LNG - The Fuel Solution?

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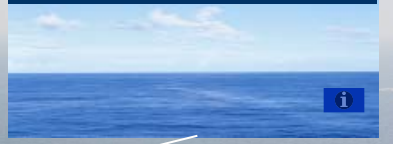
International shipping faces a range of challenges, many related to environmental issues

Reduced emissions to air

Crew training and awareness

Waste handling

Risk of accidental fuel oil pollution



Corporate Social Responsibility

Ballast water treatment

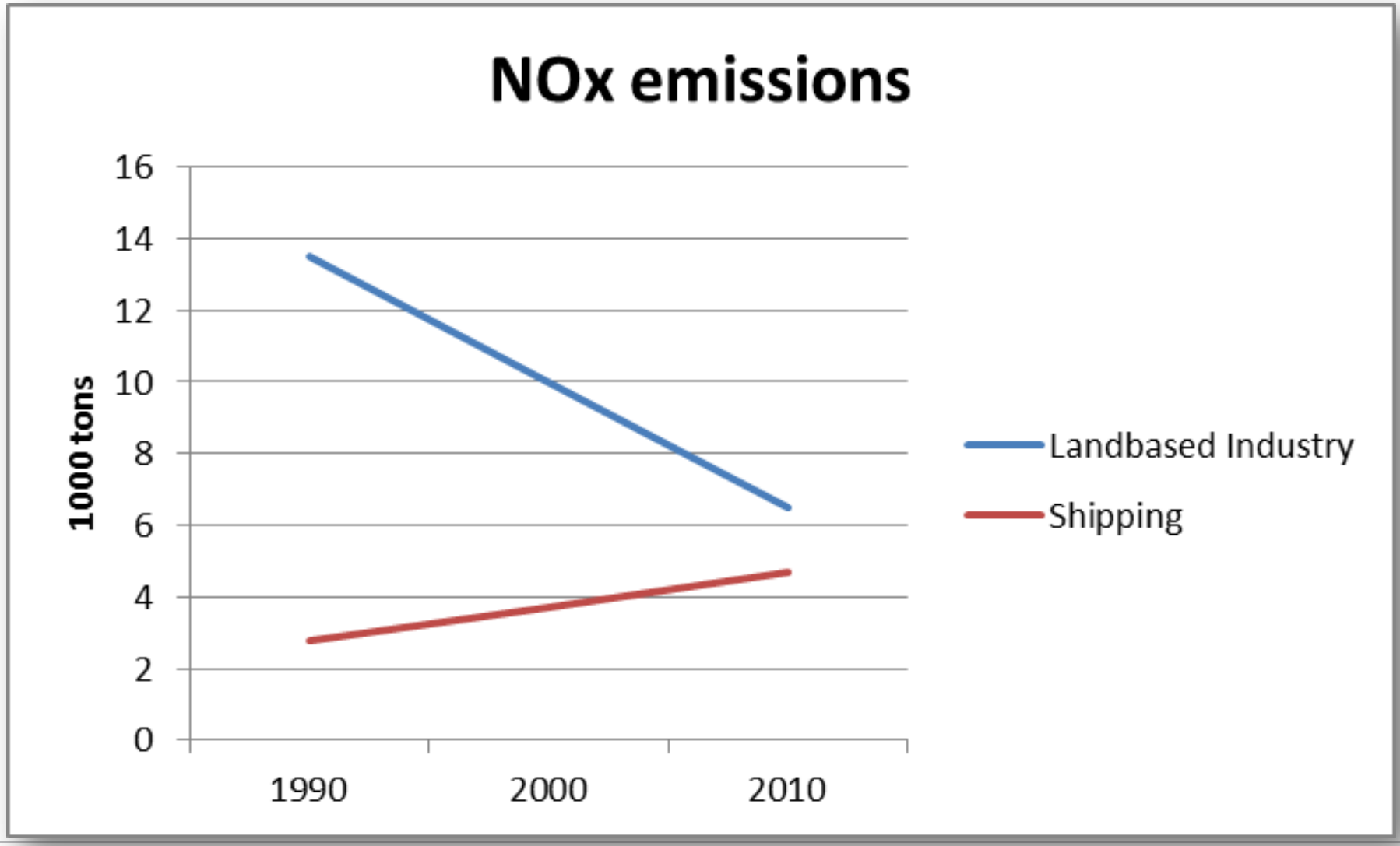
Non-toxic Antifouling

High fuel prices

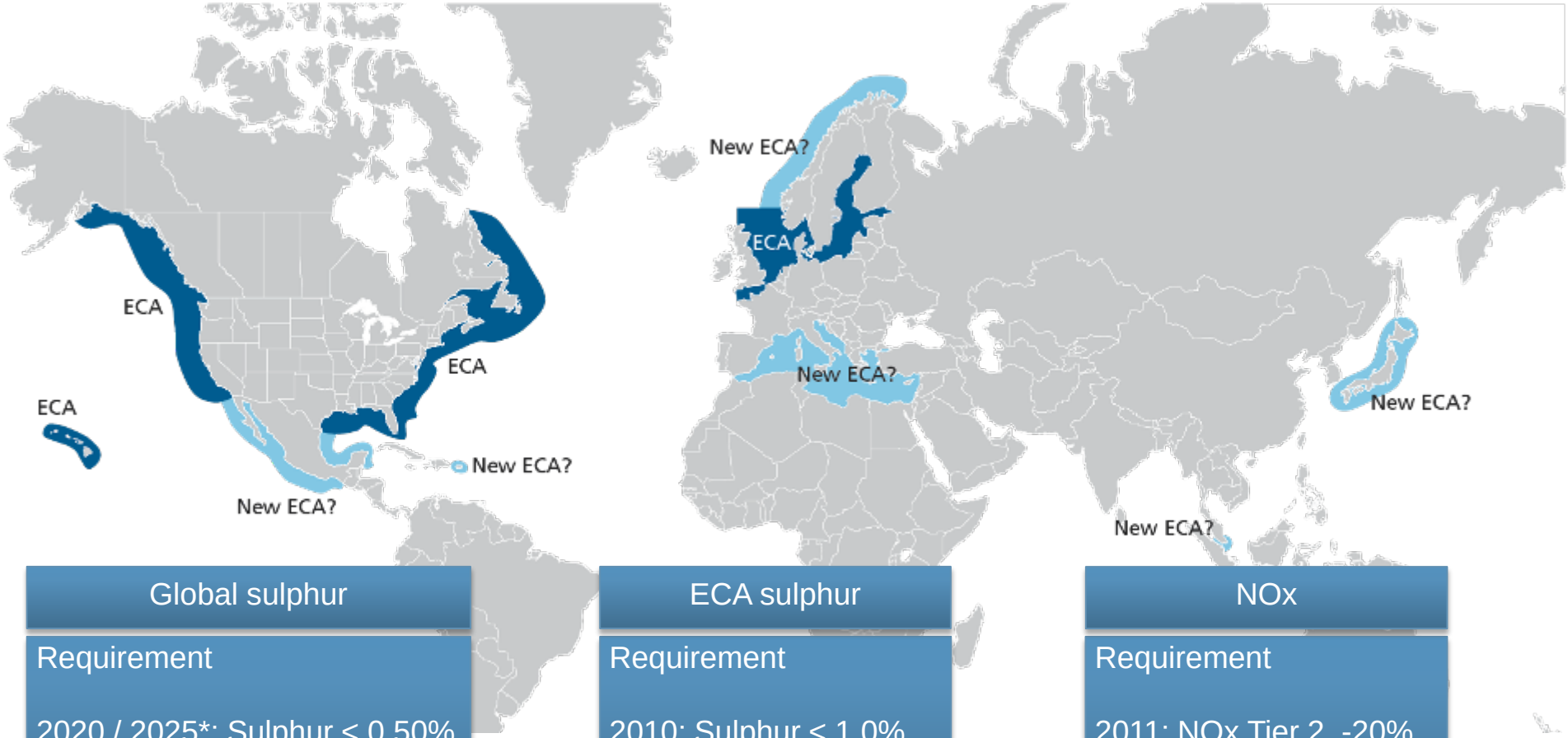
Less use of chemicals

Shipping is a large contributor to local air pollution, having real health and environmental impact

Shipping is lagging land-based industry on reducing emissions and still on a negative trend

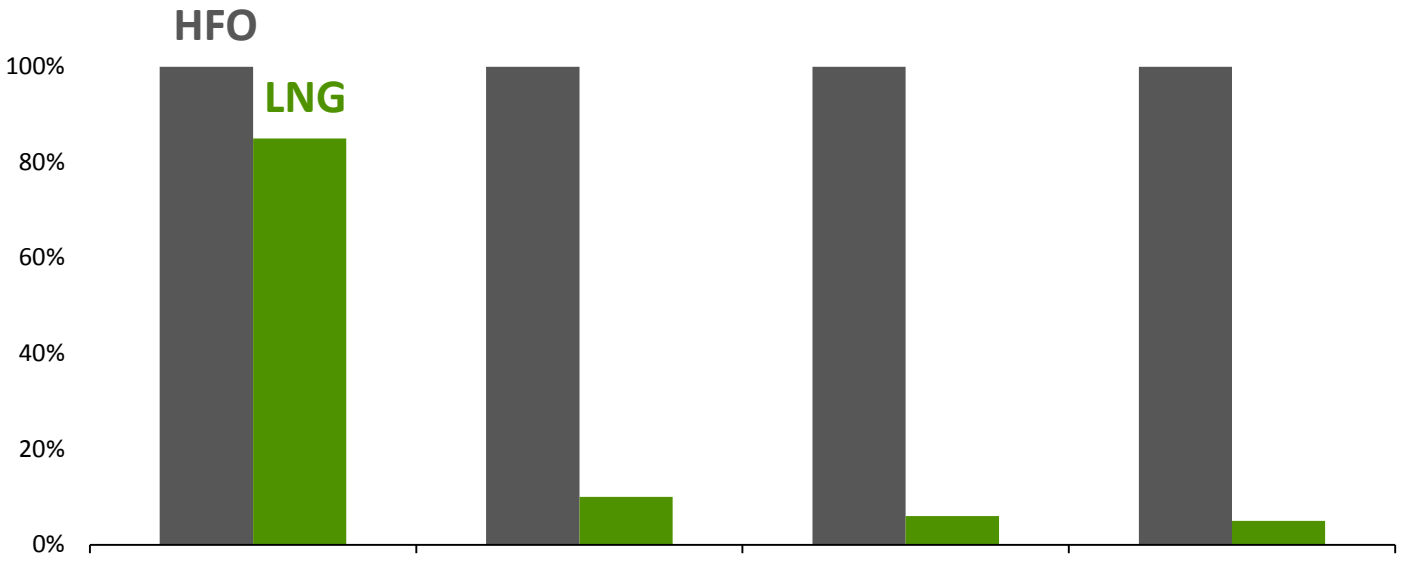


The regulatory response – requirements are tightening



Global sulphur	ECA sulphur	NOx
Requirement 2020 / 2025*; Sulphur < 0.50% * Date TBD pending 2018 review	Requirement 2010: Sulphur < 1.0% 2015: Sulphur < 0.10%	Requirement 2011: NOx Tier 2, -20% 2016: NOx Tier 3, -80%* * New builds, only in ECA

LNG – a one-stop compliance option?



CO2:	NOx:	Particulate matters:	SOx:
~20%	**~90%**	**>95%**	**>95%**
reduction	reduction	reduction	reduction

Classification rules available, international codes and standards emerging

RULES FOR
CLASSIFICATION OF

SHIPS

NEWBUILDINGS

SPECIAL EQUIPMENT AND SYSTEMS
ADDITIONAL CLASS

PART 6 CHAPTER 13

GAS FUELLED ENGINE INSTALLATIONS

JANUARY 2007

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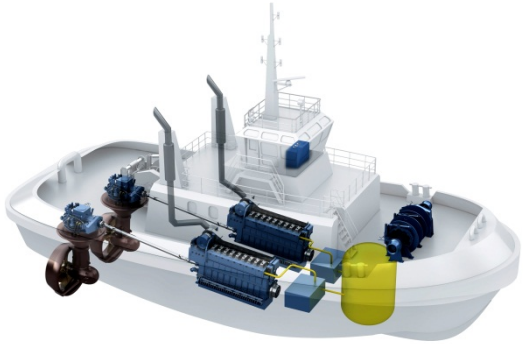
The number of ships has gradually increased since 2001



Tug
0 in operation
2 on order (B&B)

High Speed
0 in operation
1 on order

Ferries & Cruise
16 in operation
9 on order

Supply & Special
10 in operation
11 on order

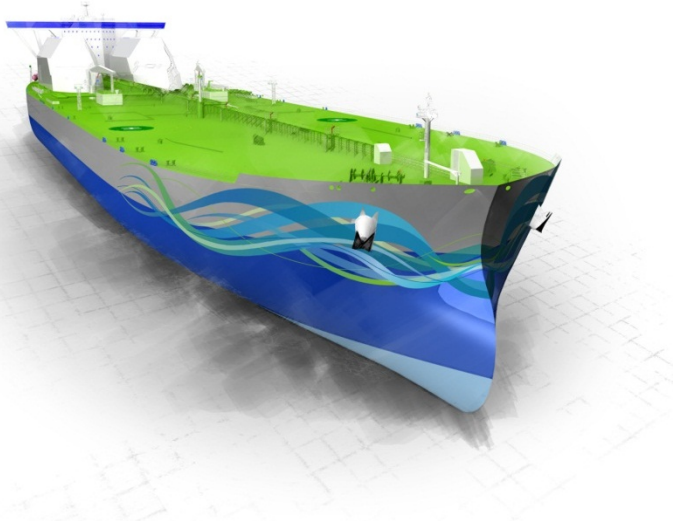
Ro-Ro / General Cargo
0 in operation
6 on order

Data as per April 2012

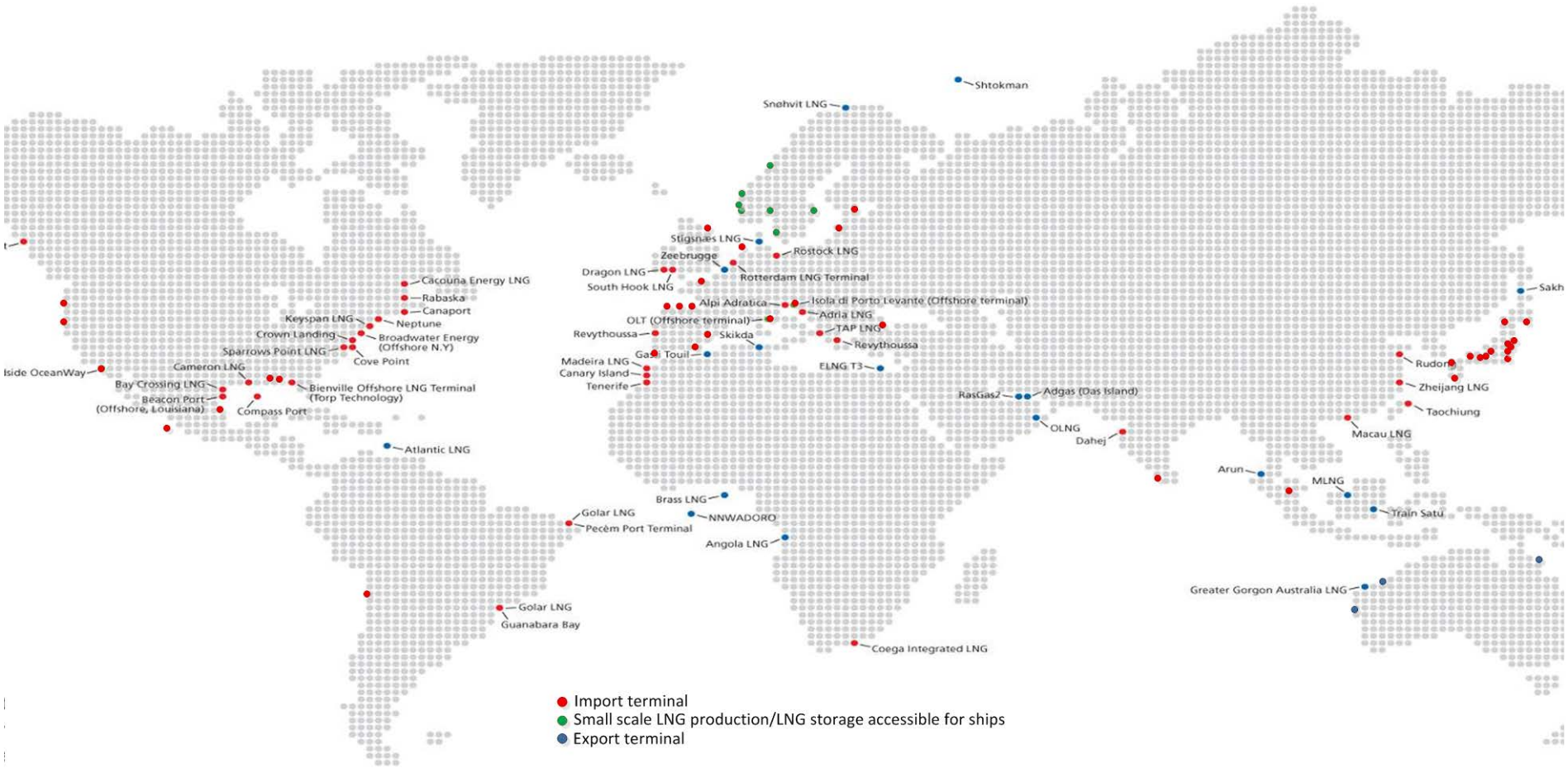
Experience of more than 100 ship-years of operations shows that LNG as fuel works

- A ten-fold of vessels have been through main class renewal and a handful of vessels will up to 2nd class renewal next year
- Even taking ‘teething’ problems into account, the experience is good

Feasibility for deep sea trades demonstrated through concepts

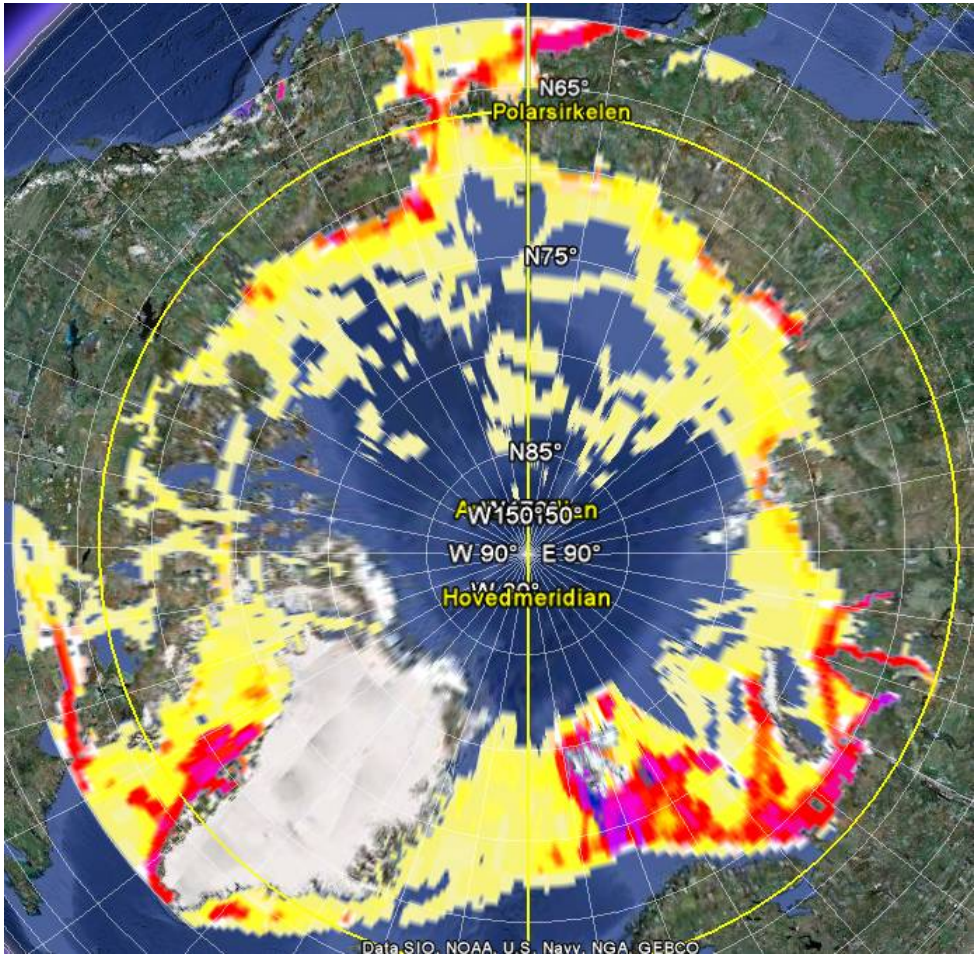


LNG is available across Europe, North America and Asia but more bunkering facilities needed for LNG fuelled ships

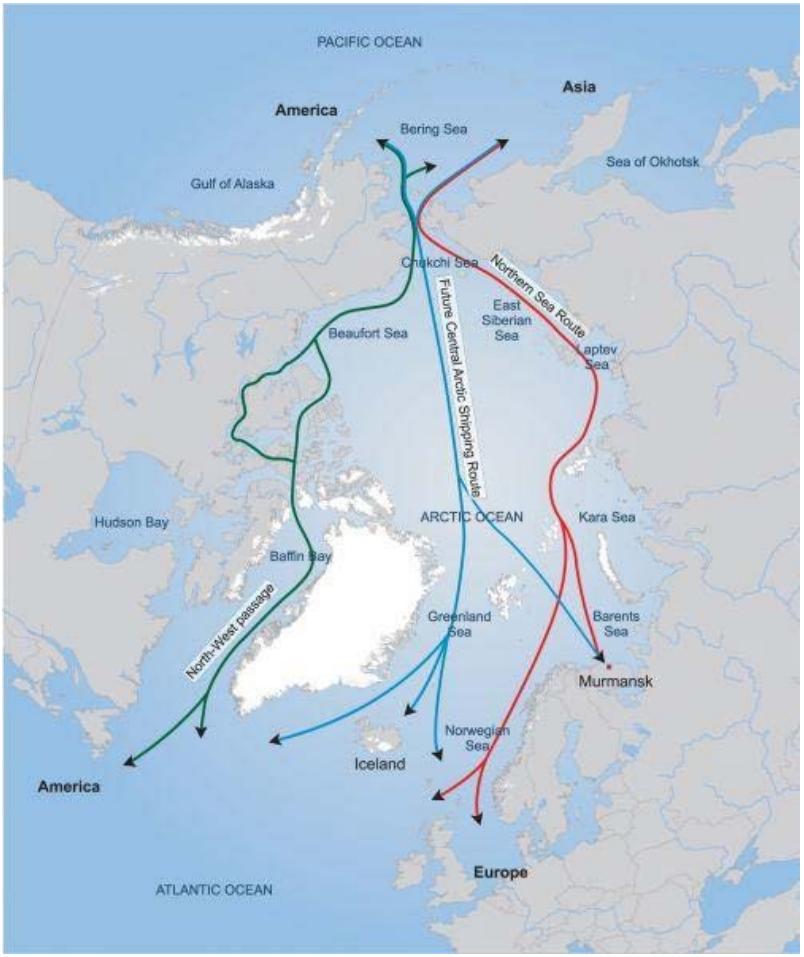


The Arctic is a loosely defined region, very diverse, and with oil, gas and shipping activities on the rise

Shipping is a major risk contributor to Arctic oil spills – LNG fuelled ships can reduce the risk



Vessel activity (August-November 2010)



Future traffic?

Black Carbon is a polar ice melt accelerant, replacing liquid fuels with LNG gives significant BC reductions

Key take-aways

- Shipping is lagging land-based industry on reducing air emissions
- Global and local regulations becoming increasingly stringent, LNG is a “one-stop” compliance option
- Experience of more than 100 ship-years of operations shows that LNG as fuel works, and works safely
- Feasibility for LNG as fuel for deep sea trade is demonstrated through concepts
- Bunkering infrastructure and price differential vs. liquids are key to industry uptake
- Traffic density inside the Arctic will increase significantly – replacing liquid fuel with LNG both reduces risk of Arctic oil spills and the local impact of emissions to air

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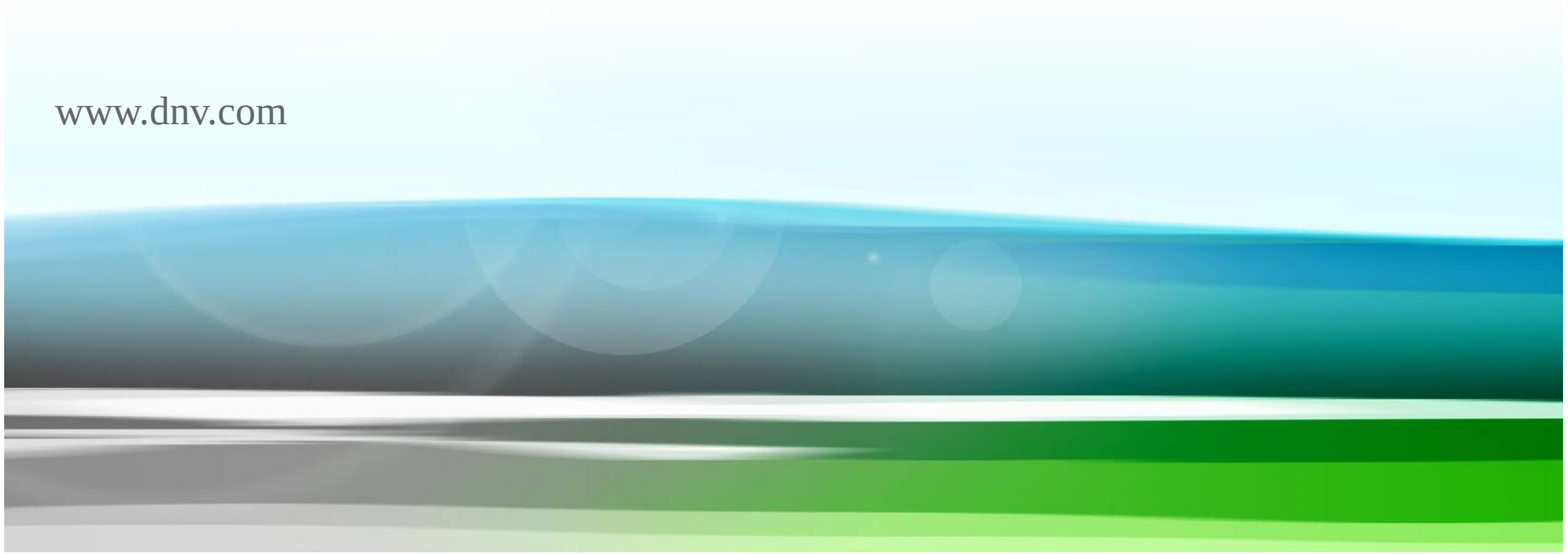

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