Natural Resources Canada | Ressources naturelles Canada

Deputy Minister | Sous-ministre

Ottawa, Canada
K1A 0E4

UNCLASSIFIED

209162

MEMORANDUM TO THE MINISTER

CANADIAN AND U.S. LNG EMISSIONS VS. COAL

(For Information)

ISSUE

- In early October, Dr. Robert Howarth (Cornell University) published a study on the emissions intensity of U.S. LNG shipped from the Gulf Coast to Asian markets for use in power generation (Attachment 1). NRCan has done a preliminary review of the report and prepared the following summary and considerations from a Canadian context.

KEY FINDINGS

- The report concluded that LNG from the US is 33% more emissions intensive than U.S.-sourced coal being used domestically for power generation, indicating that it is not beneficial for Asia to import U.S. LNG for emission reduction in power generation.

- Howarth has used several assumptions in his analysis that may overstate the difference in emissions intensity.

- Using Howarth's methodology, the emission intensity of Canadian LNG exported to Asia is expected to be significantly lower than that of U.S. coal, and up to half that of U.S. LNG sourced from the Permian and shipped from the U.S. Gulf Coast.

- Canada's LNG emissions advantage can be attributed to:
    1. Strict regulations on flaring and fugitive methane emissions management,
    2. Higher gas well productivity in the Montney Basin in Canada versus higher emissions intensity in the Permian,
    3. Relatively short shipping distances to Asia (7-10 vs 22-36 days); and
    4. Less energy intensive liquefaction in BC due to a colder climate.

ANALYSIS

Howarth Study

- Howarth concluded the average lifecycle GHG emissions intensity of U.S. Gulf Coast LNG is about 33% greater than that of U.S.-sourced coal when used for power-generation (160 grams of carbon dioxide equivalent per megajoule [gCO_2e/MJ] vs. 120 gCO_2e/MJ). This is largely due to methane leakage in upstream processes and boil-off gas (i.e., evaporation) that occurs during shipping.

- Methane leakage is a major component in Howarth's conclusion on LNG emissions intensity. Howarth factors a 2.8% fugitive methane emissions rate for upstream production.

  - Other studies estimate the methane leakage rate to be approximately 2% (Environmental Defense Fund) and as low as 1.3% (University of Bremen).
  - In contrast, NRCan's analysis factored-in fugitive methane emission rates of 1.58% for Alberta and 0.38% for BC, derived from on a measurement-based independent studies.

- Howarth's use of U.S.-based coal emissions intensity is not an adequate substitute for the lifecycle emission intensity of coal used in Asia for power generation. An approximate emission intensity of 222 gCO_2e/MJ, which is 85% higher than Howarth's coal figure may be more appropriate. This value, published by Rystad Energy, is based on the array and efficiency of coal-fired power plant technology in place in Asia as well as the varying quality of coal used there.

- The report uses a 20-year Global Warming Potential factor (GWP_{20}) in its calculations, whereas national inventories reporting under the United Nations Framework Convention on Climate Change (UNFCCC) require the use of a 100-year GWP. GWP is an index of heat trapping potential over a given period. A 20-year GWP focuses on heat trapping over 20 years (rather than 100 years) and weighs gases with lifespans shorter than CO_2 (e.g., methane) more heavily in calculations.
  - Howarth's use of GWP_{20} results in an intensity of methane 2.95 times higher relative to a GWP_{100} scenario and an increase in emissions intensity of US LNG by 46% using Howarth's factor for fugitive emissions. For Canadian LNG using Alberta and BC-sourced gas, applying GWP_{20} increases the emissions intensity by 25% and 13%, respectively.

Comparison to Canadian LNG

- Using Howarth's assumptions, it was found Canadian LNG would likely be significantly less emissions intensive than his calculation for U.S. sourced coal and Permian sourced LNG (Figure 1). Using UFCCC reporting standards (GWP_{100}) as is the generally accepted practice, Canadian LNG would fare even better (Figure 2).

- Canadian LNG will have significantly lower emissions intensity than U.S. Gulf Coast LNG for several reason, including:

  1. **Oil-dominant basins like the Permian in the US tend to have higher methane loss rates** due to inefficient flaring of associated gas or a lack of adequate gas gathering infrastructure.
  2. **Operations in the Montney are focused on the specific delivery of gas production to market and have high well productivity**; the Montney formation in BC and AB is regarded as one of Canada's most economically viable gas plays with high reservoir quality.
  3. **Strict regulations around flaring and fugitive methane emissions:**
     - [redacted]
     - BC mandates rigorous leak detection and repair (LDAR) surveys at many facilities, which involve directly measuring identified leaks. Additionally, operators are required to publish their LDAR data, enabling tracking of performance.
     - AB has been investing in methane reduction technology (gathering lines, fugitive detection, etc.).
     - This has all led to upstream methane emission intensities ranging from 1.35-1.97% in AB, and 0.33-0.44% in BC.

4. **Shorter LNG shipping distances from the BC coast to Asia** (7-10 days) than U.S. Gulf Coast via the Panama Canal (22-36 days).
5. **Less energy intensive liquefaction in BC** decreases emission intensity due to cooler average temperatures than in the USGC (7°C vs. 22°C).

Figure 1. Coal and LNG Emission Intensity Comparison (GWP-20)

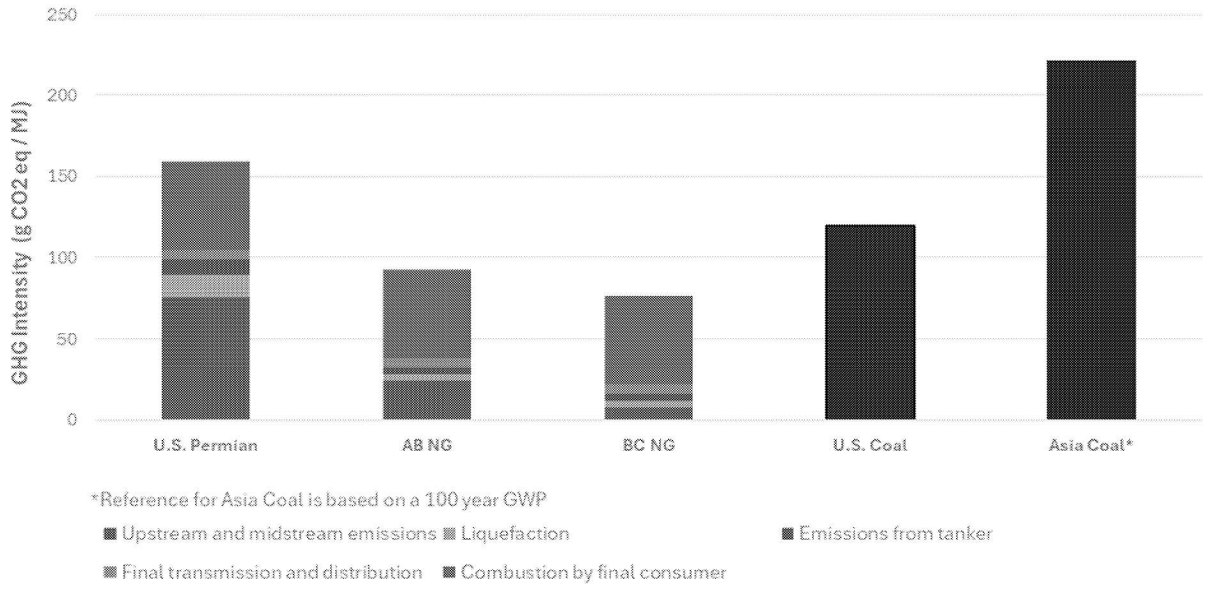
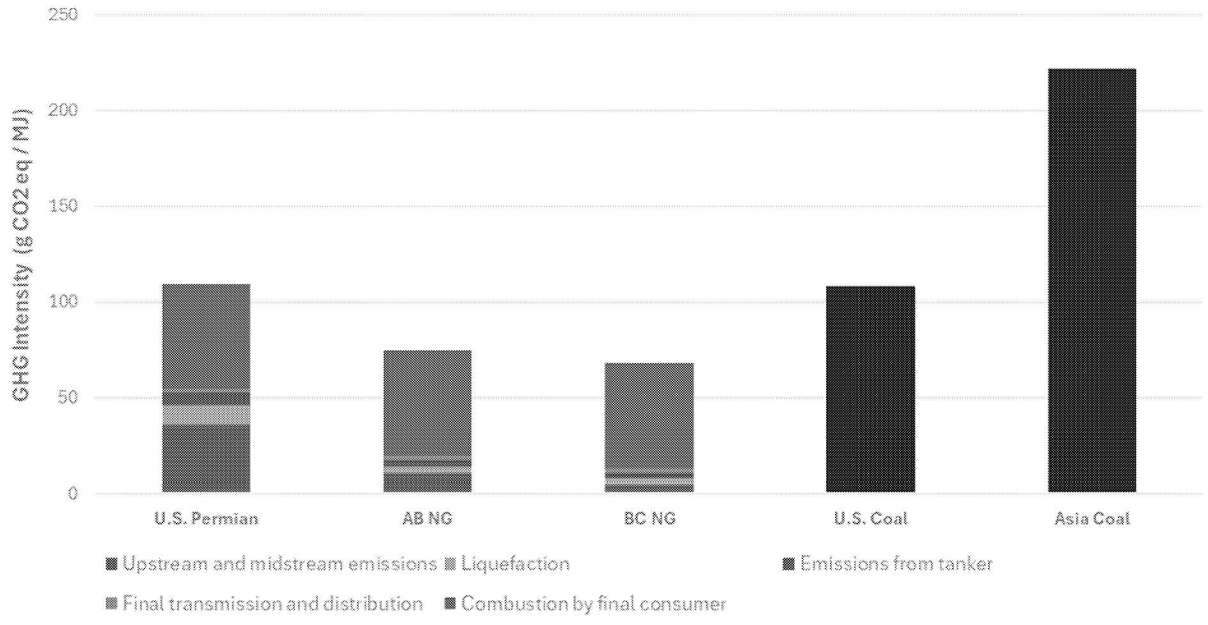


Figure 2. Coal and LNG Emission Intensity Comparison (GWP-100)



NEXT STEPS