The LNG Supply Team

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Policy Paper




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Supplying liquefied natural gas to remote communities: Freeze or go full steam ahead?

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Abstract:

Liquefied natural gas (LNG) may be a better alternative for diesel fuel in remote communities due to its low greenhouse gas (GHG) emissions, smaller storage capacity, and increased safety. However, the costs associated with production, liquefaction, transportation, and storage limits the interest of private investors and stakeholders in such projects. In this paper we introduce the current obstacles surrounding the adoption of LNG and analyze the hamlet town of Fort Chipewyan, Alberta as a case study. We specifically address the obstacles considering the environmental, safety, economical, and political aspects. Environmental and safety factors favor the adoption of LNG technology to power remote communities. Economically, the challenge is presented in the high capital expenditure and operational costs, combined with the lack of proper distribution networks, all-season roads, and the fall in the global LNG price. Additionally, the multi-layered political structure associated with the geographic location of the remote communities may present the biggest challenge. Under these considerations, implementing such technology in Fort Chipewyan is unlikely. Accordingly, we propose additional policy options that would favor the adoption of such technology by introducing conditional government funding for energy infrastructure to lure private investors, while stressing the importance of improving the communication between the various levels of government and public agencies with the First Nations communities.

1.0 Introduction/Policy Issue

The supply of energy to remote communities has been a long-standing challenge in Canada [1]. One major obstacle is logistics, as many remote communities lack proper infrastructure or year-round access [2]. The cost for fuel in remote communities can reach values three times the amount in other parts of Canada, related to the costs of transportation and increased energy demand [3]. In addition, remote communities are directly facing the effects of climate change and need to reduce greenhouse gas (GHG) emissions. As a result, energy affordability and carbon footprints in these communities are major issues.

According to the Government of Canada's remote communities database, there are 265 remote communities in Canada with a population nearing 188,525 people [2]. Most of these communities rely on fossil fuels, mainly diesel and gasoline, with only a few communities relying on renewable energy sources [2]. However, there exists a lack of desire to use other fossil fuel sources, such as liquefied natural gas (LNG), as viable alternatives. This report will utilize Fort Chipewyan, one of Alberta's largest remote communities, as a case study for the potential use of LNG to act as an alternative fuel source. Thus, aiming to answer the question of whether LNG is a more viable option to power remote communities in Alberta than the current system?

2.0 Background and Current Status

Most remote communities use diesel generators for electricity and experience high energy costs [2]. Diesel is primarily used because it is considered the only reliable source of energy in cold climates and isolated communities [4]. However, diesel is subject to high operating costs, price volatility, large amounts of GHG emissions, and risks of spillage [4]. Fort Chipewyan primarily uses diesel for electricity generation, transportation, and heating [5]. The Pembina Institute estimates that the total energy cost in Fort Chipewyan for the average home is over $2,900 CAD/year, while powering commercial buildings costs nearly $1 million CAD/year, and transportation costs equal about $1.78 million CAD/year [5]. Thus, the community requires a cheaper energy solution and producers need to consider other alternatives.

LNG plants in Canada are used as an import facility. The Canaport LNG facility in New Brunswick is used as a regasification import terminal [6]. In addition, there are 5 Canadian LNG plants that service domestic and industrial demands [7, 8]. Examples include FortisBC Tilbury Facility and Gaz Metro LSR Montreal Plant, which service northern remote communities and industrial mines [6]. In addition, the National Energy Board (NEB) has approved 24 LNG export projects since 2010 to service Asian market demand [6]. Government legislation and regulatory agencies present major hurdles for LNG producers to overcome. In Alberta, regulatory bodies such as the Alberta Utilities Commission (AUC) and Alberta Electric System Operator (AESO) supervise and govern matters related to electricity supply, transmission, distribution, and pricing [9]. In addition, private companies such as ATCO Electric provide electrical service to remote communities and develop power plants for electricity production [9].

2.1 Legislation and Public Agencies

The public agency governing the energy and electrical distribution in Alberta is the Alberta Utilities Commission (AUC). The AUC is an independent and quasi-judicial agency that regulates transmission lines, electric substations, power generation facilities (i.e. power plants including wind turbines), and gas utility pipelines. According to the AUC Act (SA 2007) [10], the Commission is made up of nine members appointed by the Lieutenant Governor in Council and each hold terms of up to 5 years. In Section 8(5), the Act outlines that the commission may make an order on appeals relating to disputes and are responsible for holding hearings and determining if utility projects are in the public interest [11]. Ultimately, any LNG plant or project requires approval from the AUC.

Another important statute in Alberta is the Hydro and Electric Energy Act (RSA 2000) [12]. Under Section 11 of the Act, the AUC must approve the construction and operation of any LNG plant before production can begin [12]. Section 19 explains that the AUC is responsible for granting or denying approvals, permits, and licenses [12]. Additionally, the commission may demand modifications to the plans, specifications, or locations for LNG plants, before allowing a project to proceed [12]. If the applicant wants to make minor alterations to a power plant, then the corporation must submit a Letter of Enquiry containing the need for the project, timing of construction, and environmental impacts. These provisions are specified in the Hydro and Electric Energy Regulation (409/83) [13] under Section 12.

The Isolated Generating Units and Customer Choice Regulation (165/2003) [14] enables Alberta to govern the provision of energy to areas separate from the interconnected electric system, as well as isolated communities. Under this legislation, Fort Chipewyan is defined as an isolated community, which is fueled by diesel energy powering designated generating units CUL 453, 454, 455, and 456 [14]. In Section 2, the regulations clearly state that the owner of the electric distribution system where an isolated community is located must get approval for the pricing and costs associated with providing energy to those communities [14].

2.2 Approval Process

In order to develop an LNG fueled power plant in remote communities, utility companies need to follow a robust approval process established by the AUC [10]. During this procedure, ATCO Electric is required to follow an intensive nine step process involving public consultations, hearings, appeals, and a final decision from the AUC. As part of the process, community support is required before proceeding with energy projects.

In the nine step approval process [15], the first step is public consultation, which involves the applicant addressing concerns from various stakeholders. Next, the company is required to make an official application to the AUC. Then, the AUC issues a notice of hearing to any members of the public who wish to participate in the approval process. The fourth step involves interested parties making submissions or objections to the application. The next step is an opportunity for consultation and negotiation. Shortly after, the AUC holds public hearings and makes the decision to either deny the project, approve it, or put conditions on the approval. The final two steps involve an appeal process for dissatisfied participants and the ultimate construction and operation of the LNG facility.

3.0 Key Considerations

3.1 Political Considerations

In Fort Chipewyan, there are several significant political challenges to overcome before shifting community power generation sources to LNG. Fort Chipewyan has a complicated and multi-layered political structure due to its remoteness and status as a First Nation community. The community is governed primarily by the Chief and four council members of the Athabasca Chipewyan First Nation (ACFN) [16]. Additionally, the ACFN works together with four other First Nations communities forming the Athabasca Tribal Council (ATC) to collaborate and govern their communities effectively [17]. In order to get approval for any project or to convert sources of energy for power generation, each of these communities need to agree to the project. As a result, the formal support of the ATC is essential. Fort Chipewyan is also under the jurisdiction of the Regional Municipality of Wood Buffalo (RMWB) and is officially located on Crown land [18]. Thus, the political issues are further complicated because Fort Chipewyan is not on reserve land but is still considered a First Nations' community. Consequently, four layers of political actors (ACFN, ATC, RMWB, Alberta government) need to be involved in the decision-making process before any LNG project may proceed.

3.2 Economic Considerations

LNG is measured by the cost of delivered energy (MMBtu), which constitutes the costs of purchasing gas from producers, pre-treatment, liquefaction, transportation, and delivery to customers [19]. The World Bank estimates that the cost of delivery by truck for LNG is anywhere from $6.16-$11.62 USD/MMBtu [20]. If the LNG plant is close to the community, then liquefaction constitutes the vast majority of costs, whereas transportation constitutes majority of costs in long distance situations [20]. ICF International Consulting estimates the total cost of delivery to be $18 CAD/MMBtu for LNG, compared to $39 CAD/MMBtu for diesel, with the liquefaction process accounting for 56% of the total cost [21] (Figure 1). FortisBC, a domestic LNG plant, estimates their liquefaction costs to be about $4.59 CAD/MMBtu [21].

There are a few remote communities that already use LNG to generate electricity and heat homes. Inuvik, NT has been using LNG in conjunction with diesel since 2013 and have seen cost savings ranging from 10-20% [21]. In 2015, Yukon Energy in Whitehorse, YT replaced two diesel powered generators with LNG generators and expect to save over $2 million CAD annually [21]. On average, LNG is expected to reduce costs for remote communities by 6% to 22% [21]. Thus, LNG appears to be economically beneficial for remote communities.

However, there are several economic limitations of LNG. Fort Chipewyan lacks the necessary LNG infrastructure such as distribution networks, all season road access, liquefaction/regasification plants, and storage facilities. LNG infrastructure is very expensive for producers and projects may not be viable if remote communities do not have existing distribution networks or all-season road access. Vaporizers can cost $4 million CAD, LNG transport trucks can cost up to $275,000 CAD, and storage costs add up quickly if there is limited road access [21]. For example, the expected situation for Fort Chipewyan is $25 CAD/ USg [22] of storage, for an approximate storage of 320 days with a daily consumption of 5,768 USg [23, 24], amounts to $46,144,000 CAD in storage costs. As a consequence, logistical factors such as storage, infrastructure, and transportation costs may make LNG projects uneconomical for producers, especially in Fort Chipewyan. Additionally, LNG prices have declined globally, reducing the margins needed to justify the capital-intensive development required, as well as difficulties in securing long-term supply Canadian contracts [6, 21] (Figure 2).

3.3 Environmental Considerations

Climate change will have significant negative impacts on remote communities in Canada. Possible effects include increases in forest fires, shorter winter road seasons, changes to wildlife migration, and an increase in both pests and diseases [5]. These factors will increase fuel costs, reduce time available for transportation, and dramatically increase other expenditures for communities [5]. Therefore, GHG reduction is extremely important for remote communities to combat the negative effects of climate change. In Fort Chipewyan, electricity generated from diesel accounts for over 50 % of the community's GHG emissions, while gasoline and fuel oil account for another 40 % of GHG emissions [5]. In total, the community emits approximately 15,000 tonnes of carbon dioxide every year [5] (Figure 3).

LNG represents a possible environmental solution to diesel for remote communities. According to the NEB, "natural gas emits less CO_2 and less particulate matter" than diesel [6]. LNG effectively reduces air pollution from carbon monoxide or sulphur dioxide and constitutes an average of about 22 % reduction in GHG emissions when compared to diesel [21]. For example, Stornoway Diamond Corporation has developed an LNG fueled power plant for the Renard Diamond Project in Quebec [25]. The feasibility study estimates a 43 % reduction in GHG emissions and significantly less nitrogen dioxide air pollution compared to the current diesel operations [25]. As a result, LNG will likely provide Fort Chipewyan with several environmental benefits.

3.4 Safety Considerations

LNG has a very safe environmental record, with the only large industrial accident involving LNG dating back to 1944 [26]. In the unlikely scenario of a spill during transportation, the environmental impact is expected to be minimal, as compared to diesel [27]. Diesel may pool on the ground and will require extensive cleaning operations, while LNG will evaporate into the air as an odorless, non-corrosive, and non-toxic gas. The dangers that LNG poses in cases of spills are immediate, at the time of leak, where the cold gas can cause cold burns (frost bites). In addition, as the gas vapors are heavier than air they may cling to the ground, for a short duration before evaporation, causing a potential fire hazard, as well as an asphyxiation hazard in enclosed spaces. Lastly, the vapors are flammable if exposed to an ignition source, provided they are sufficiently warmed and within the flammable range [28]. However, despite these factors, LNG is a clean fuel and its use has many advantages in reduced pollution on land and waterways [29].

4.0 Policy Options

Our first policy option is to not supply Fort Chipewyan with LNG sources for power or heat. Several economic factors, mainly the lack of all-season roads and high capital expenditure associated with such technology limit its viability. The benefits of adopting LNG are long term and are seen in the reduction of GHG emissions as well as decreased operational expenses. However, the costs of storage, transportation, critical infrastructure, as well as volatile LNG prices make LNG a risky and uneconomical prospect for private investors. In addition, political and regulatory challenges, as well as lengthy approval processes may delay projects, significantly increase costs, or neutralize the project altogether.

Another policy option is to switch Fort Chipewyan fuel sources to LNG, subject to the condition of government funding for energy infrastructure. Conditions should also include long-term contractual commitments from First Nations groups to LNG projects to ensure project viability and promote investor confidence. Additionally, all levels of government need to improve their communication with First Nations communities and supply them with jobs in the LNG industry to achieve buy-in on projects and express the various benefits to receive public approval. LNG will only become a viable solution for remote communities if the federal and/or provincial government is willing to invest in better road access, distribution networks, and other critical infrastructure in partnership with First Nations groups. For example, the federal government has recently allocated $1.6 billion CAD to help 16 Ontario First Nations communities connect to the power grid and transition away from diesel fuel sources [30].

Significant government investment in infrastructure will allow communities like Fort Chipewyan to reduce their GHG emissions, decrease energy costs, and improve the safety of energy delivery. In addition, these investments will likely improve private investor confidence, make projects more economical, and initiate the flow of capital towards domestic LNG projects. However, this plan may be difficult to achieve considering the multitude of political layers, government expenditures required, and time to complete these projects.

5.0 Conclusions

Our recommendation is to implement the second policy option because it simultaneously achieves the goals of environmental sustainability, safety, and reducing energy costs in remote communities. Although LNG projects will be difficult to approve initially, improved communication, access to information, and coordination between First Nations groups and government agencies will promote public confidence and allow the communities to experience the benefits associated with these projects. Additionally, the benefits of government investments in critical infrastructure will likely outweigh the costs in the long-run due to the creation of economic development, as well as cleaner, healthier, and safer communities. Powering remote communities is an extremely complicated and important issue that does not necessarily have a clear solution, However, LNG can solve several problems simultaneously, if governments are willing to initiate the action plans themselves.

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8.0 Tables and Figures

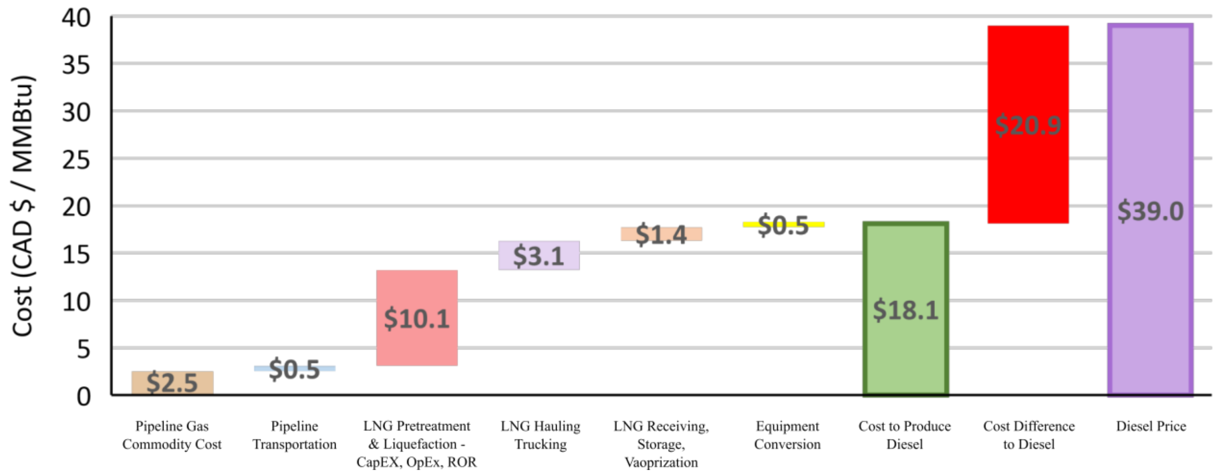

Figure 1 - Breakdown of LNG Supply chain vs. Diesel costs [21]. CapEx: Capital expenditure; OpEx: Operational costs; ROR: Rate of return.

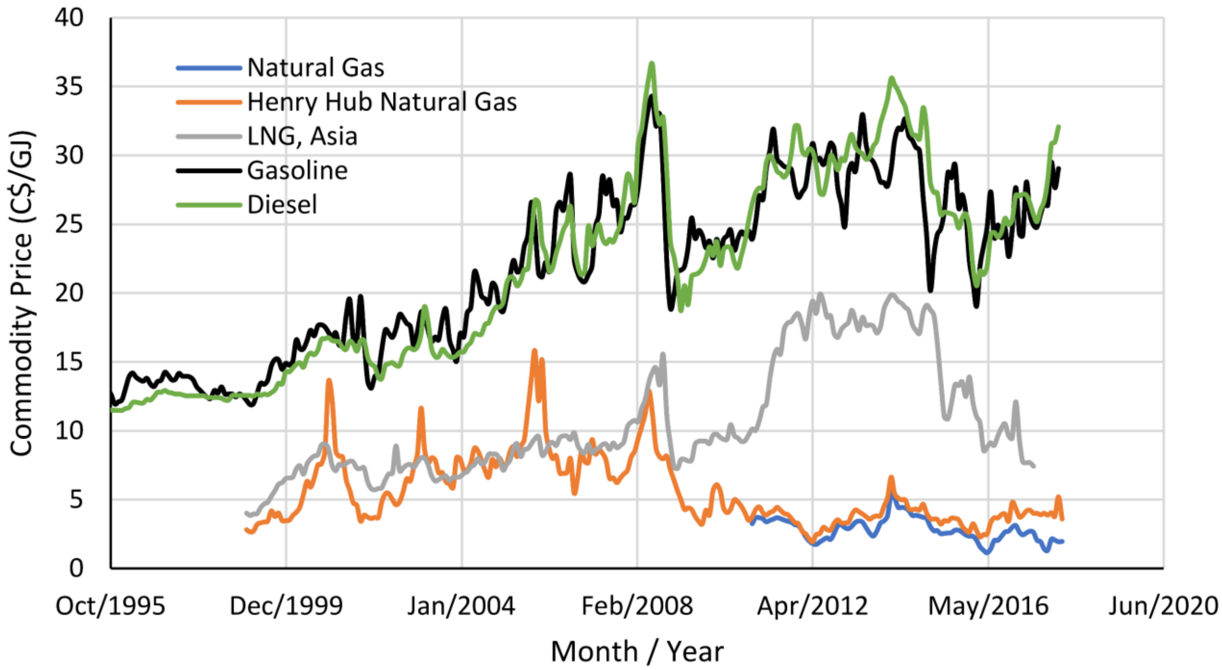

Figure 2 – Fluctuation of various fuel prices: Natural Gas [31]; Henry Hub Natural Gas [32]; LNG Asia [33]; Consumer Gasoline [34]; and Consumer Diesel [34].

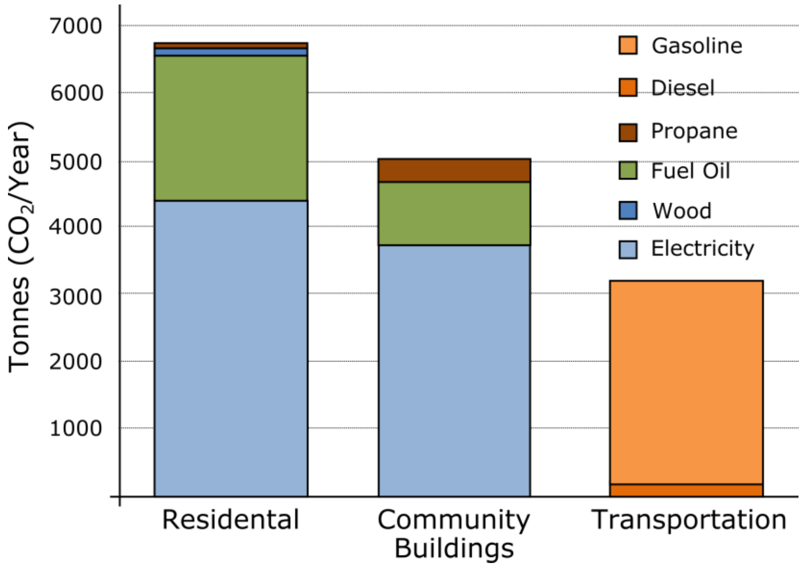

Figure 3 - Annual Fort Chipewyan GHG emissions by energy source and sector [5].