Western Canadian LNG: A Pathway to Global GHG Reduction and Reconciliation

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Abstract

Liquified natural gas (LNG) generates fewer greenhouse gas (GHG) emissions than coal, which could help combat climate change. Western Canada is uniquely positioned to provide LNG to Asian markets, but progress has been stymied by a lack of export capacity[1]. LNG Canada is a $40B LNG export facility under construction in Kitimat B.C. (British Columbia) capable of exporting a maximum of 3.5 billion cubic feet per day (Bcf/d) of LNG at full capacity[2]. This research quantified the net benefit of LNG development using a case study: what happens if Japan switches its electricity generation feedstock from coal to B.C. LNG?[3,4,5,6,7,8] Using a series of life-cycle assessments (LCAs), we found that B.C. LNG produces up to 53% less CO_2/MWh than coal annually for power generation. Additionally, the socioeconomic benefits of LNG must be shared with the Haisla First Nation, who live close to LNG Canada[9,10,11]. We also suggested mitigation measures to ensure Haisla Nation benefits fairly from LNG development while safeguarding their traditional ways[12]. LNG could be a pathway to economic reconciliation for Indigenous peoples and contribute to global climate change mitigation.

1. Impact to Haisla Nation

Indigenous peoples in Canada have historically been exploited by resource development. In Fig 1., we identified 1) lack of social supports, 2) corruption of tradition and values, 3) possible environmental damage, and 4) increased GHG emissions as major impacts of LNG Canada's operations in Kitimat on the Haisla Nation (Fig 2). Implementing mitigation measures for these impacts can help ensure the Haisla benefit from LNG development.

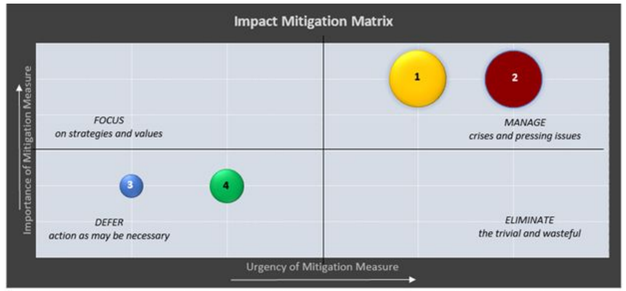
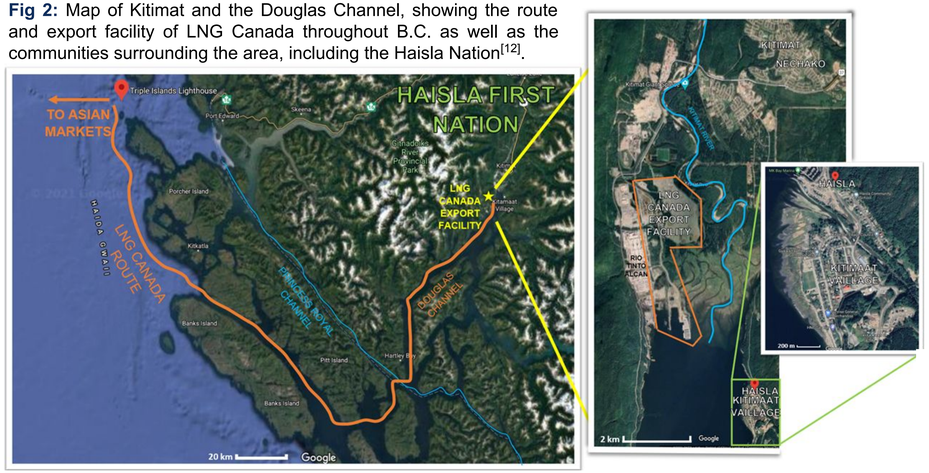


Fig 1: Impact mitigation matrix developed by authors. Numbers correspond to issues identified above. The size of each circle corresponds to the issue's degree of impact on Haisla Nation, i.e., larger circle = greater impact.

2. Approach

The impact on global GHG emissions if Japan switches their power plant feedstock from coal[3] to Canadian LNG from LNG Canada was examined using existing LCAs. LCAs take a 'cradle-to-grave' approach by accounting for emissions at each stage of the life-cycle (Fig 3). To directly compare different sources of electricity, we consider both coal and LNG in terms of the functional unit kilograms of carbon dioxide equivalent per megawatt-hour (kg CO_2-eq/MWh)[4,5,6,7,8].

Fig 2: Map of Kitimat and the Douglas Channel, showing the route and export facility of LNG Canada throughout B.C. as well as the communities surrounding the area, including the Haisla Nation[12].



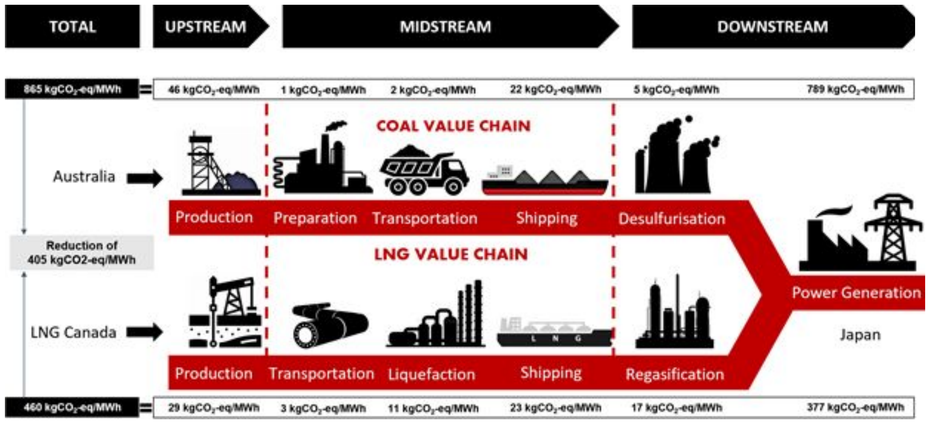
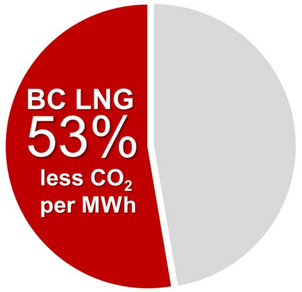


Fig 3: Getting the difference between the life-cycle emissions of coal and LNG, we estimate that global GHG emissions from Japanese power generation can be reduced by 405 kg CO2-eq/MWh by replacing coal feedstock with Canadian LNG[4,5,6,7,8]. This reduction can be as much as 512 kg CO2-eq/MWh if the maximum life-cycle emissions from coal are used. Figure is modified by authors.

3. Findings

Considering a maximum of 972 kgCO_2-eq/MWh for the coal value chain[6], which accounts for emissions from different coal-supply countries to Japan, **we found that GHG emissions can be reduced up to 512 kgCO_2-eq/MWh** (Fig 3). These results are based on the current operational status of the coal and LNG plants as they are described in the literature. Regarding additional emissions within B.C. and Canada (Table 1), use of carbon capture and storage (CCS) technologies and hydroelectricity could result in additional reductions of up to 1.6 MtCO2-eq (only electrification) at the liquefaction facility and 7.2 MtCO2-eq in northeastern B.C. (CCS and electrification).[14,15,16]

Fig 4: Maximum CO_2 reduction, as calculated by authors.



LNG process	Annual GHG emissions ($MtCO_2$-eq)
Extraction and production[4]	+(10.7)
Transportation[7]	+(1.3)
Operation[7,17]	+(4.0)
Total =	**+(16.0)**
Reductions from CCS + Hydro[14,15,16]	**-(1.6 to 7.2)**

Table 1: Net GHG emissions from LNG activity within Canada.

4. Takeaway Message

LNG can play a key role in global GHG emissions reduction. **Western Canadian LNG can serve as a pathway for economic reconciliation for Indigenous peoples and contribute to global efforts in combating climate change.**

5. Future Work & Significance

This case study could serve as a model for future full life-cycle GHG emission assessments that consider the implications of transitioning to low carbon-intensity energy sources, and provides a framework for mitigating the effects of future LNG projects on Indigenous peoples in B.C. Future work could examine the feasibility of CCS to offset emissions, and study diversification options for LNG products (i.e. hydrogen for steel).

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Acknowledgements

Authors are scholarship recipients of NSERC CREATE ReDeveLoP Grant #386133824, a collaborative research and training experience in responsible energy development. We gratefully acknowledge the support and guidance extended by the Indian Resources Council, Inc., Dr. Jennifer Winter, Dr. Celia Kennedy, Dr. Brad Hayes, Dr. Mirko van der Baan, Haisla Chief Councillor Crystal Smith, ReDeveLoP HQPs, and the entire ReDeveLoP team.