Climate risks of using LNG as a marine fuel

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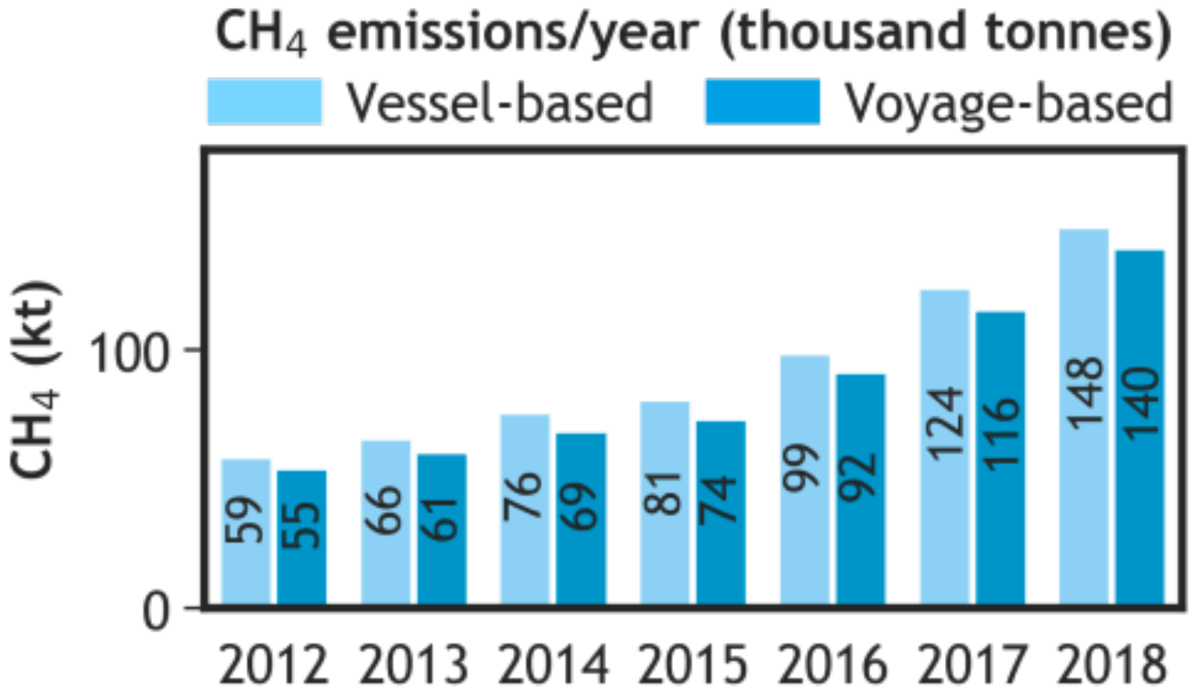
Methane emissions from international shipping have grown more than 150% in recent years



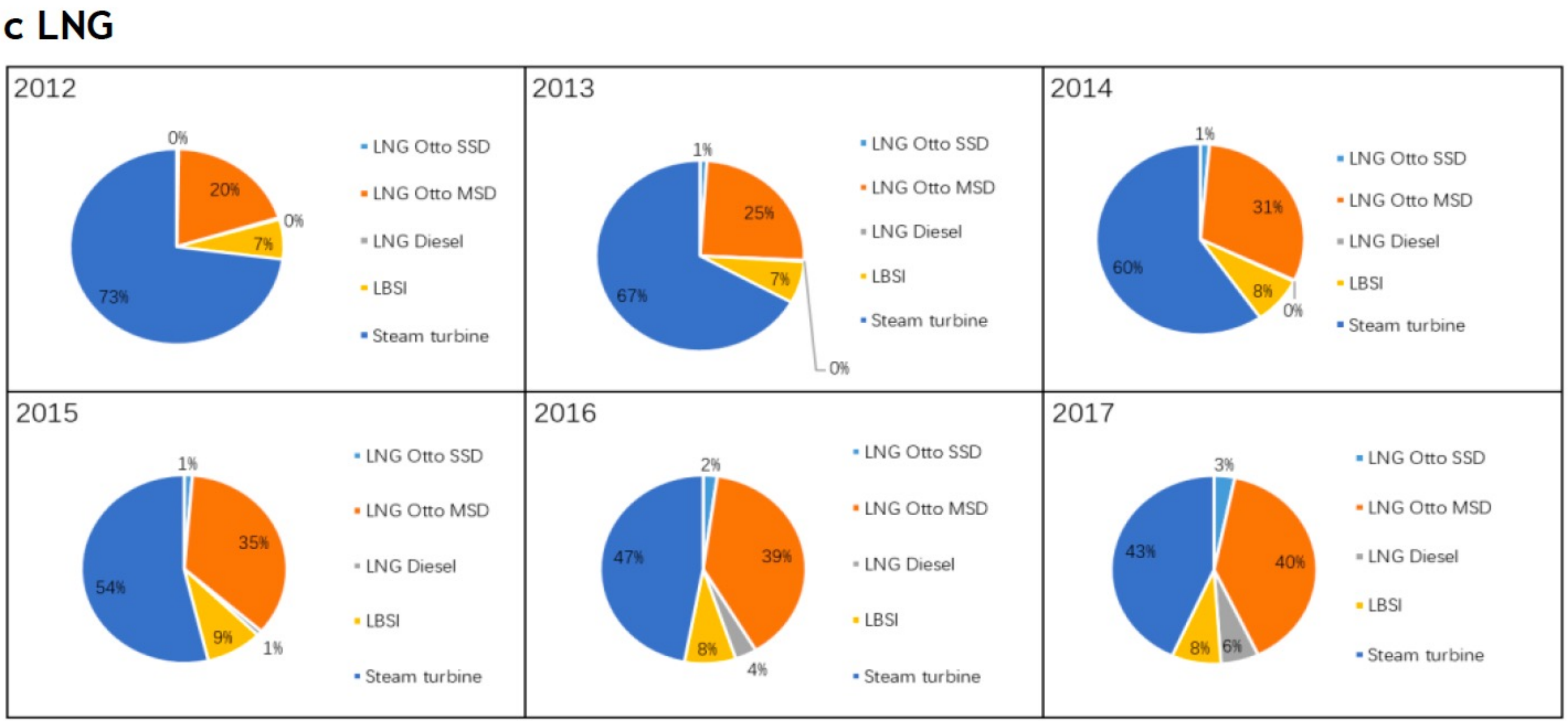
Faber et al. (2020). *Fourth IMO Greenhouse Gas Study 2020*. Available at the International Maritime Organization website, https://www.imo.org/en/OurWork/Environment/Pages/Fourth-IMO-Greenhouse-Gas-Study-2020.aspx. See Figure 76.

Marine LNG engines come in two main varieties; unfortunately, the most popular (and cheapest) engine type is the leakiest

Least leaky:	Most leaky:
HPDF: High-pressure, dual fuel, 2-stroke, slow-speed (<100 rpm)	LPDF: Low-pressure, dual fuel, 4-stroke, medium-speed (~500 rpm)
~0.15% methane slip	~3.5 to ~4.5% methane slip
>90 ships, mainly LNG carriers, as well as container ships	>300 ships, mainly LNG carriers as well as cruise ships

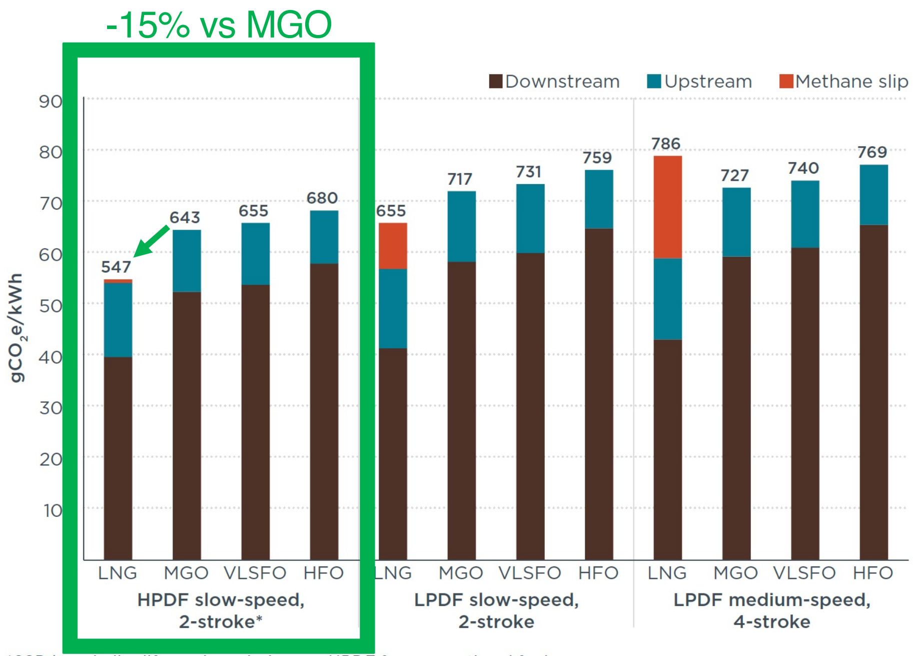
Pavlenko et al. (2020). *The climate implications of using LNG as a marine fuel*. Available at the International Council on Clean Transportation website at https://theicct.org/publications/climate-impacts-LNG-marine-fuel-2020

The leakiest LNG engine (orange) represents 70% of LNG fuel consumed in internal combustion engines in 2017, and its share is growing each year



Faber et al. (2020). *Fourth IMO Greenhouse Gas Study 2020*. Available at the International Maritime Organization website, https://www.imo.org/en/OurWork/Environment/Pages/Fourth-IMO-Greenhouse-Gas-Study-2020.aspx. See Figure 59.

Best case scenario (left) is a 15% reduction in life-cycle GHGs compared to distillate (MGO) using the most expensive engine; the cheaper engine emits more (right)



*SSD has similar life-cycle emissions as HPDF for conventional fuels.

Figure 3: Life-cycle GHG emissions by engine and fuel type, 100-year GWP

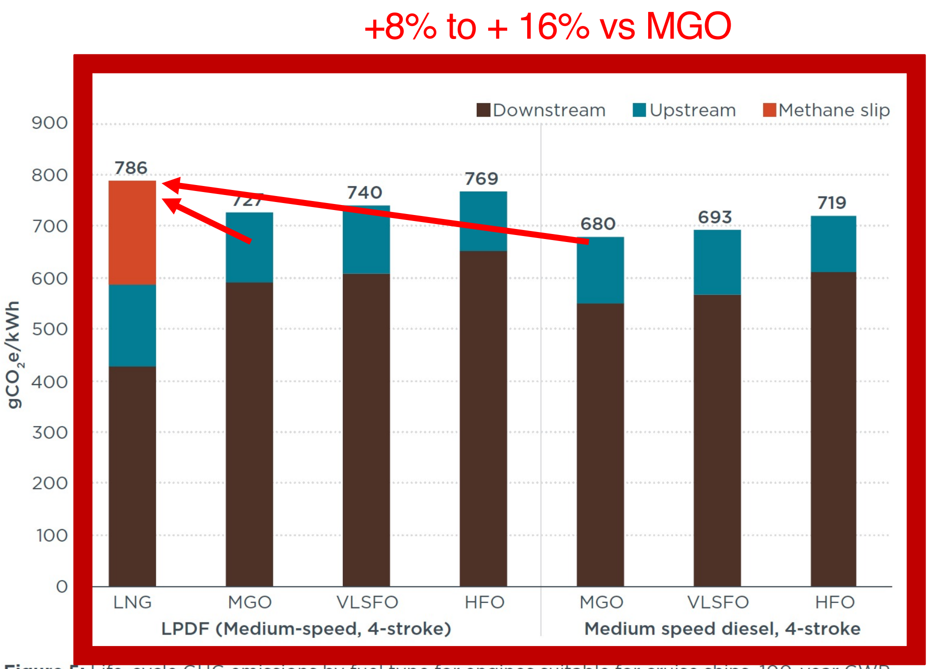


Figure 5: Life-cycle GHG emissions by fuel type for engines suitable for cruise ships, 100-year GWP

Assumptions: 100-year GWP; well-controlled upstream emissions; no crankcase emissions

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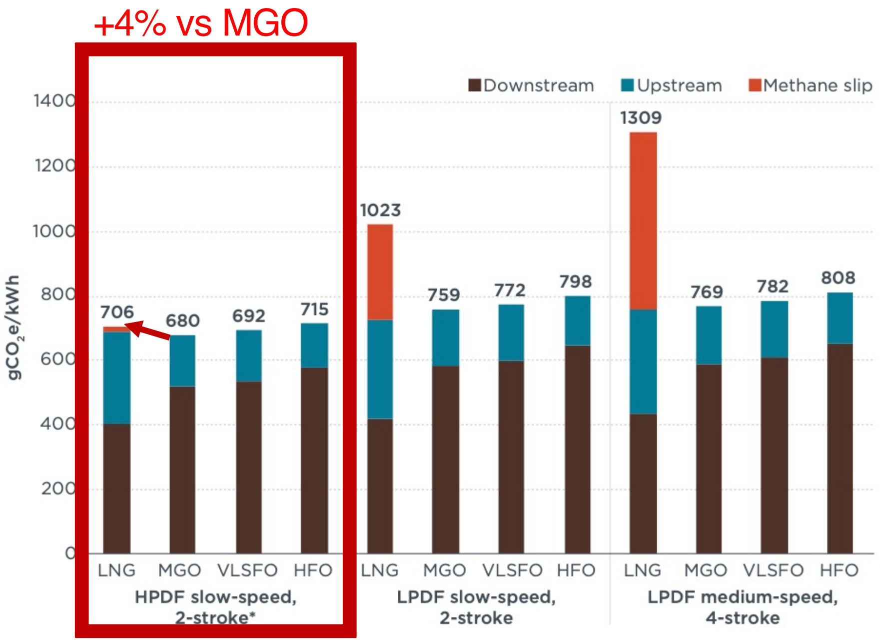
Worst case scenario (right) is an 82% increase in life-cycle GHGs compared to MGO using the cheaper engine; when using GWP20, even the best engine (left) isn't better than using MGO



*SSD has similar life-cycle emissions as HPDF for conventional fuels.

Figure 8. Life-cycle GHG emissions by engine and fuel type, 20-year GWP, higher methane scenario

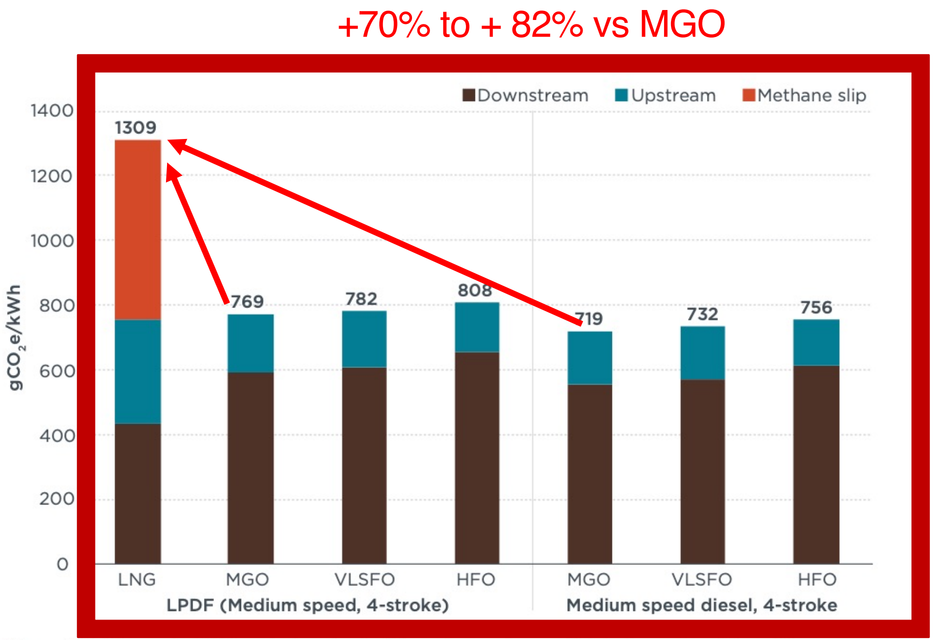


Figure 10. Life-cycle GHG emissions by fuel type for engines suitable for cruise ships, 20-year GWP, higher methane scenario

Assumptions: 20-year GWP; slightly higher upstream emissions; crankcase emissions from LPDF engines

Pavlenko et al. (2020). *The climate implications of using LNG as a marine fuel*. Available at the International Council on Clean Transportation website at https://theicct.org/publications/climate-impacts-LNG-marine-fuel-2020

Main conclusion:
Using LNG as a marine fuel is risky for the climate

- LNG does not deliver the emissions reductions demanded by the IMO's initial GHG strategy which aims to reduce absolute GHG emissions by at least 50% by 2050. Proposals for zero or net-zero GHG emissions by 2050, plus interim 2030 and 2040 targets, are on the table for the revised IMO GHG strategy, set to be agreed in 2023.

- LNG is not compatible with the Global Methane Pledge signed by Canada and more than 100 other countries at COP26, which aims to cut methane emissions at least 30% below 2020 levels by 2030.

- Investing instead in energy-saving technologies, wind-assisted propulsion, low life-cycle emission fuels, batteries, and fuel cells would deliver both air quality and climate benefits.

Questions or comments?
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