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Comparison of GHG Emissions from LNG Canada to American Alternatives: The Canadian Advantage

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Summary

Not all liquified natural gas (LNG) is created equal. The energy required to liquefy and ship LNG impacts the greenhouse gas (GHG) emission intensity along the entire value chain, thereby impacting the net benefit to global GHG reduction efforts. This research compared the GHG intensity of LNG that will be exported from LNG Canada's export facility in Kitimat, British Columbia (B.C.) to that of American competitors (Sabine Pass LNG, Jordan Cove LNG), and found that Canadian LNG exported from LNG Canada has lower GHG intensity.

Context

Canada is a relatively late entrant into the crowded global LNG market, with no current operating export facilities. LNG Canada is set to be the first such export facility in Canada and is slated for completion in late 2025. It is a $40B joint venture owned by Shell Canada, PETRONAS, and PetroChina Canada; it will receive natural gas sourced from the Montney Formation in NE British Columbia through the Coastal GasLink pipeline and will export 3.5 billion cubic feet per day (Bcf/d) at full capacity[1]. The facility is in the Kitimat Arm of the Douglas Channel, which is a deepwater fjord that connects the coast of British Columbia to the Pacific Ocean. The product would then be transported to the ocean via large LNG carrier ships en route to customers in mainly Asian markets. Sabine Pass LNG (Cameron, Louisiana, United States) is the only operating LNG export terminal in North America, but it is located in the Gulf of Mexico and therefore has long shipping times to Asia[2].

Although cost is still a primary consideration for most LNG investors[3], the full life-cycle greenhouse gas (GHG) emission intensity along the entire LNG value chain is also an important factor. Countries that are signatories of the Paris Agreement, a global pact to combat climate change, agreed that ambitious mitigation efforts were necessary to keep global temperature rise below 2^{o}C above pre-industrial levels by reducing GHGs like carbon dioxide (CO2)[4]. For example, the Japanese government recently revised its energy policy to focus on diversifying its energy mix and curbing carbon emissions, with the goal of cutting the country's GHG emissions by 26% between 2013 and 2030[5]. GHGs from LNG Canada's gas storage and liquefaction facility are considered relatively low compared to other LNG suppliers[6]. This advantage is realized in 3 key ways:

1. **Shorter shipping:** LNG Canada's facility is much closer to Asian markets compared to American suppliers, reducing the GHG emissions required for shipping; Sabine Pass LNG's liquefaction facility is in the Gulf of Mexico.

2. **Cold climate**: Gas liquefaction in cold climates is comparably easier than in warmer regions. Lower temperatures could save energy and therefore reduce GHG emissions. The average temperature in Kitimat, BC is much cooler (7°C) than the US Gulf Coast (e.g.: 22°C in Corpus Christi, Texas).
3. **Renewable hydroelectricity:** LNG Canada is proposing to use renewable electricity from BC Hydro in its LNG export facility in Kitimat, which is designed to be 32% more efficient than LNG plants currently setting industry standards for low emissions.

The Jordan Cove LNG project, located in Coos County, Oregon (U.S.), is a proposed LNG liquefaction facility capable of exporting 1.3 Bcf/d of LNG to Asian markets at full capacity[7]. Although this project has experienced significant setbacks in the form of a $1.6B investment write-down in 2021 as well as regulatory hurdles and delays[8], this facility is the most realistic North American competitor for LNG Canada in terms of Asian LNG market share.

Case study: What if Japan's electricity was powered by LNG?

In our review, we considered a case study of Japan if it were to shift its thermal electricity generation fleet from imported coal to LNG by reviewing existing life-cycle assessment (LCA) studies. LCAs take a 'cradle-to-grave' approach by accounting for emissions at each stage of the life cycle. To directly compare different sources of electricity, we consider both coal and LNG in terms of the equivalent functional unit kilograms of carbon dioxide equivalent per megawatt-hour (kg CO2-eq/MWh)[9,10].

We present our review of selected life-cycle assessment (LCA) studies[11] and discuss the impact on global GHG emissions if Japan were to transition its planned new power plant feedstock from coal to Canadian LNG sourced from LNG Canada versus American alternatives (i.e.: Jordan Cove or Sabine Pass). While our assessment will focus on Japan – a nation heavily reliant on imported energy given its scarce domestic natural resources – the approach is translatable to other major LNG-importing Asian countries like China and South Korea.

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