



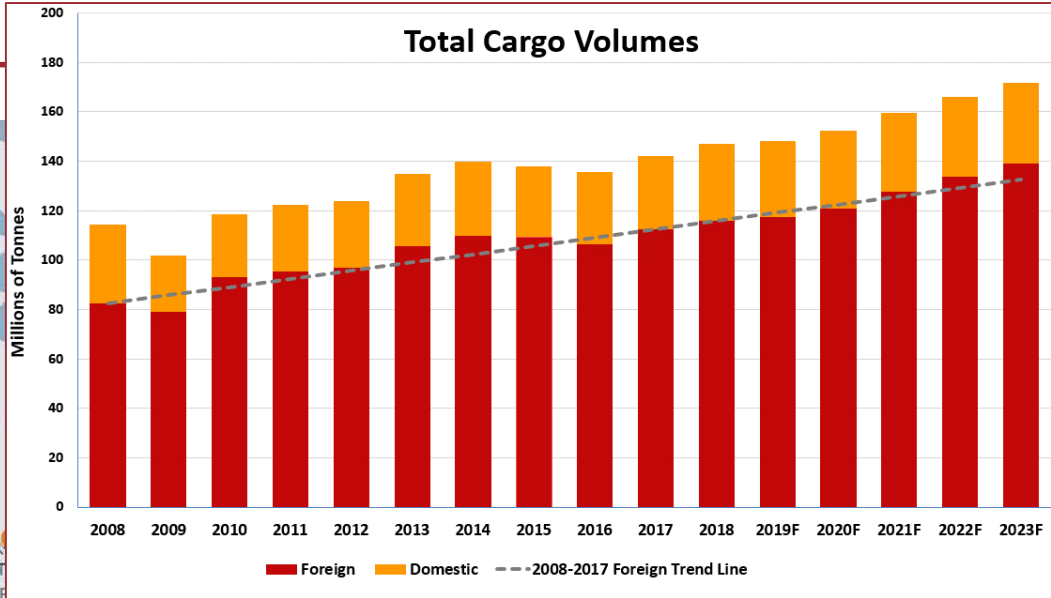
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Natural Gas as a Marine Fuel and Bunkering within Vancouver

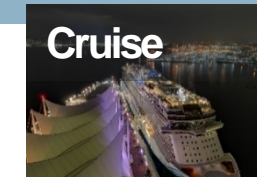
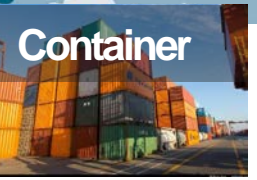
NSWLC

Dec 2020

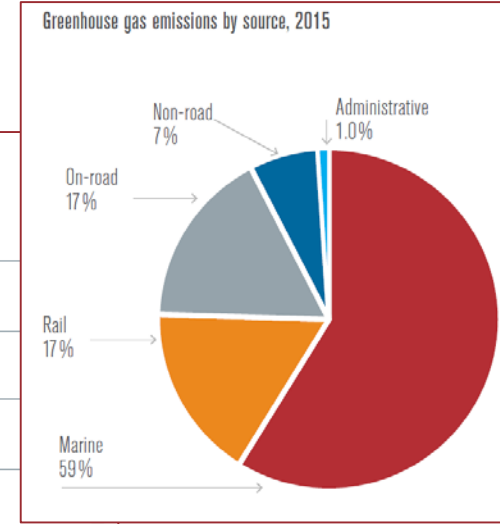
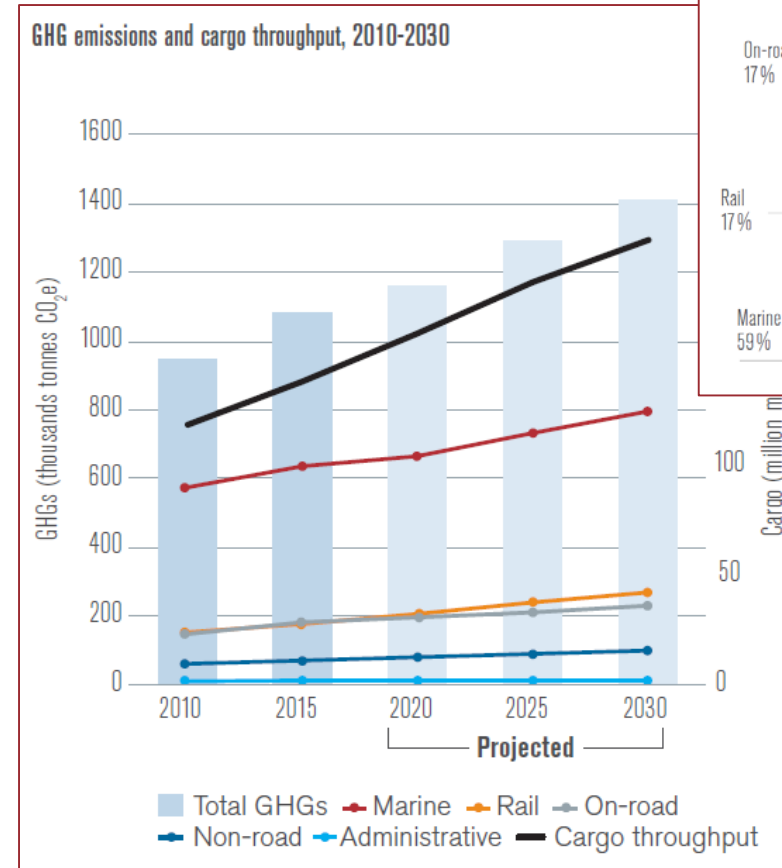
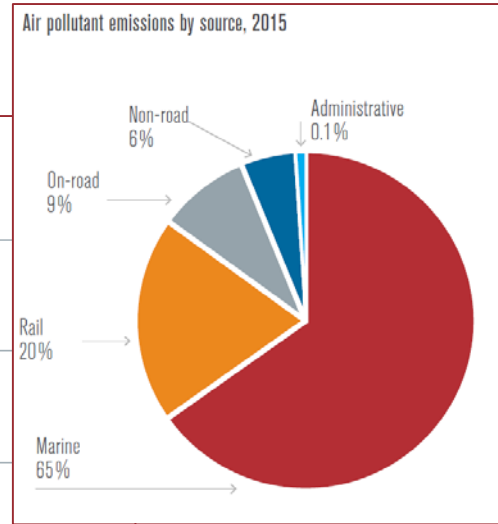
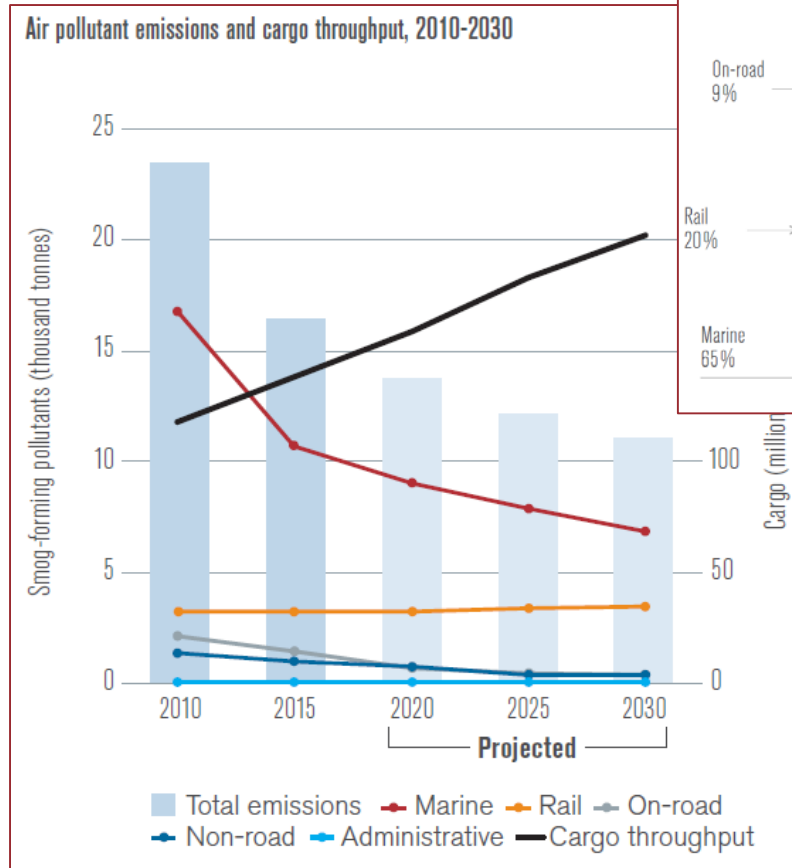
Canada's Largest Port



3.6% Forecasted Growth



Air Pollutant and GHG Emission Trends (2015 Inventory)



Regulations to Marine Reduce Emissions

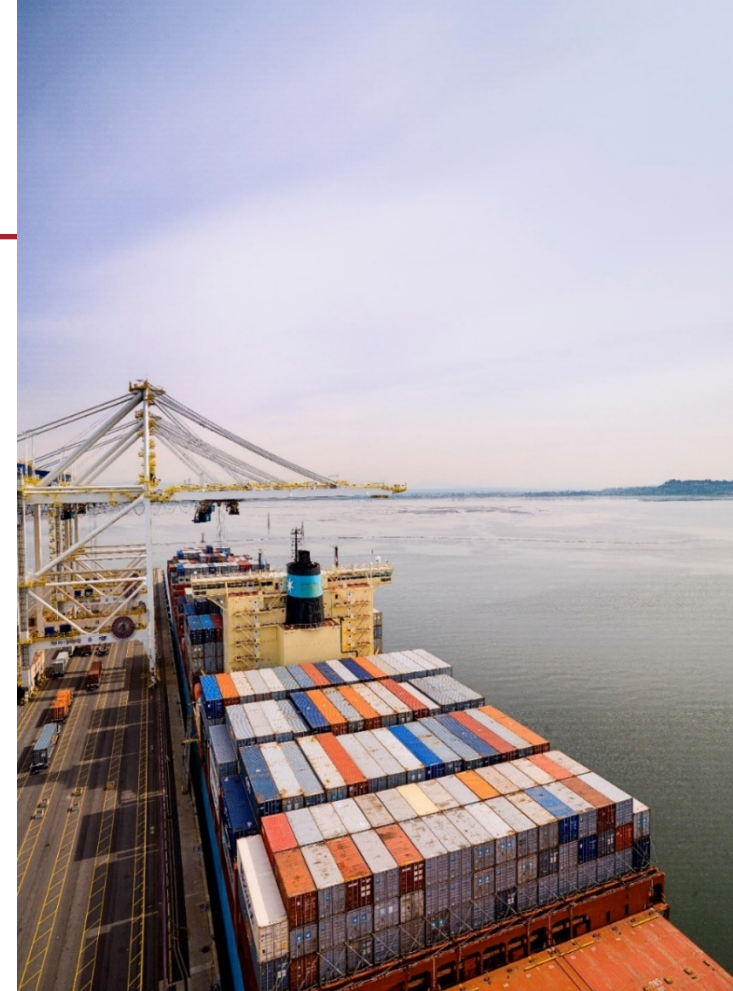
International Maritime Organization (IMO) regulations that significantly impact the shipping industry:

- the 2020 global application of a fuel sulphur limit of 0.5%, and;
- the GHG regulation due in 2023.

Three compliance options for the 2020 global sulphur limit:

1. Shift to low sulphur fuel oil that meets the 0.5% limit
2. Continue to use heavy fuel oil in combination with exhaust gas cleaning systems (i.e. install scrubbers)
3. Transition to dual fueled ship propulsion systems that can use LNG as a marine fuel (generally only available on new vessel builds)

Note: LNG fuel contains no Sulphur, the diesel pilot fuel contains Sulphur, overall reduced SOX emissions



LNG as a Marine Fuel

Society for Gas as Marine Fuel (SGMF), global GHG study on LNG marine fuel (2019) confirmed:

- LNG is the only commercially viable and scalable alternative to oil-based marine fuels that can deliver up to a 21% reduction in GHG emissions compared to conventional oil-based fuels.
 - A portion of the global shipping fleet will transition to LNG fuel in response to regulations on fuel sulphur content and GHG emissions
 - Future developments in bio and synthetic LNG will enable further GHG reductions

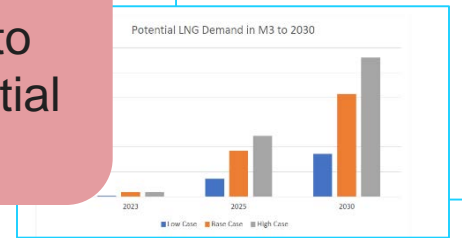
Liquefied natural gas (LNG) is a mixture of substances — predominantly methane (CH₄) — that has been cooled to about -162°C ($-259,6^{\circ}\text{F}$) at atmospheric pressure. The liquefaction process reduces the volume of natural gas by about 600 times, making it easier to transport and store.

Attracting and supporting LNG fueled ships through LNG bunkering in Port of Vancouver will enable a significant reduction in ship emissions and continued growth in trade.

Marine Shipper Adoption

- LNG as a Marine Fuel is expected to be adopted by shipping lines, across several sectors, by mid-decade:
 - Regional Tankers
 - Auto Carriers
 - Container
 - Cruise

Sector Forecasts
Conducted to
Gauge Potential
Demand

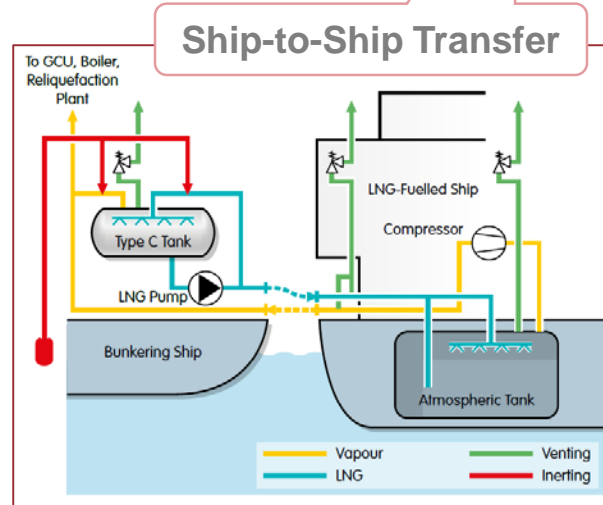
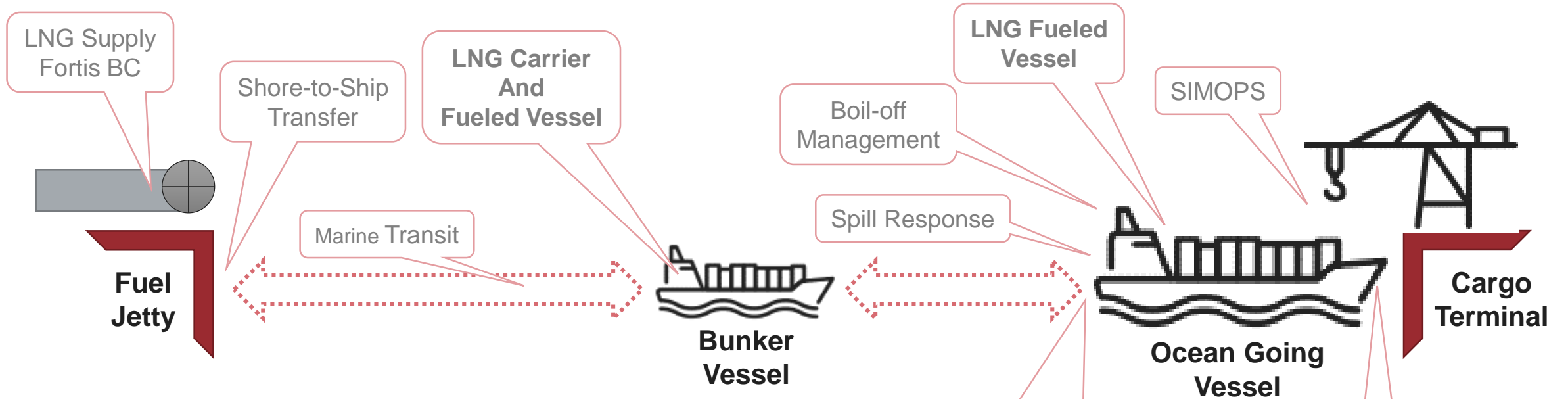


November 18, 2020



NYK's First LNG Fueled and Data Smart Vessel makes Inaugural Call into the Port of Vancouver

What is Bunkering



Port Authority Facilitating a Transition to Cleaner Marine Fuels

- Port authority is currently active in supporting a transition to cleaner alternative fuels:
 - Examine safety through preliminary risk assessments,
 - Understand the economic viability of using natural gas sourced from within Canada,
 - Understand the environmental performance of vessels and carbon intensity of fuel choices,
 - Working directly with stakeholders (i.e. industry, shipping lines, terminal operators) to explore a path forward, and
 - Engaging provincial and federal agencies to ensure that Canada is well positioned to facilitate a transition to cleaner fuels.





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Thank You