Life Cycle GHG Emissions of the LNG Supply at the Port of Vancouver

Final Results – prepared by *Sphera (former thinkstep)*, March 2020

commissioned by Vancouver Fraser Port Authority and FortisBC

Source: Vancouver Fraser Port Authority, credit - John Sinal Photography

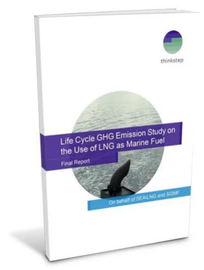
Background

The international shipping industry, as other industry sectors, are under pressure to reduce emissions. The International Maritime Organization (IMO) has announced the ambition to reduce the GHG emissions from international shipping by at least 50% by 2050 compared with 2008. Reliable and up-to-date data are key to understand the benefits and barriers of LNG as marine fuel.

Focus of this study:

Extend the SEA\LNG & SGMF GHG study "Life Cycle GHG Emission Study on the Use of LNG as Marine Fuel" by analyzing the Port of Vancouver specific LNG supply.

SEA\LNG & SGMF study: www.info.thinkstep.com/LNG-GHG-Study



Goal & Scope

Intended application:

- Quantify the GHG intensity of LNG bunkers at the Port of Vancouver
- Compare Well-to-Wake ship engine GHG emissions with global average

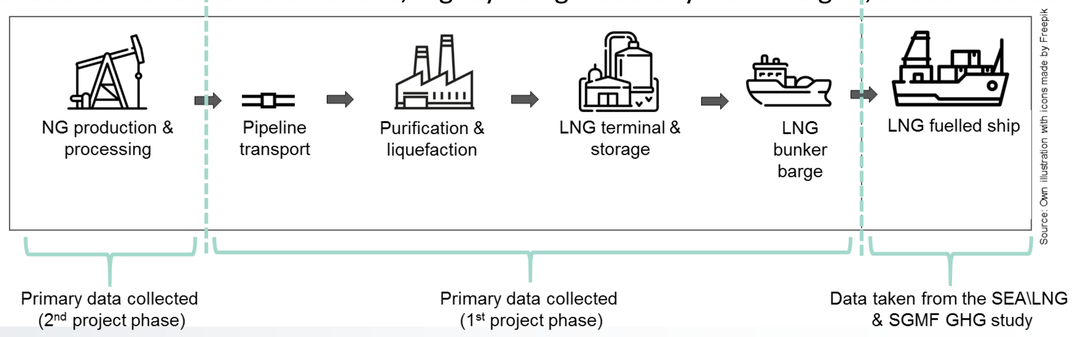
Reasons for carrying out the study:

- Add-on to the SEA\LNG & SGMF GHG study by using the same methodology to:
  - Support the open and transparent communication with external stakeholders
  - Strengthen Port of Vancouver as LNG bunkering port

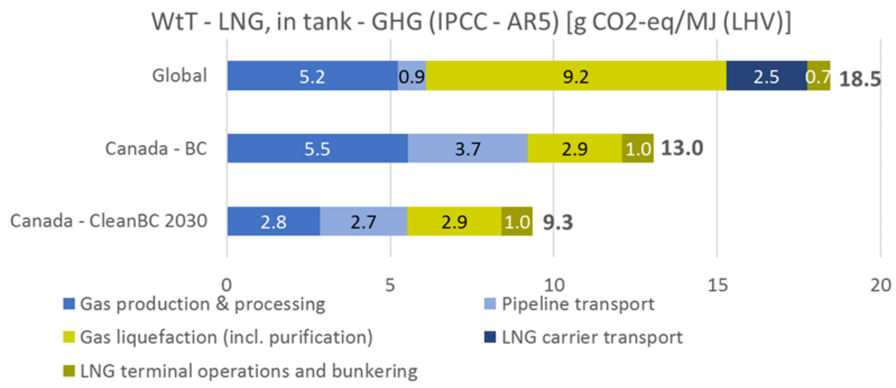
Intended audience:

- Public dissemination and dialogue with external stakeholders and clients, particularly ship operators, investors, regulators, governmental authorities and NGOs.

The British Columbia (BC) specific LNG supply is analyzed from Well-to-Wake by following the life cycle assessment (LCA) approach (ISO 14040/44) for the year 2018. All major GHG emissions (CO_2, CH_4, N_2O) from direct sources, e.g. combustion, processing, leakages, fugitives and indirect GHG emissions, e.g. by using electricity from the grid, are considered.



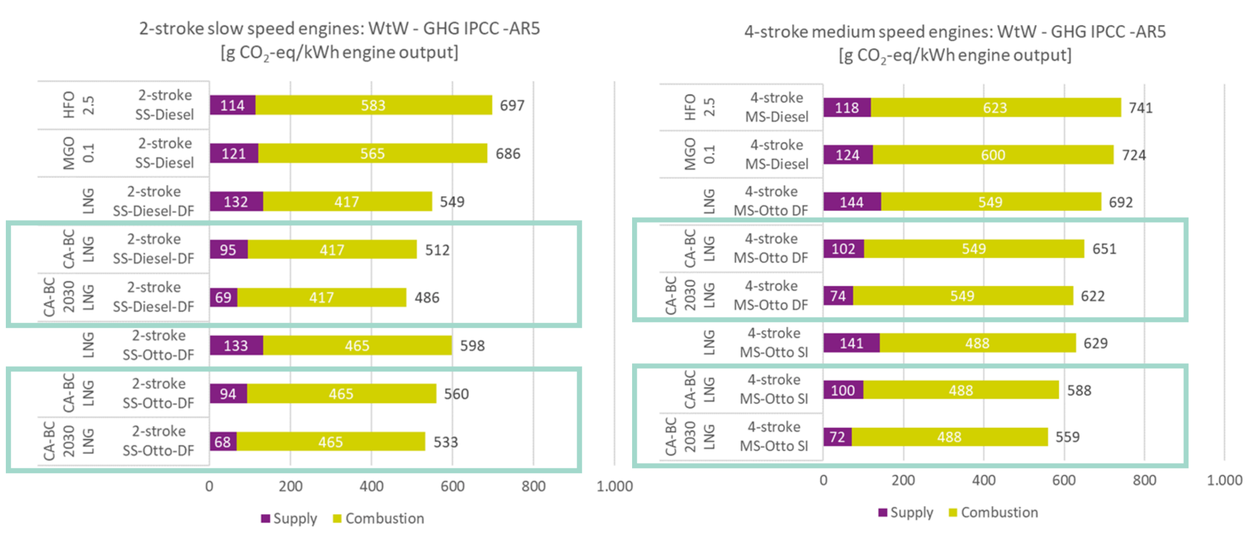
Results (see *Disclaimer* within Limitations)



The BC LNG supply GHG emissions (Well-to-Tank) are 29% lower compared with the global average LNG supply.

The BC "LNG terminal operations and bunkering" GHG emissions are 0.3 g CO_2-eq/MJ (LHV) higher due to the longer distance travelled by the bunker barge. For the BC LNG supply no "LNG carrier transport" of imported LNG is required, since all LNG is produced in BC. GHG emissions from liquefaction are reduced by ~ 1/3 compared with global average due to the usage of electricity from the grid, which is based on ~90 % hydro power. The BC "pipeline transport" includes a long-distance transport of 825 km. The BC gas production & processing is similar to the global average.

The "Canada - CleanBC 2030" scenario shows a GHG reduction of further 28% (compared with "Canada-BC"), and a 49% lower GHG intensity compared with the global average. All results refer to Well-to-Tank LNG and are expressed in g CO_2-eq/MJ (LHV), in tank following IPCC Assessment Report 5.



2-stroke slow speed engines:

- When using global LNG, GHG reduction is 14-21% compared with $HFO_{2.5}$
- The use of BC LNG reduces the GHG emissions by 20-27% compared with $HFO_{2.5}$
- The use of CleanBC 2030 LNG 24-30%

4-stroke medium speed engines:

- When using global LNG, GHG reduction is 7-15% compared with $HFO_{2.5}$
- The use of BC LNG reduces the GHG emissions by 12-21% compared with $HFO_{2.5}$
- The use of CleanBC 2030 LNG 16-25%

Limitations

- The results are based on the analysis of one single LNG supply chain being considered BC representative
- The assessment considers global warming as an environmental impact category only and all conclusions are drawn from these results. The analysis of other environmental impact categories, indicators and pollutants might lead to other conclusions
- *Disclaimer*: Please note that the SEA\LNG and SGMF results were critical reviewed according to ISO 14040/44, while the BC LNG supply analysis was not 3rd party reviewed, and hence no ISO 14040/44 conformity of the results presented is given

Summary

- Shipping data (Tank-to-Wake) are taken from the SEA\LNG & SGMF study
- Since no "LNG carrier transport" is required, the GHG intensity of the BC LNG supply is reduced significantly (globally it accounts for ~13%)
- Usage of BC's relatively "green" electricity mix at liquefaction reduces the liquefaction GHG emissions by roughly 1/3
- The CleanBC 2030 scenario shows that through methane emission reduction and electrification in the upstream operation, the GHG emissions can be reduced by 30% compared with the base case, and to half the level of the global average
- The BC LNG supply is less carbon intense and will contribute to the GHG reduction of shipping emissions and hence contributing to IMO GHG reduction targets

Contact: Oliver Schuller, PhD, oschuller@sphera.com

Sphera GmbH
Hauptstrasse 111-113
70771 Leinfelden-Echterdingen, Germany
www.sphera.com