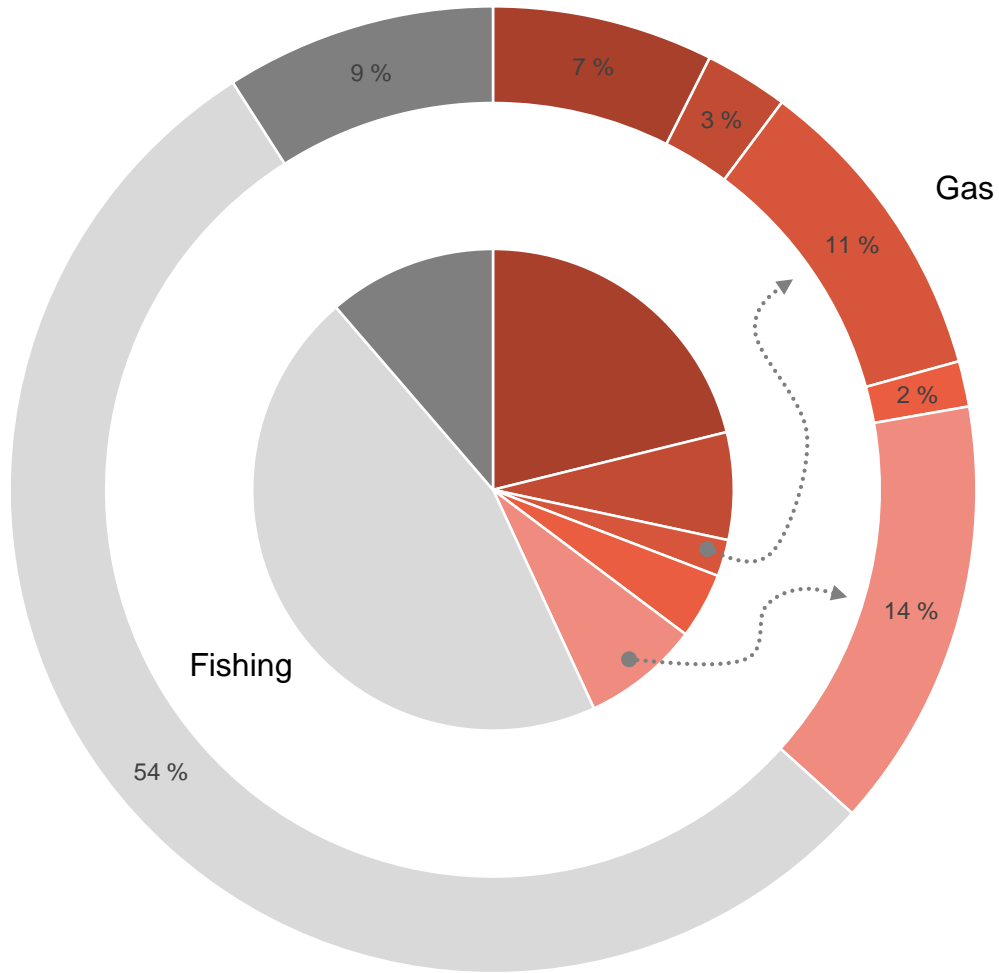
Norwegian Arctic shipping is dominated by fishing



Ship types in Norwegian Arctic
75% below 10,000 GT



Emissions in Norwegian Arctic: only 3.5% of shipping in Norwegian waters

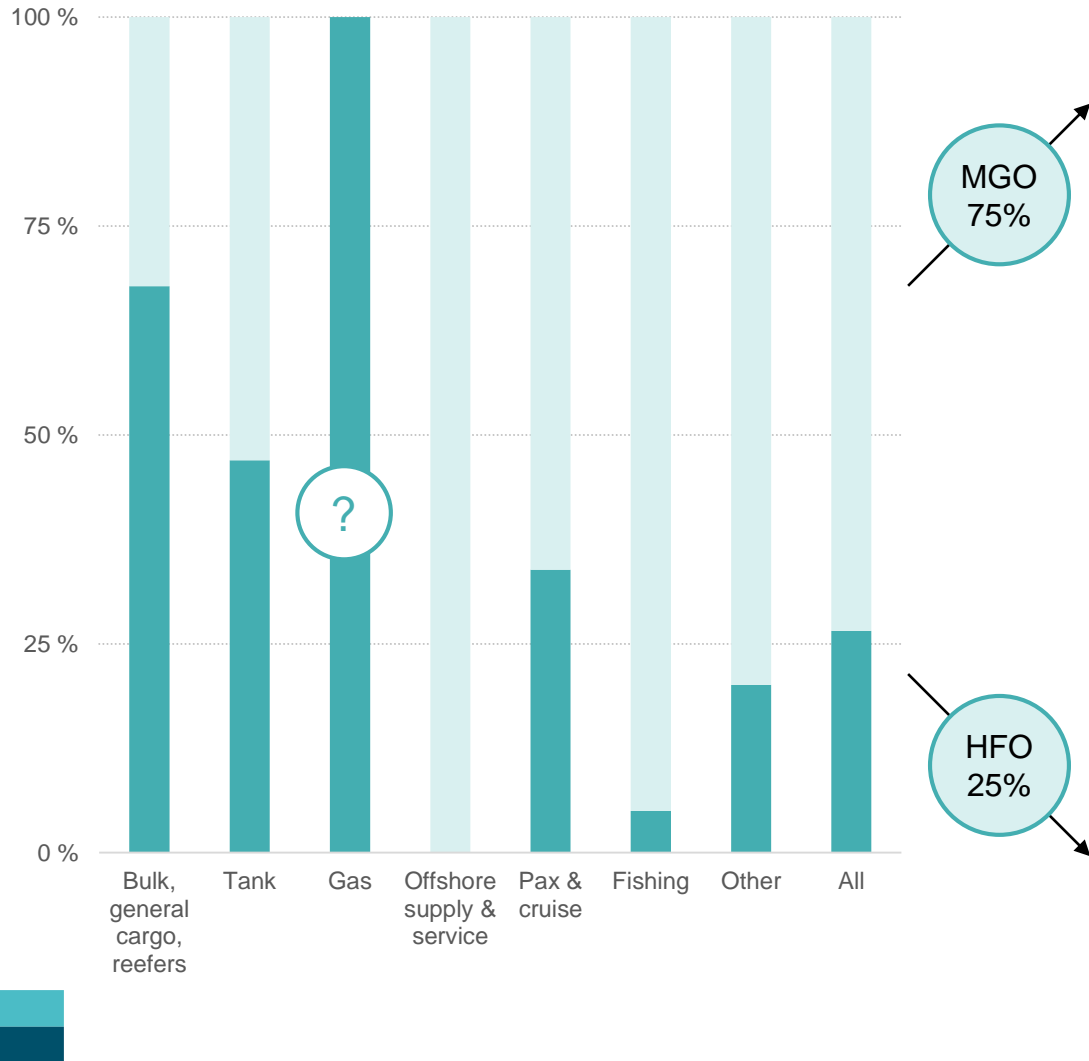


Emissions in Norwegian Arctic:
320,000 t/y

Environmental concerns specific to the Arctic



Heavy fuel oil: Low share (in Norw. Arctic) and falling?



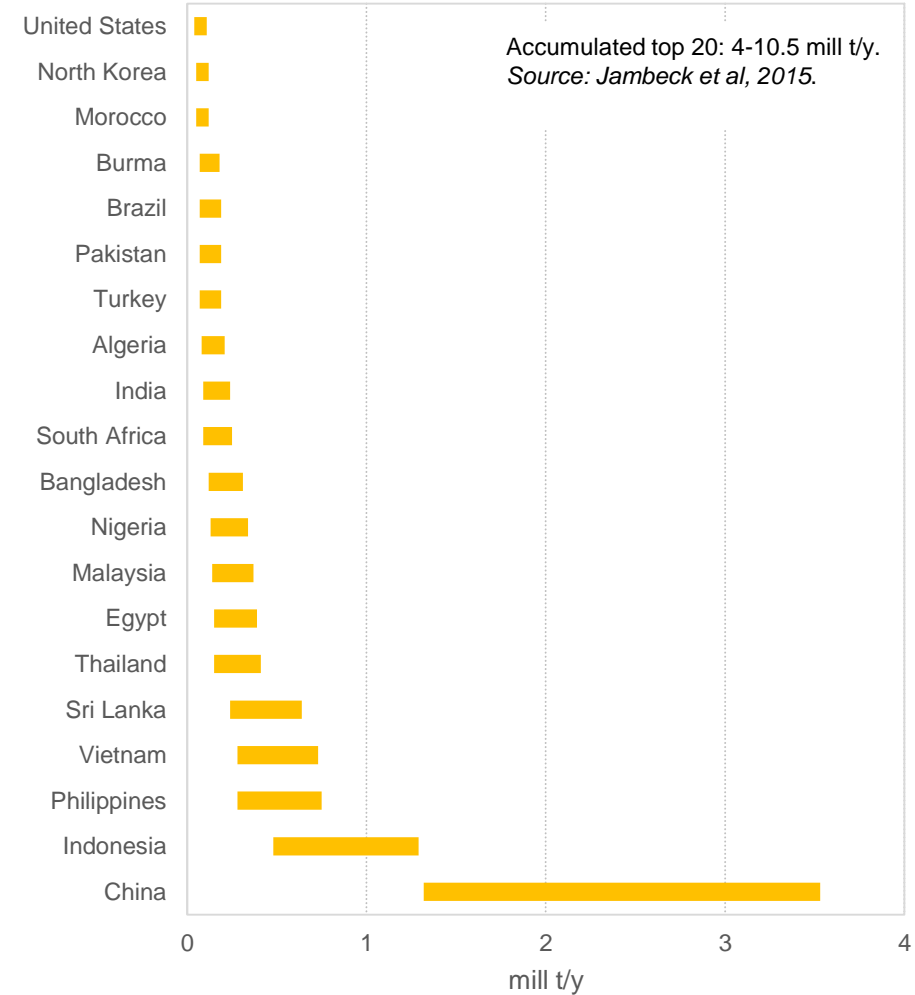
5-10%
(share of worldwide fleet w. scrubber)

Black carbon

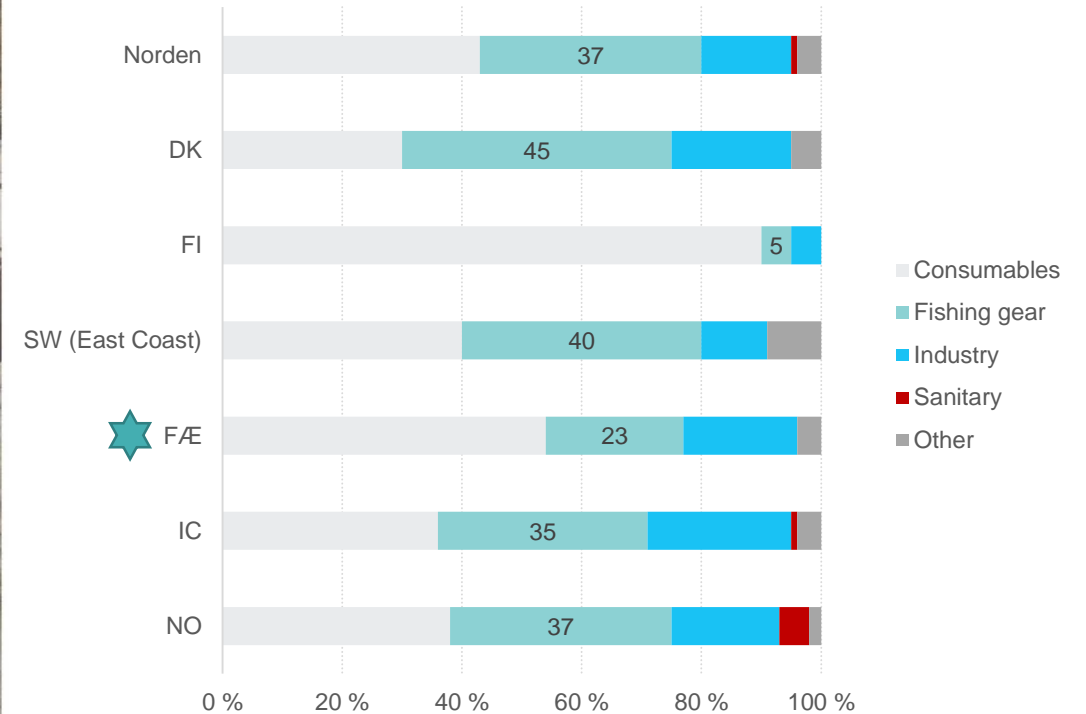
- Indirect and subsequential global warming effect
- 7% of shipping GHG (equivalent)
- Latitude-dependent GWP_{100} : 2914 (Hodnebrog et al)
- Main source of arctic soot is European coal and road traffic (Winiger, 2017).



Plastic waste (and other) regulated by Marpol since 1989



Marine plastics in Nordic Countries



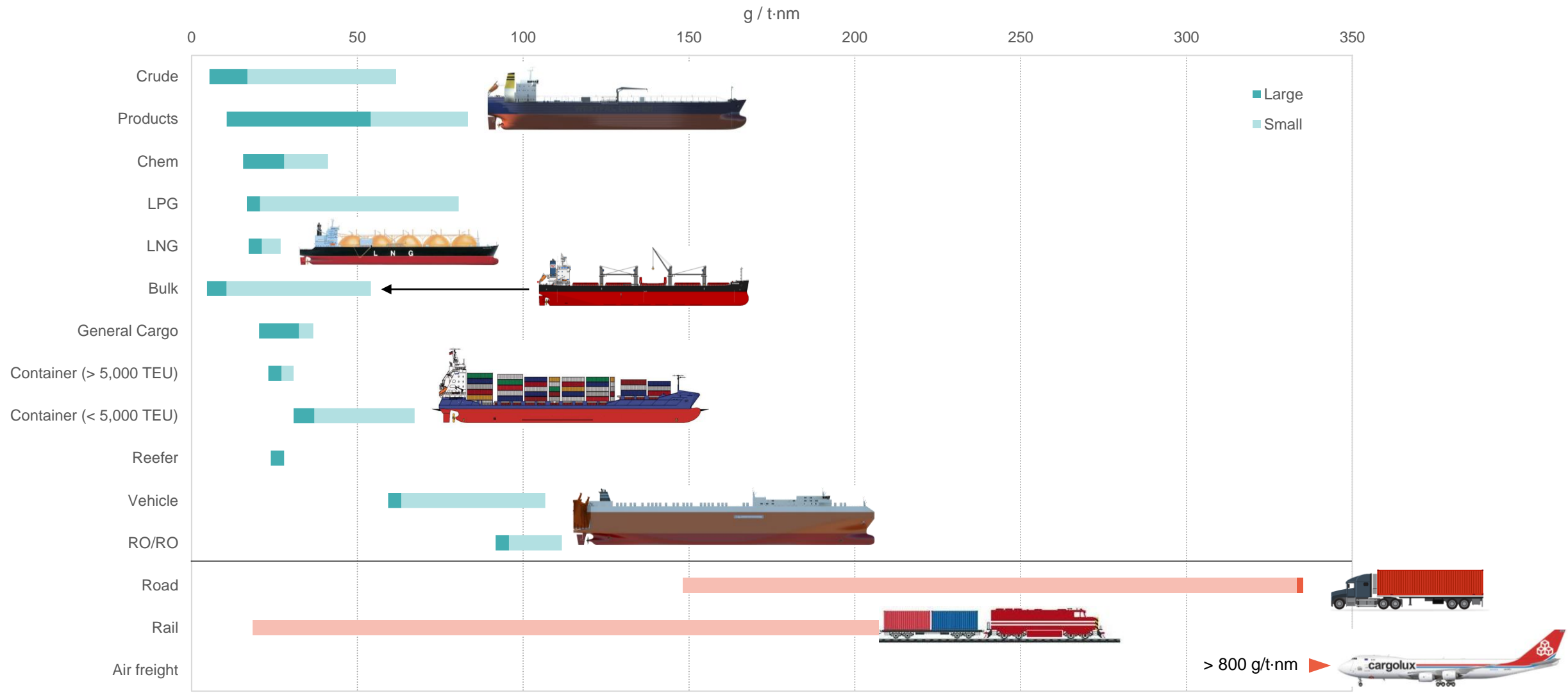
Faroe Islands (FÆ):
 «Remarkable efforts and particularly thorough studies.»



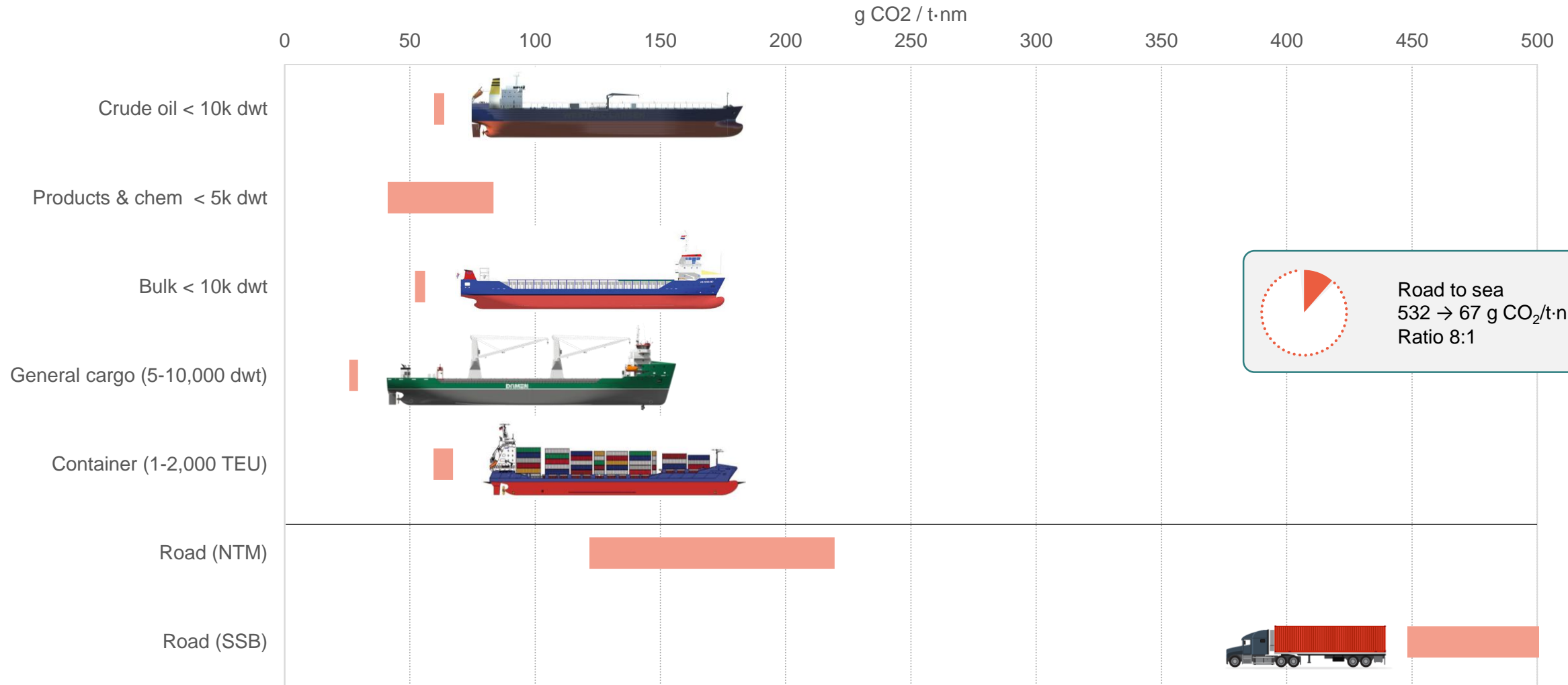
On a general note



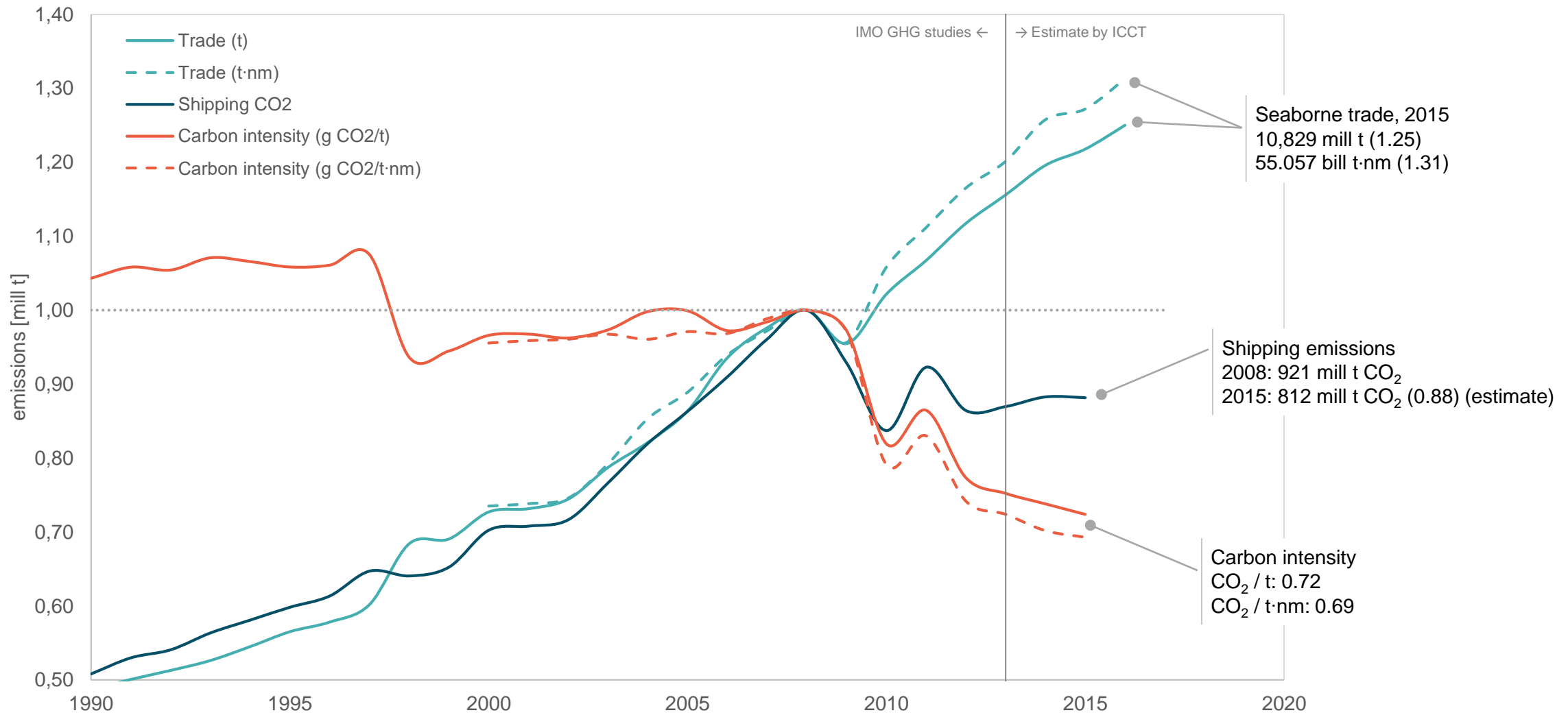
The greenest transport mode (CO₂ per ton nautical miles)



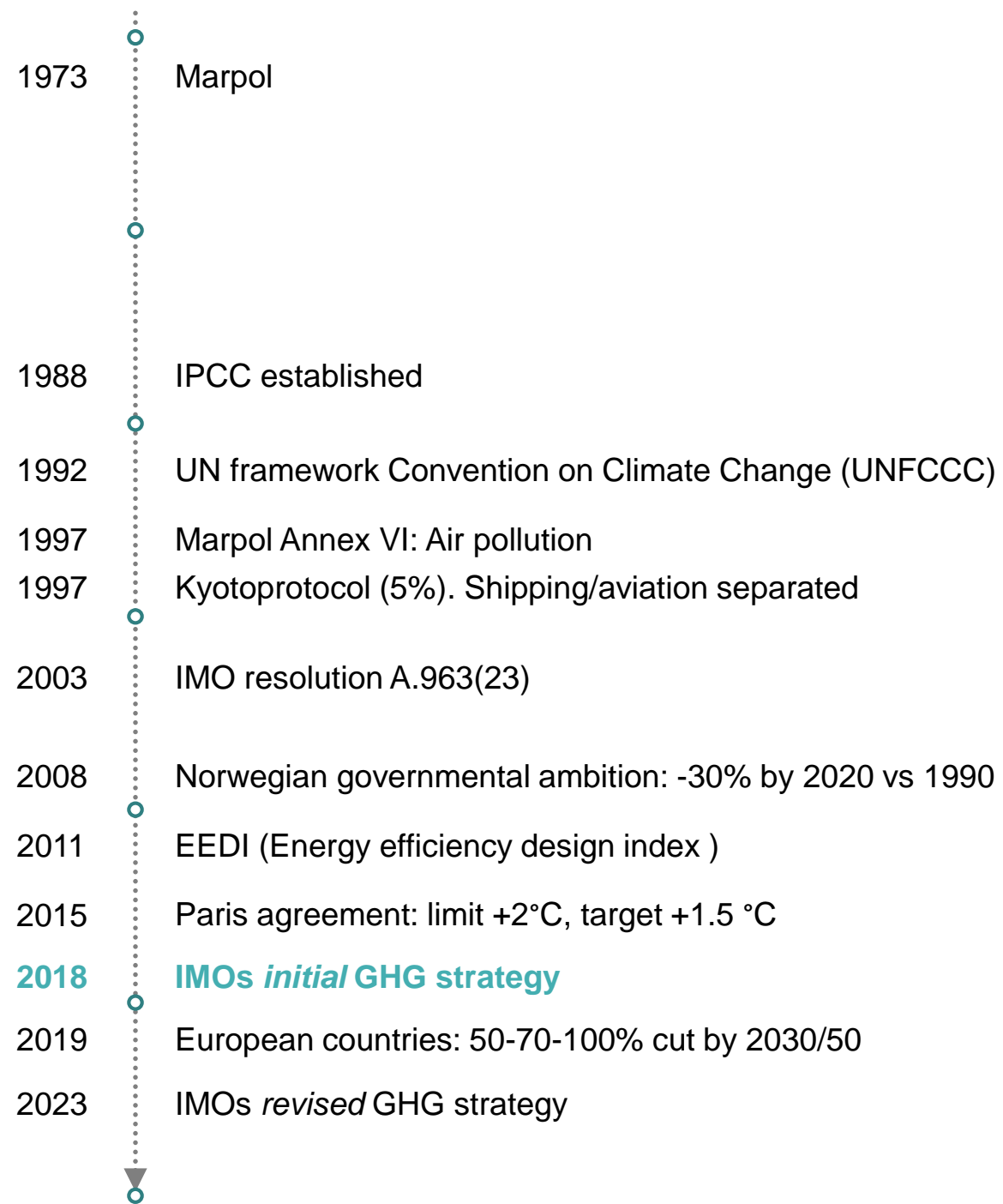
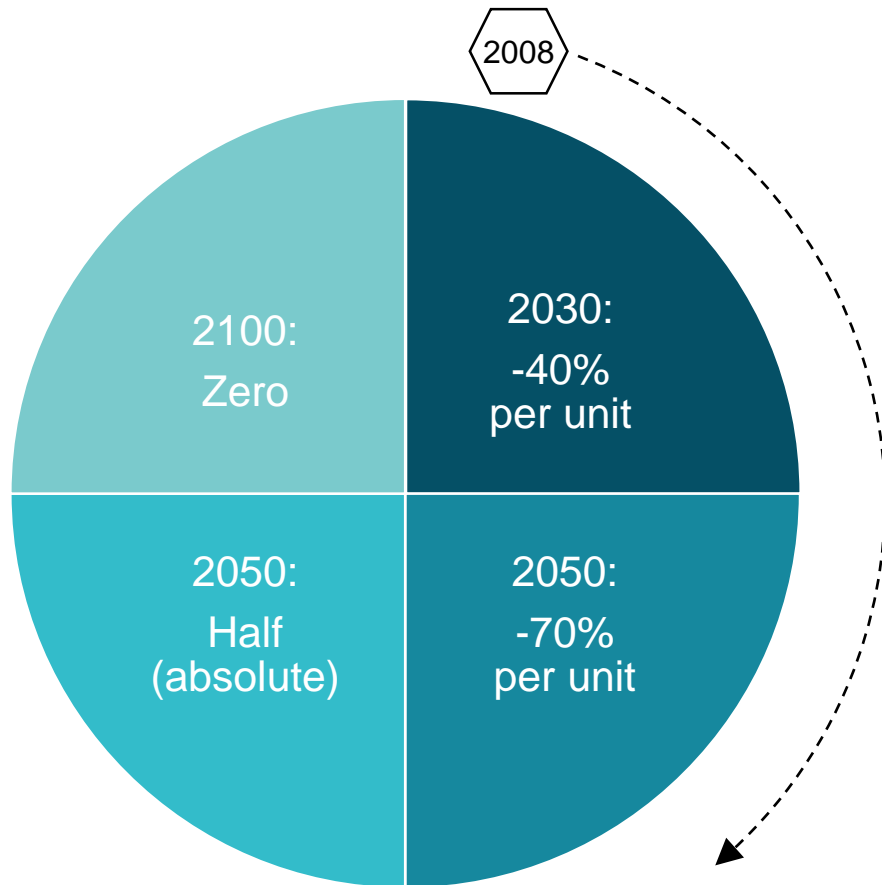
The greenest transport mode (CO₂ per ton nautical miles)



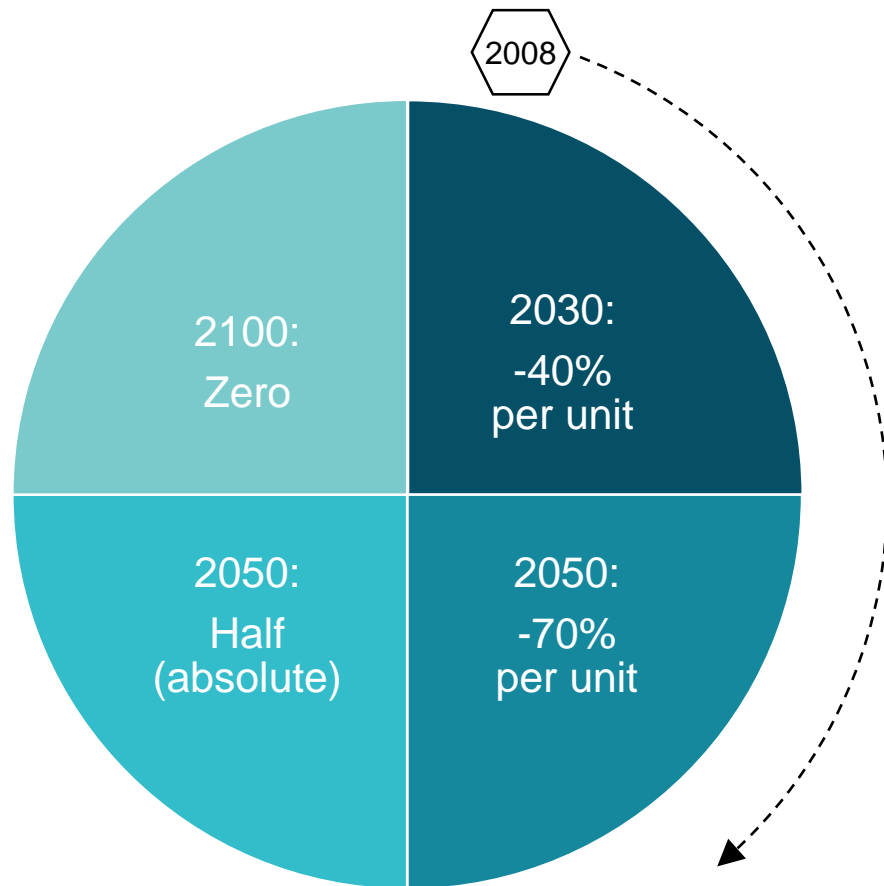
Seaborne trade, emissions and carbon intensity indexed against 2008



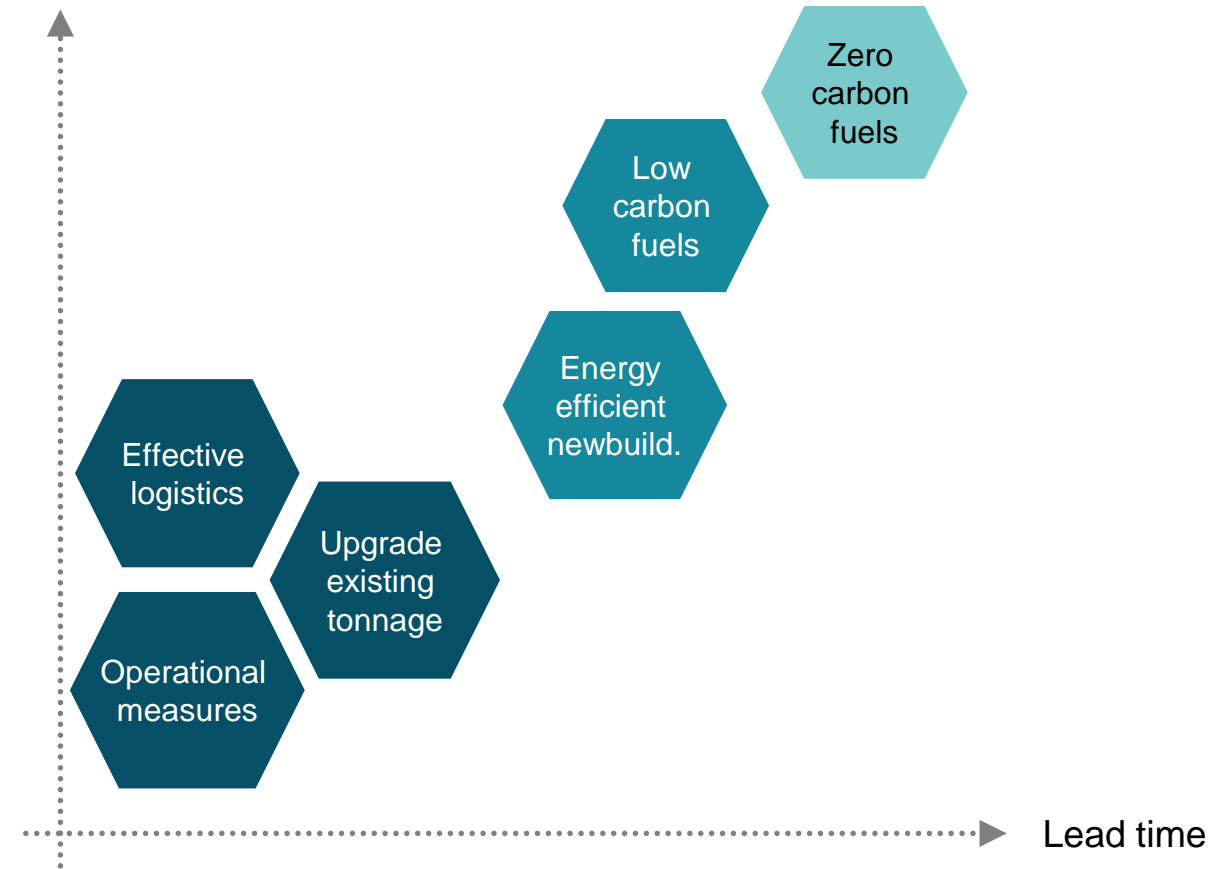
IMO's GHG-strategy (April 2018)



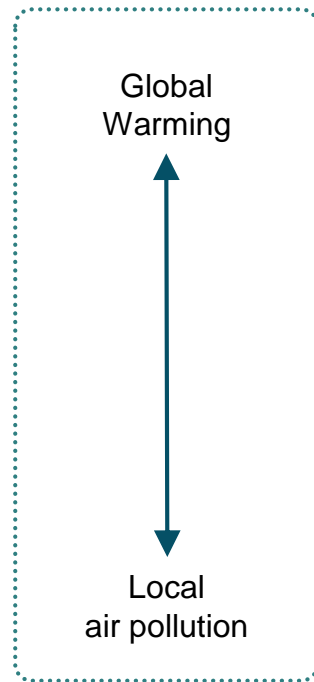
Two imperatives: Finding good solutions quickly



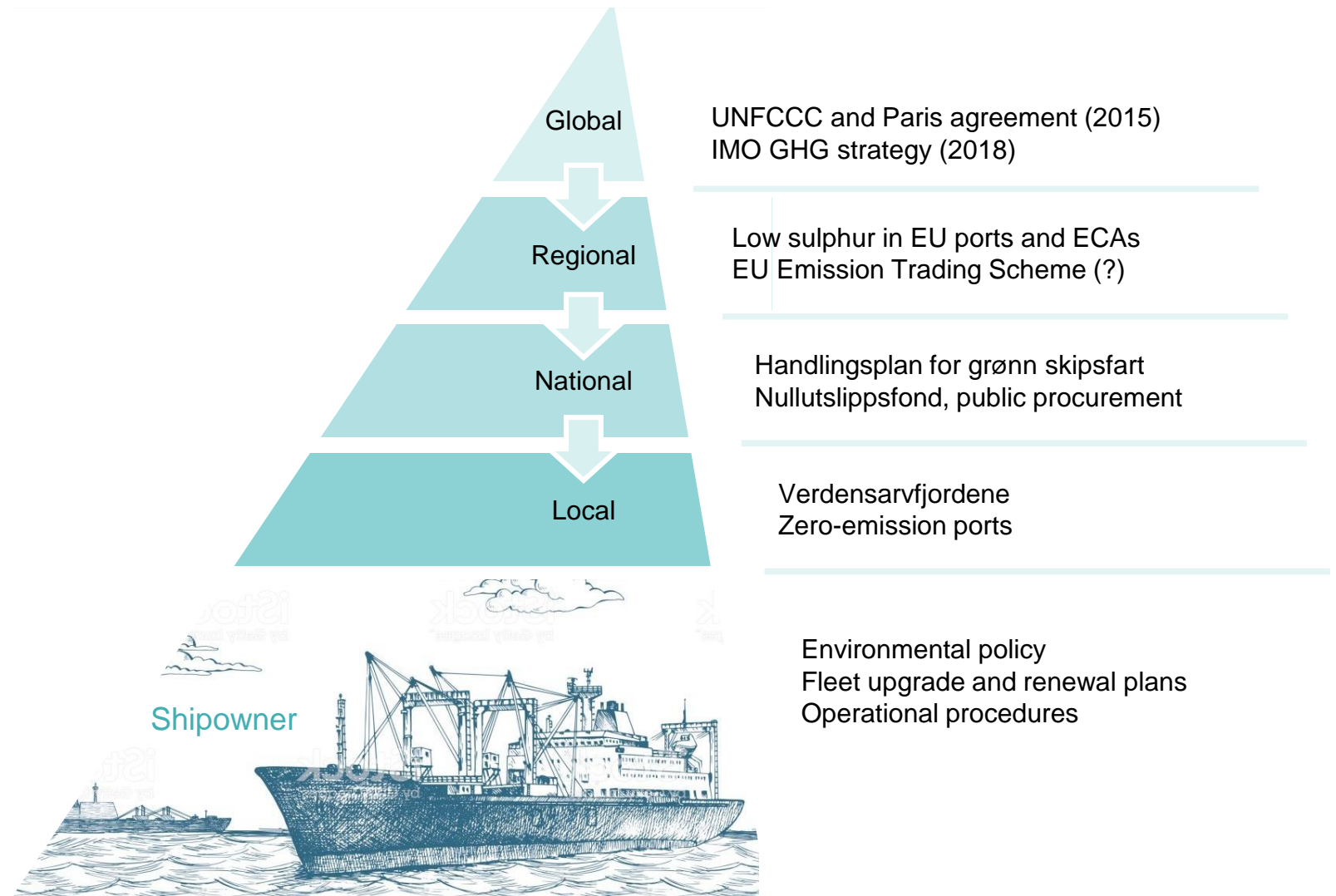
Potential



Many layers of regulations: Consistency and coordination



Main focus



Green operations

Low/zero
carbon
fuels

Energy
efficient
newbuild.

Effective
logistics

Upgrade
existing
tonnage

Operational
measures

Slow-steaming
Ballast- and trim optimization
Hull and propeller cleaning
Weather routing
Dialogue and aligned interests with charterer



Change bulbous bow on existing ships during regular dry docking

Low/zero
carbon
fuels

Energy
efficient
newbuild.

Effective
logistics

Upgrade
existing
tonnage

Operational
measures

- New bulb
- New propeller or energy saving devices
- Derated main engine
- New machinery
- Batteries for peak shaving
- Shore power
- Low friction anti-fouling



Change propeller and derated engine

Low/zero
carbon
fuels

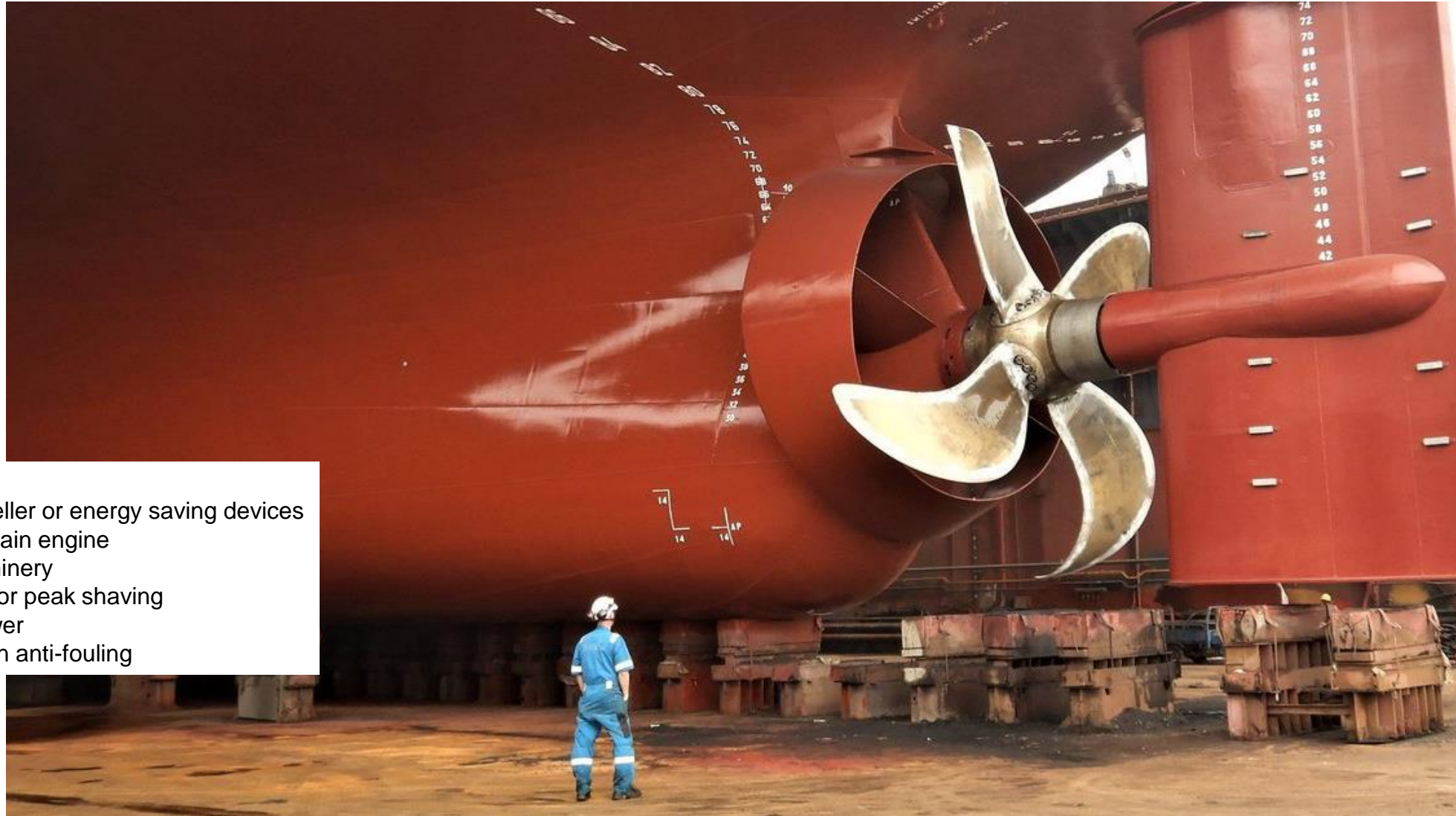
Energy
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Effective
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Operational
measures

New bulb
New propeller or energy saving devices
Derated main engine
New machinery
Batteries for peak shaving
Shore power
Low friction anti-fouling



Just in time arrival allows slower sailing

Low/zero
carbon
fuels

Energy
efficient
newbuild.

Effective
logistics

Upgrade
existing
tonnage

Operational
measures

Modal shift from road and air to sea and rail
Optimize the entire supply chain as a whole
Coordination ship and port



New ropax saves 20-40% with batteries and waste heat recovery

Low/zero
carbon
fuels

Energy
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Operational
measures

Tailor made ships
Optimum main dimensions
Hull form optimized for wind & waves
Efficient machinery
Waste heat recovery
Efficient equipment and systems



Hurtigruten runs on waste from the fish farming and forestry

Low/zero
carbon
fuels

Electric
LNG
LPG
Sustainable biofuel & biogas
Hydrogen (H₂)
Ammonia (NH₃)
Methanol (CH₃OH)

Energy
efficient
newbuild.

Effective
logistics

Upgrade
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Operational
measures



Norway leads the way with world's first LNG (2000), el (2014) and hydrogen (2021)

Low/zero
carbon
fuels

Electric
LNG
LPG
Sustainable biofuel & biogas
Hydrogen (H₂)
Ammonia (NH₃)
Methanol (CH₃OH)

Energy
efficient
newbuild.

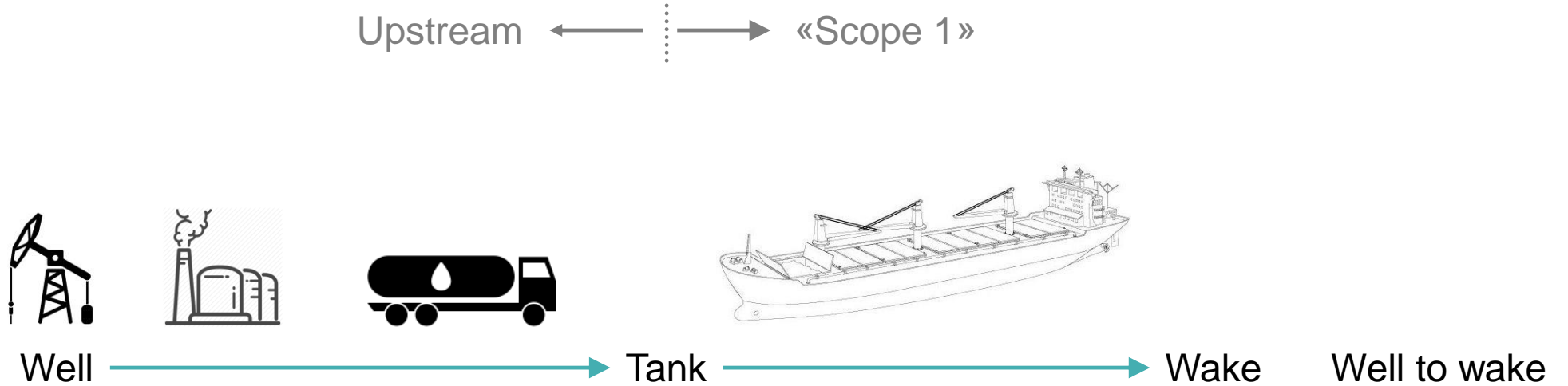
Effective
logistics

Upgrade
existing
tonnage

Operational
measures



Life cycle perspective (well to wake)



Hydrogen/ammonia

↑

0

?

Biofuels

↓

Same

± ↓100% (?)

LNG

↑ (?)

↑ 0 to 25%

±0 to ↓25%

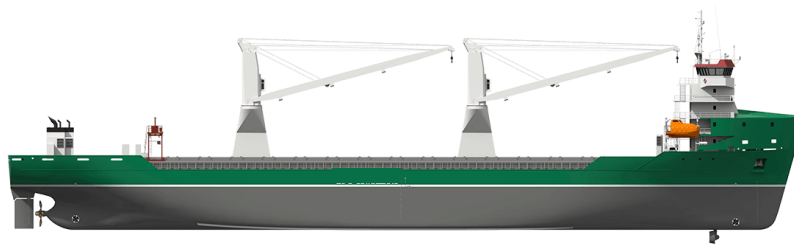


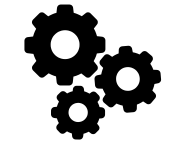


A small fee for the greater good



2 \$/t x 250 mill t/y = 500 mill \$/y

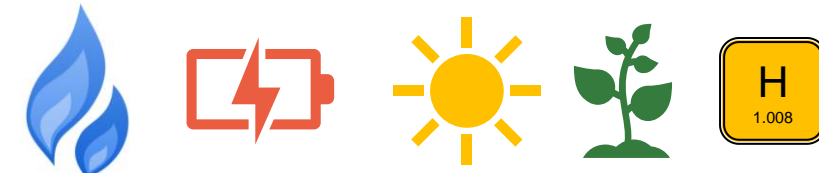
Industry proposal for 2 \$/t fuel R&D fee and fund








Energy efficiency Storage Machinery

Ship
technology





Production Supply chain Infrastructure

Alternative
fuels