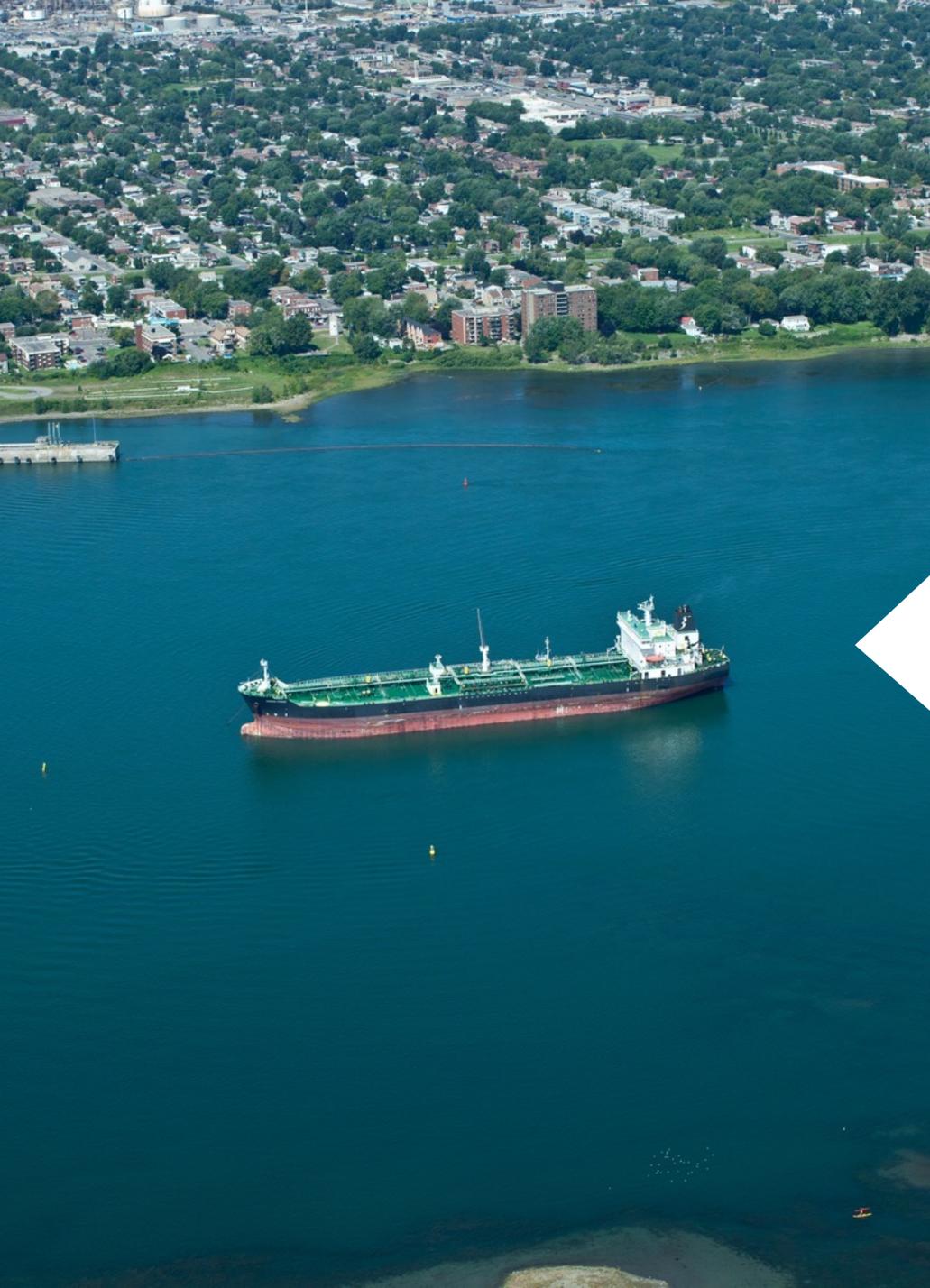




UNINTENDED CONSEQUENCES: IDENTIFYING CONFLICT BETWEEN
DUAL OBJECTIVES OF REDUCING GHG EMISSIONS AND AIR
POLLUTION FROM SHIPPING

Paul Blomerus
Executive Director

clearseas.org



ABOUT CLEAR SEAS

Safe and Sustainable Marine Shipping

ENGAGE • INFORM • RESEARCH

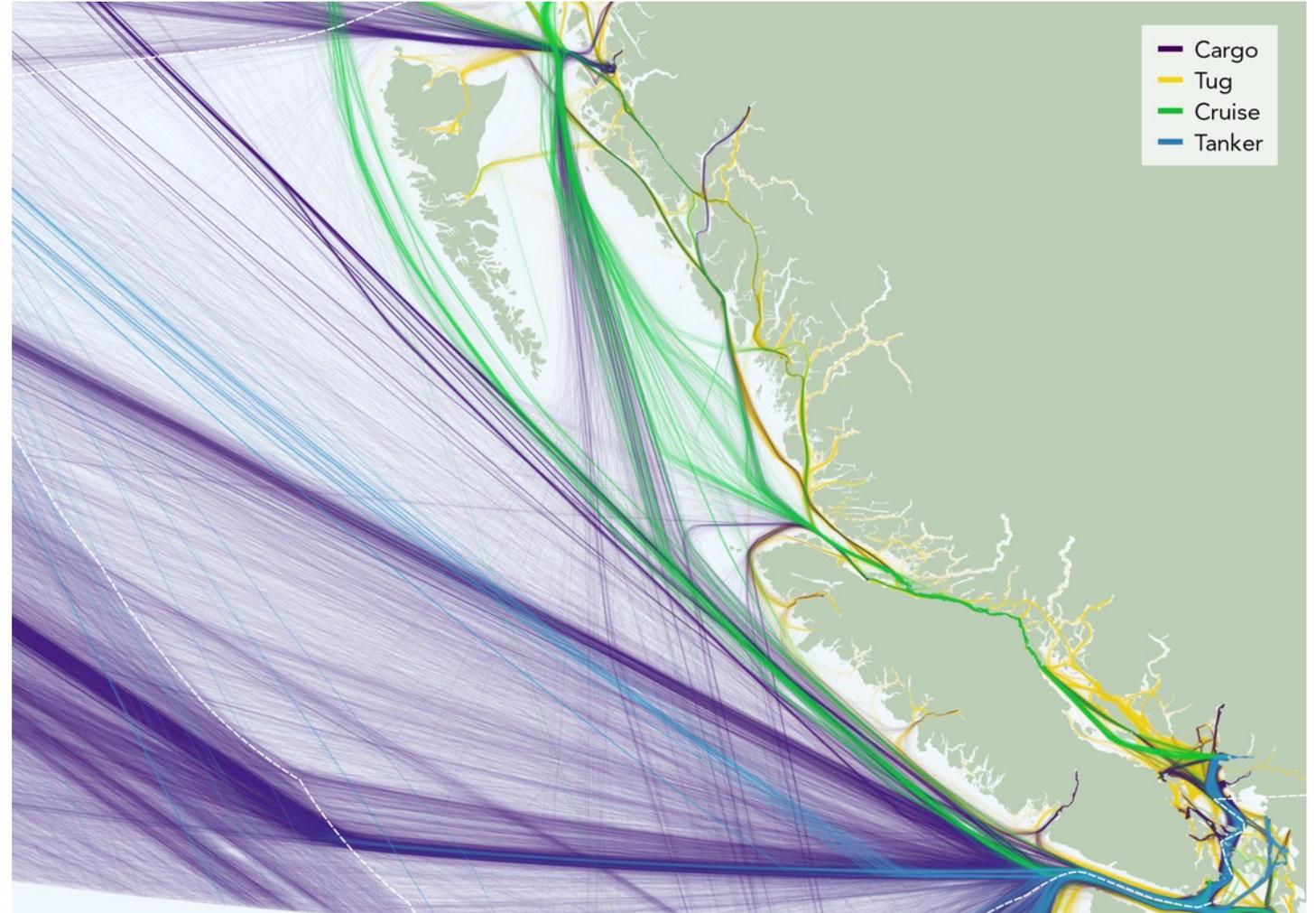
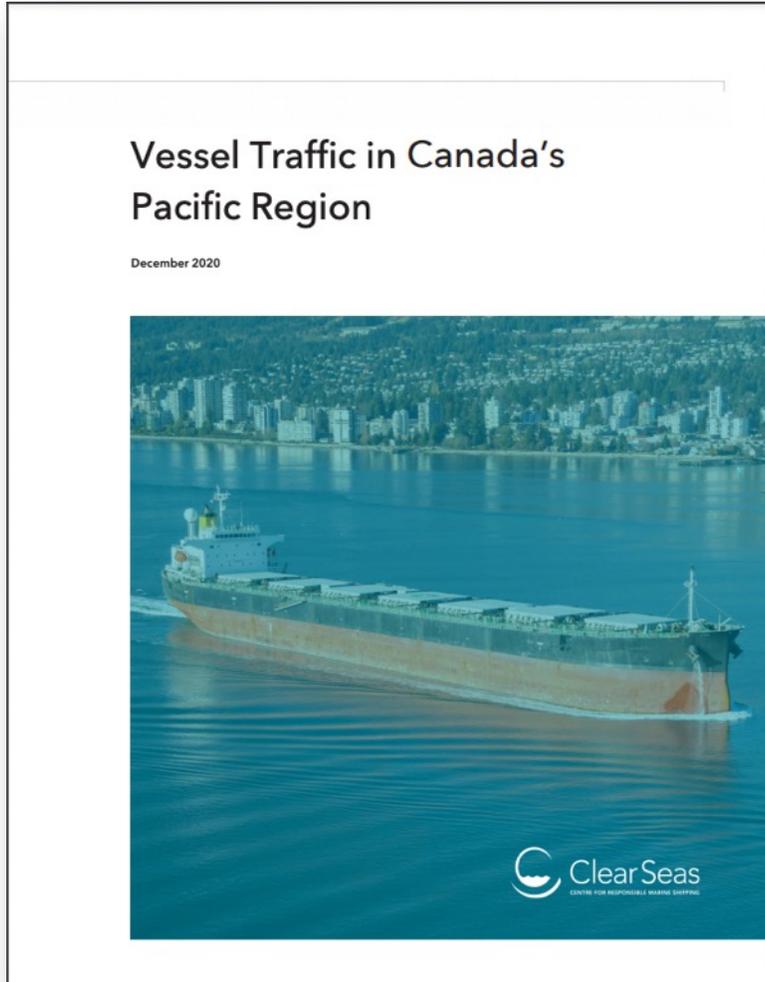
Audience:

- General Public
- Policy Makers
- Industry
- Indigenous and Coastal Communities

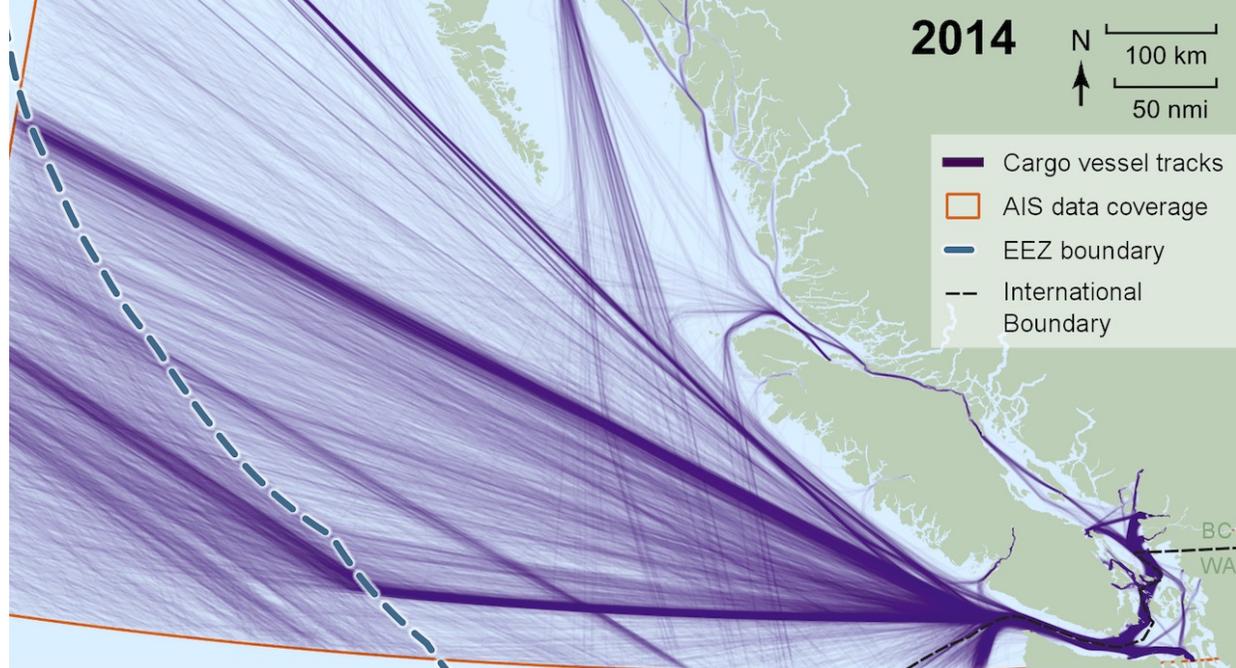
CASE STUDIES

- SOX EMISSIONS CONTROLS INCREASE GHG EMISSIONS
- NOX EMISSIONS CONTROLS CAUSED METHANE SLIP PROBLEM

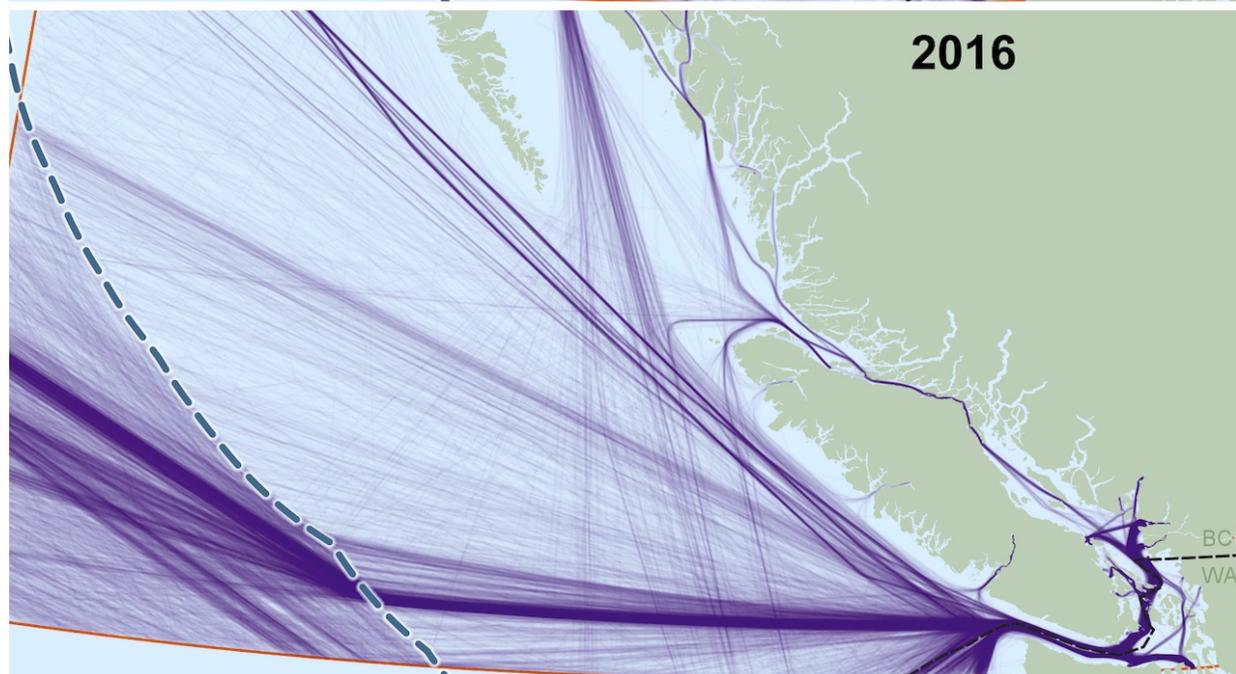
VESSEL TRAFFIC ANALYSIS PROJECT







CHANGE IN VESSEL TRAFFIC PATTERNS ON CANADA'S PACIFIC COAST 2014 - 2016



NORTH PACIFIC TRADE ROUTES

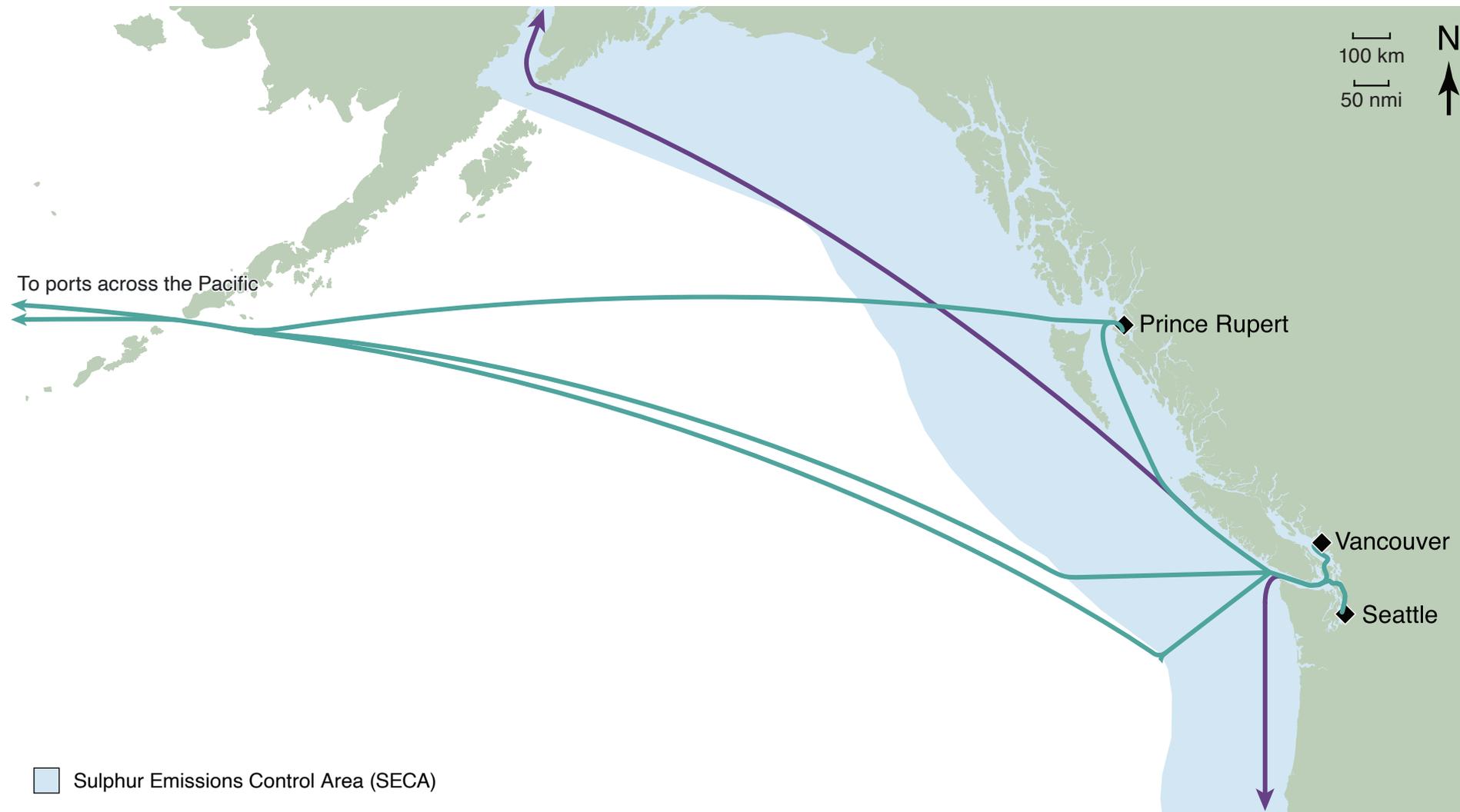
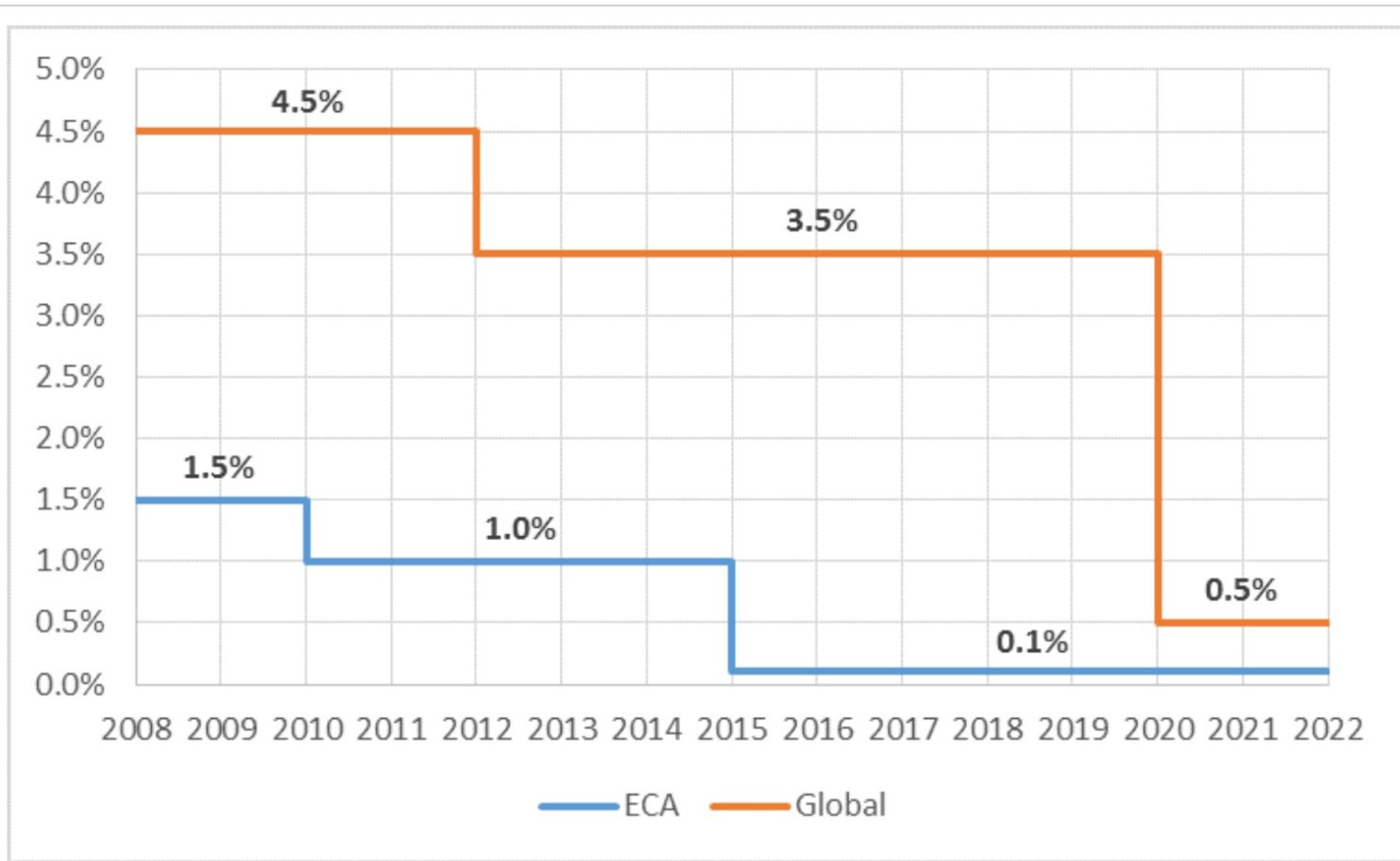


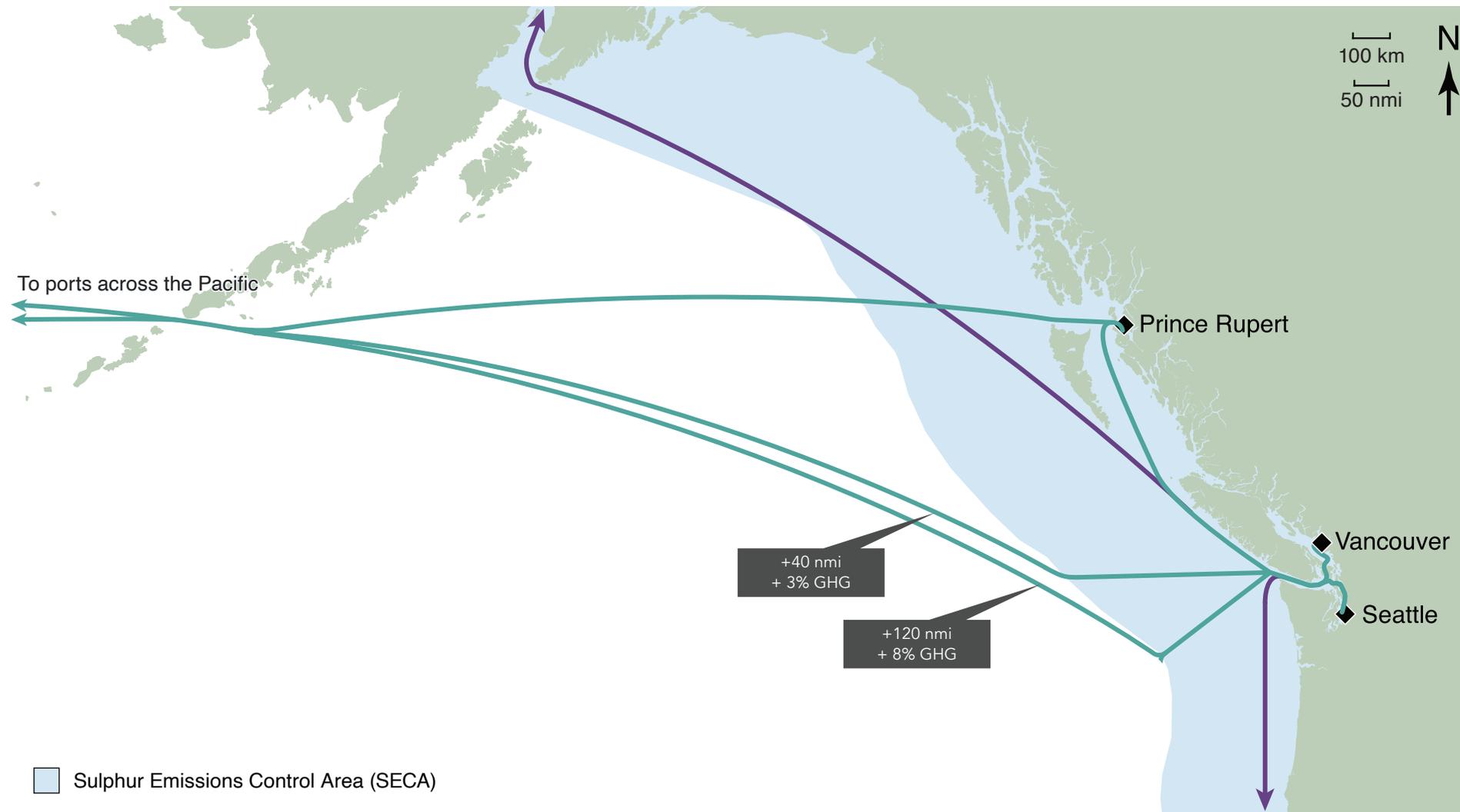
Figure 1: Global level of sulphur content permitted in marine fuels over time



Reductions in Sulphur Emission Levels

(Source: <http://barrelperday.com/2017/06/20/changing-marine-fuel-legislation/>)

NORTH PACIFIC TRADE ROUTES



LNG FUEL: METHANE EMISSIONS CONTROVERSY

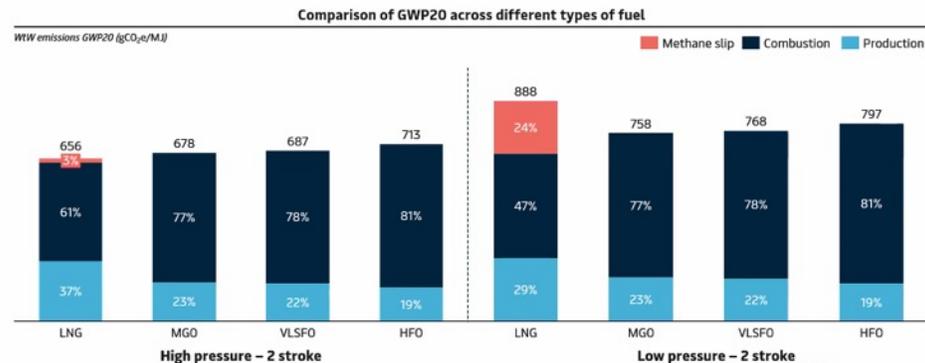
SHIPPINGWATCH

Carriers Suppliers Offshore Ports Logistics **Regulation** Danish

OECD and the Netherlands warn against LNG as a transitional fuel to reach climate goals

In the effort to reduce CO2 emissions in shipping, LNG as a transitional fuel is not the smart choice, estimates OECD and the Dutch government in a response to the IMO's Marine Environment Protection Committee. Both advocate for CO2 taxes.

Our pathway will not include LNG due to the full lifecycle impact



Source: International Council for Clean Transportation: The Climate Implications of using LNG as Marine Fuel, January 2020



Hapag-Lloyd first in world to convert large container ship to LNG

Retrofitting of the 15,000 TEU vessel "Sajir" to use LNG propulsion / Pilot project paves the way for converting large ships to LNG / 15 to 30 percent less CO2 emissions possible

Container Line CMA CGM Orders 12 More LNG-Powered Boxships

by Ship & Bunker News Team
Monday, May 3, 2021

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The LNG bunker market is set to receive another boost over the next **three years** as container line CMA CGM has ordered **12 more gas-powered boxships**.

The firm has signed a deal with **CSSC Group** to order six **15,000 TEU gas-powered container ships**, six **13,000 TEU gas-powered container ships** and another **10 smaller 5,500 TEU vessels** running on VLSFO, it said in a statement on its website on Friday.



CMA CGM is already the world's largest buyer in the niche LNG bunker market. File Image / Pixabay



MAY 5, 2021

Scandinavian Biogas invests in new Norwegian plant

Scandinavian Biogas Fuels is investing 170 million krone (€17 million) in a liquid biogas plant in Skogn, outside Trondheim. The company already has the world's largest plant to produce liquid biogas on the site in Norway.

The plant will be operational in the third quarter of 2022 and will produce 35 GWh of biogas. Skogn has been supplying liquid biogas since 2018.

Skogn will supply the shipping company Hurtigruten with biogas as fuel for their fleet of ships.



LNG SHIP FUEL NORWAY



Fjord1 with new LNG ferries

Fjord1's environmental focus has put the Norwegian company at the very forefront on the use of natural gas in ferries



PUBLISHED 11-23-09 SUBMITTED BY FJORD1

This weekend Fjord1 had a naming ceremony for its three new LNG ferries in Gdansk, Poland. The ferries are scheduled to operate on the Norwegian Romsdalsfjord in 2010, and are part of a larger LNG-ferry order at Remontowa shipyard.

Fjord1's environmental focus has put the Norwegian company at the very forefront on the use of natural gas in ferries and the company expects to operate altogether 11 LNG ferries along the Norwegian coastline in 2011.

Following the success of the world's first ferry to run on natural gas with Glutra in 2000, Fjord1 is still the only company using natural gas ferries for vehicle and public transportation with five more large vessels operating the busy links along the busy coastal roads of Norway.

LNG is an attractive alternative fuel not only because it is relatively clean, but also because Norway has an ample supply.

Liquid Natural Gass (LNG) reduces air pollution

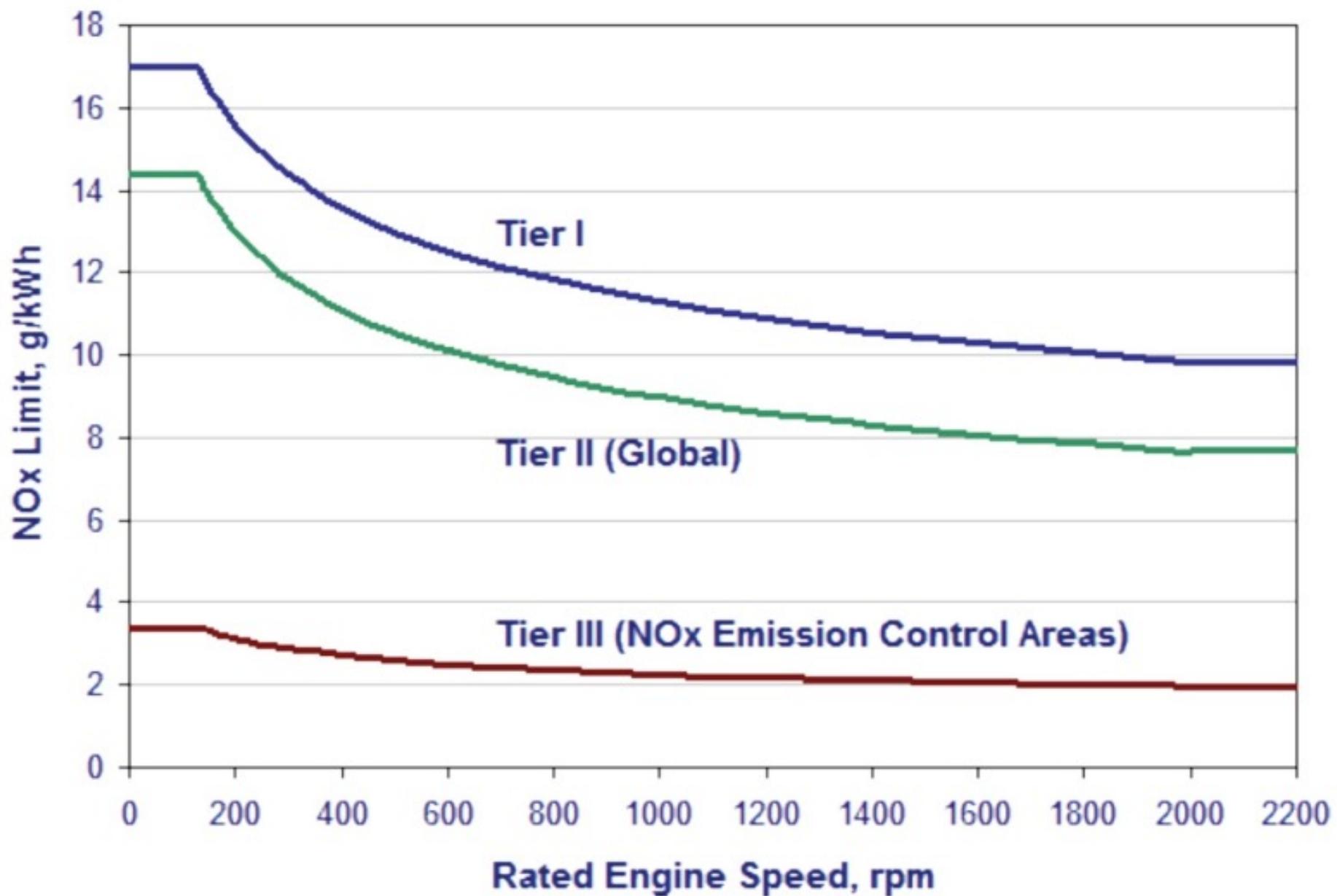
Fjord1 expects a solid reduction of air pollution with the new vessels. The ferries will reduce NOx emissions with 90% compared to conventional diesel operated ferries.

- If we compare all our gas ferries with conventional diesel ferries, the NOx-emissions are reduced with 90 percent. That equals more than the total emissions of the amount of cars in Oslo, says Managing Director in Fjord1 MRF, Anker Grovdal.

Smoke and soot will be as good as gone. - Because natural gas is clean fuel, as much as all emissions of particles and sulfur will be removed, says Grovdal. He also points out that the CO2-reduction will be about 20 percent compared with diesel ferries.

The first ferry to be ready is Moldefjord (128 PCU) which will be operating from January 1st 2010. For local travelers, the ferries will provide an altogether better solution with 20 percent more capacity than today's solution.

More than 70 guests from Norway attended today's naming ceremony, together with Norwegian Ambassador to Poland - Mr. Enok Nygaard and Honorary Consul of Norway in Gdynia - Mr. MichaÅ, Rzeszewicz, as well as representatives from Remontowa shipyard under the leadership of Mr. Jaroslav Flont. Guests of honor of the event were: Pomeranian Voivode - Mr. Roman Zaborowski and Vice-President of GdaÅ,sk - Mr. Andrzej Bojanowski.

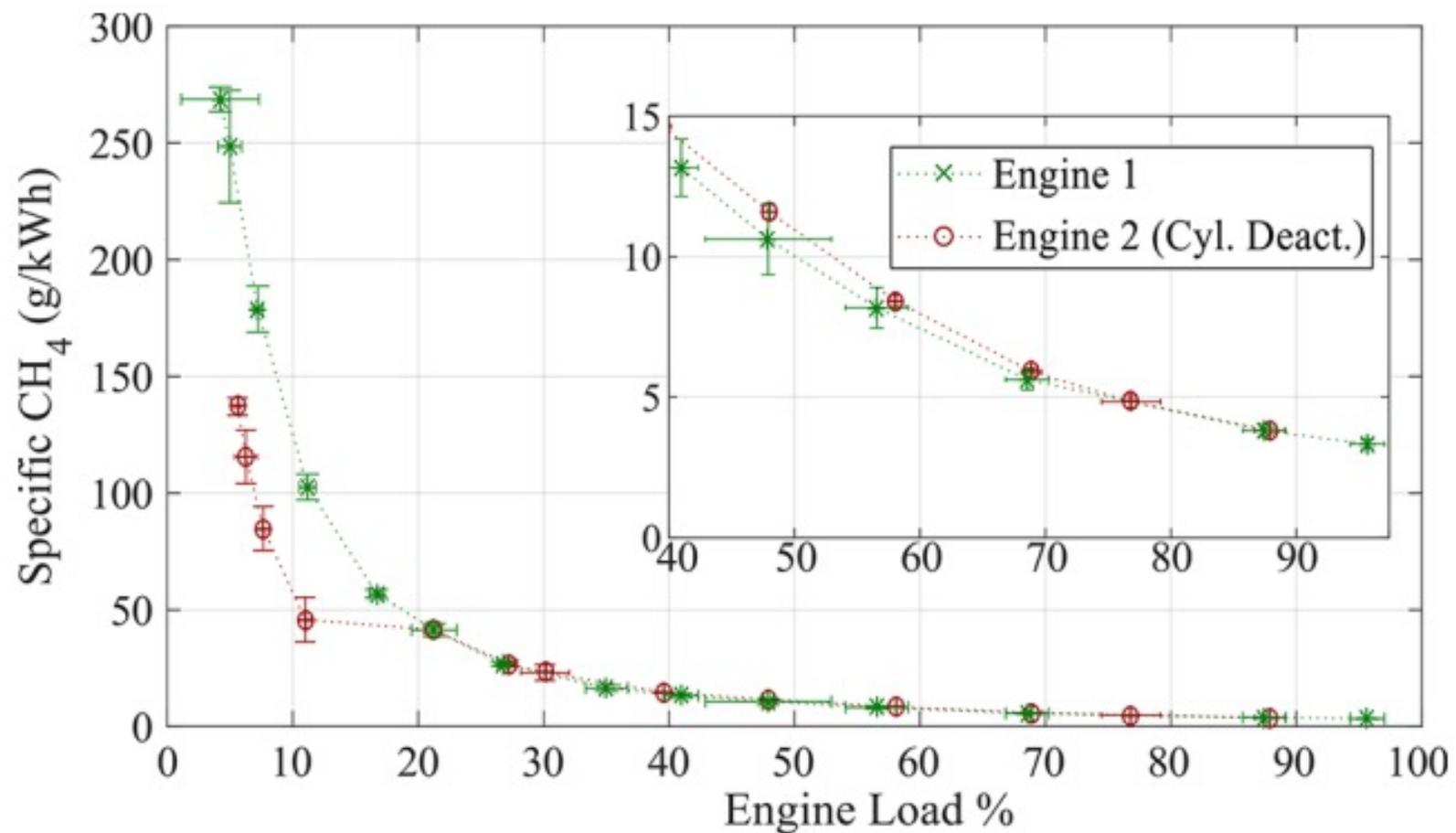


GAS ENGINE TECHNOLOGY SELECTION

	Spark Ignited	HP Dual Fuel	LP Dual Fuel
Fuel Efficiency	OK	GOOD	OK
Methane Slip	POOR	GOOD	POOR
Meets IMO Tier III NOx	Yes	No*	Yes
Fuel Flexibility	No	Yes	Yes
Cost	\$\$	\$\$\$	\$

* Requires additional exhaust aftertreatment systems similar to diesel engine

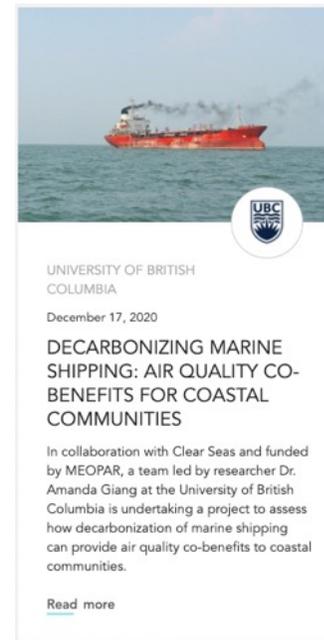
LP DUAL FUEL ENGINE METHANE EMISSIONS



Source: Sommer et al. 2019

PATH TO DECARBONIZATION

- Better data and clear facts
- Carefully consider interactions – beware the unintended consequences
- Take a a multi-generation view
- Follow our research into co-benefits of decarbonization and air pollution reduction



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