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Flared Gas in Canada: From Waste to Opportunity

By Mohamed Refaei and Jose Duran-Armas

Editorial Committee: Ganesh Doluweera, Dinara Millington, Allan Fogwill

The COVID-19 pandemic has had a severe impact on the global economy, putting businesses across all sectors at risk. The oil and gas industry (O&G) took one of the biggest hits due to the resulting recession, drop in energy demand, and the oil price crash. Canada's O&G sector understands the importance of ensuring its ability to recover from the economic downturn and maintain a secure energy supply. This article identifies options and opportunities to diversify the exploration and production (E&P) business and create jobs for energy services and consulting companies.

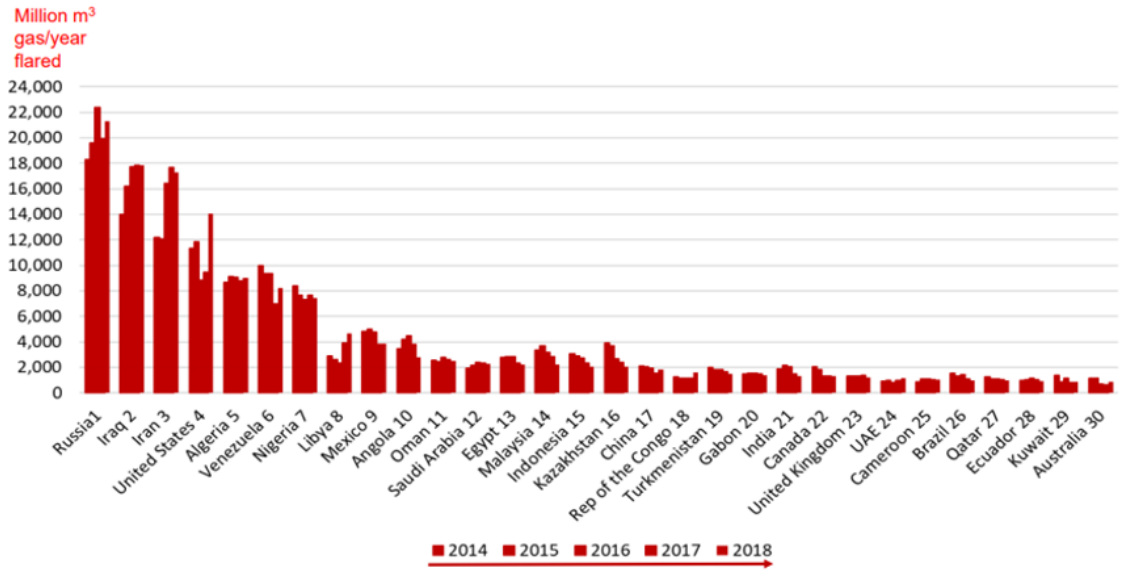
This article investigates relatively small-scale solutions to take advantage of the associated or stranded gas that usually gets flared[1]. The solutions are suitable for short-term investments and have lower financial risk as they would require relatively lower capital expenditures (CAPEX), shorter timelines for final investment decision (FID) and regulatory assessments, and a higher potential to receive incentives or funding. Moreover, it allows E&P companies to explore new products in alignment with the energy transition theme to ensure their sustainability in the long term.

The idea of monetizing flared gases has been investigated for many years by major O&G companies, international organizations, and governments. However, commercial implementation was insignificant until the last decade. The last shale boom in the US allowed many start-ups to evolve and create commercial solutions to minimize flaring and turn it into useful products such as fuels, electricity, or chemical intermediates. There are various monetization options to convert associated gas to products such as Natural Gas Liquids (NGLs), Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), Liquefied petroleum gas (LPG), Gas To Wire (GTW), and Gas To Liquids (GTL). It is important to note that all of these technologies are highly mobile, scalable, and modular to meet the operator's natural gas volumes and field space requirements. Also, some of these technologies could be leased or rented without the need to purchase them.

As shown in Figure 1, the quantity of natural gas flaring in Canada is very low compared to other countries [1]. This is due to the high regulatory standards that limit flaring and encourage the conservation of natural gas in all Canadian jurisdictions. However, the governmental agencies, environmental authorities, and energy providers in Canada frequently provide incentives for innovations toward the low carbon economy. For example, SaskPower's Power Generation Partner Program supports the development of projects that generate and sell power from flare gas to provincial utility, SaskPower[2].

[1] Natural gas can be flared or vented.

Figure 1: Top 30 Flaring Countries



Source: The World Bank Group, 2018 [1].

Why Consider These Options?

The monetization of flared gas is attractive from a business perspective for several reasons.

The pandemic and economic downturn impacted major players, including the downstream sector and the LNG industry. There has already been a significant CAPEX reduction in the O&G sector, where many large-scale projects have been delayed or cancelled. After relaunching the global economy, many companies will reassess their mega projects to determine their viability based on supply and demand markets; a process that may take some time. Meanwhile, it will be possible to implement small scale projects to meet the incremental increases in market demand. Commercially available technology in the form of small-scale modular units will be able to provide breakeven rental, lease, or purchasing costs over short periods; these units can then be repurposed or assigned to a different project where the demand market exists.

It is important to note that the economies of scale would still make larger projects more economic than small-scale projects. However, the COVID-19 pandemic and related lockdowns changed the situation and affected market demand, production rates, supply chain logistics, and international trading in general, which forced many industry players to reduce or shut in production[3]–[7]. This situation may give small-scale projects the chance to enter the market and provide similar products from a feedstock that otherwise would have been flared.

Canada is experiencing temporary logistics and transportation issues including limited pipeline capacities, rail blockades, and COVID-19 related lockdowns, which have affected trading businesses. The flexibility of modular units (e.g. Mini-GTL, microturbines, etc.) can favour small projects as they can be located close to the destination market. For example, many communities in Northern Canada are relying on diesel for power generation and looking for alternative solutions; flaring technologies could be a suitable substitution to meet their demand for fuel or electricity. Another example: Mini-GTL could be a solution for Newfoundland and Labrador to implement their medium- and long-term diversification plan [8] by producing synthetic fuels, gasoline blendstock, or methanol from the associated gas that is currently re-injected to maintain reservoir pressure [9].

From an E&P perspective, the monetization of flaring projects will have a minimum impact at a macroeconomic level as they do not create a significant amount of jobs like large-scale projects. Most likely, few and temporary jobs would be created for transporting the equipment and for maintenance when required. However, the main advantage is to allow E&P companies to improve their cash flow, diversify their business, and align with the energy transition. When an E&P company increases its income by selling higher value products or decreases ancillary services expenditure (electricity generation), it can improve the oilfield project economics. The job creation benefits happen from the energy services providers (service and consulting companies), including technical designs, manufacturing, maintenance, rentals, etc.

In general, these projects should preferably be located where the oilfield is closer to the destination market so that the product is relatively cheaper and more accessible than that of other suppliers.

Monetization options

Natural gas

The first option is to consider natural gas products including CNG or LNG. CNG is a fuel for vehicles and large engines, where the natural gas is compressed to ~3,500 psi to maximize the amount of gas in a storage container and minimize transportation costs when shipping large quantities. CNG may require minor treatment to remove water, carbon dioxide, and other contaminants. The LNG may require more capital investment compared to CNG. However, it allows for transportation of larger quantities of natural gas, which is suitable to feed remote locations that lack pipeline infrastructure.

In Alberta, Sonoma LNG company is currently proceeding with a commercial-scale LNG facility at the Talbot Lake gas plant in northern Alberta to produce 90,000 US gallons per day of LNG from 8,500 thousand cubic feet per day (mcf/day) of natural gas feedstock. The project is going forward as a result of the successful pilot project in 2015 to test the new refrigeration technology currently owned by the Calgary based company PTX Technologies Inc [10].

Utilizing small-scale natural gas-based projects such as LNG or CNG is a vital opportunity to feed communities in Northern Canada with a cheaper, cleaner source of energy for power generation. It is important to note that the majority of service providers are located in the US, where they lease different equipment, including flare gas processing, on-site power generation, NGLs, CNG, and LNG[11].

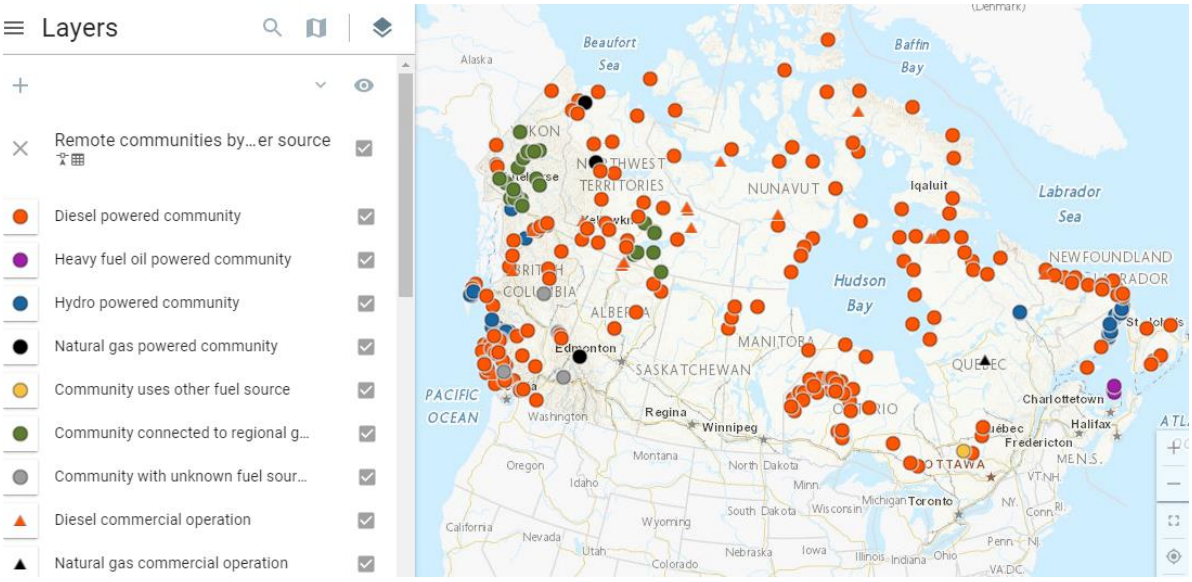
Electricity

The second option is power generation from flared gas as a distributed generation option (DG), which provides electricity ranging from 30 to 1000 kilowatts (kW) [12] at a site closer to customers than central station generation. For example, using micro-turbine generators, which uses natural gas from oil and gas wells has been an option for many years in the oil and gas industry. The massive amount of flaring in the US during the shale gas boom allowed some businesses to provide power generation solutions at sites to power oilfield equipment such as pumpjacks [13].

The mobile generators may not be limited to oilfield usage. It can provide temporary electricity (or permanent) to communities with electricity during unscheduled events such as wildfires. For example, in May 2020, California Public Utilities Commission approved a temporary generation plan proposal from Pacific Gas and Electric Company (PG&E) to mitigate blackouts, where PG&E has reserve of more than 450 megawatts of temporary mobile generation (Diesel generators) to provide electricity for customers [14]. Besides diesel as a fuel, some mobile generators in the market can handle natural gas, CNG, and LNG [15].

Figure 2 shows electricity generation by fuel type in different remote communities in Canada. The orange dots represent the diesel-powered communities. A site selection process and economic analysis are recommended to determine if any of those communities can replace diesel by taking advantage of the nearby oilfields.

Figure 2: Remote Communities Energy Database



Source: NRCan, 2018 [16]

Fuels and chemicals

The third option is gas to liquid or GTL, a well-established process which was used during WWII to produce synthetic fuels through the Fischer-Tropsch synthesis process. Mini-GTL technologies can produce different products such as synthetic diesel, jet fuel, DME, gasoline, methanol, ethanol, hydrogen, and propylene [13]. The Global Gas Flaring Reduction Partnership (GGFR) highlighted that five technology providers offer commercial solutions for gas flares [17]–[22].

In Canada, Rocky Mountain GTL Inc. designs and operates small scale modular plants to convert natural gas to zero sulphur synthetic fuels such as diesel, naphtha, and jet fuels. The company is currently constructing a modular facility utilizing its patented technology (EGTL™) to produce 470 barrels per day of synthetic diesel fuel from 5000 mcf/day of natural gas and NGLs feedstocks [23].

Methanol - The Game Changer

Methanol is a transparent biodegradable liquid with low carbon content. It is used as a feedstock to produce other chemicals such as acetic acid and formaldehyde, adhesives, foams, solvents, and windshield washer fluid. There is recent interest, especially in China, in using methanol to produce olefins (ethylene and propylene), vehicle fuel, and marine fuel [24].

CERI researched different value-added chemicals from oil and gas feedstocks for an upcoming study, *Economic Impacts of Value-Added Uses of Oil and Natural Gas*. One of the findings showed that global demand for methanol is expected to increase. As previously stated, the market drivers for methanol demand are promising due to the high consumption required to produce formaldehyde and methanol to olefins (MTO), as well as the Chinese government's interest in using high-proportions of methanol/gasoline blends in car fuels including M85 and M100 (85% methanol and 100%, respectively). Moreover, the current market dynamics are changing as a result of the International Maritime Organization's (IMO) January 2020 regulation for marine fuels, known as the IMO-2020.

Besides global demand, there are two key opportunities in Canada. The first one is supplying domestic markets, which imported 284,589 metric tonnes (MT) in 2019, with a dollar value of 90 million USD [25]. The amount of imports in 2019 is equivalent to five small scale projects. The second opportunity, which has already motivated some big players, is related to the IMO-2020 regulation. Globally, the marine sector

consumes around 380 million MT of bunker fuel per year [27]. As methanol is one of the recommended options by the IMO, it is expected that many fleets will be built or retrofitted to use methanol. As a result of Canada's geographic location on three oceans (Pacific, Arctic, and Atlantic), it is reasonable to expect an increase in methanol demand in Canada.

Conclusion

Canada has an opportunity to aid in the energy sector's pandemic recovery by implementing small-scale projects that utilize technologies that monetize flaring. This can help E&P companies improve their financial situation, create new energy services, and support start-ups that design, maintain, trade, and provide expertise for these technologies in Canada and globally.

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