GASEOUS FUELS IN CANADA'S LOW-CARBON ENERGY FUTURE

Clean Fuels Steering Committee

Gaseous Fuels Sub-Working Group

Industry
Canadian Gas Association (CGA)
Canadian Biogas Association (CBA)

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1 Introduction /Context

The Clean Fuel Steering Committee (CFSC) is a government and industry collaboration whose objective is to assess and review investment conditions and identify measures required to increase investment in the domestic production of clean fuels and electric vehicle adoption to meet climate action commitments and help with the successful implementation of the Clean Fuel Standard (CFS). The CFSC includes four Sub-Working Groups: Solid Fuels, Liquid Fuels, Gaseous Fuels, and Electric Vehicles.

1.1 Gaseous Fuels Working Group

The Gaseous Fuels Working Group represents one of four fuel streams within the CFSC. Since April 2019, the Gaseous Fuels Working Group, co-chaired by the Canadian Gas Association (CGA) and the Canadian Biogas Association (CBA), with support from Natural Resources Canada (NRCan), has facilitated discussions among stakeholders to provide a comprehensive overview regarding the most important and pressing factors for the potential growth of renewable gases in Canada. This report is the primary output of the Gaseous Fuels Working Group and reflects the views of the industry members.

2 Overview of Gaseous Low Carbon Fuels

Low carbon gaseous fuels are defined as biogas, RNG and hydrogen. Each of these fuels have a lower carbon intensity than their fossil fuel alternative, natural gas.

2.1 Biogas

Biogas is a renewable gas produced from waste and residual materials sourced from farms, food processing facilities, residential institutional and commercial entities, landfills and wastewater treatment processes that are anaerobically digested and converted into methane and carbon dioxide. Biogas is used for heat, electricity or fuel for use on-site or injected into natural gas networks. Methane is a key component of natural gas, and biogas typically is comprised of between 50–85% methane.

2.2 Renewable natural gas (RNG)

Biogas can also be upgraded to RNG, where it is processed to meet end use specifications for injection into gas pipelines or compressed and liquefied for use as a transportation fuel. RNG is interchangeable with natural gas (same composition and methane content) and used by homes, businesses, institutions, and industry. RNG can also be produced through gasification of forest or agricultural waste.

2.3 Hydrogen

Hydrogen is an energy carrier that can produce fuel when it combines with oxygen. Power-to-gas (P2G) technology is the electrolysis of water to produce hydrogen fuel. One example is a joint Enbridge and Hydrogenics power to hydrogen project currently in commercial operation in Markham, Ontario. The project, in its first phase, is not connected to the pipeline system but is

providing electricity storage and regeneration functions. Phase 2 of the project will evaluate the viability of blending hydrogen into the Enbridge Gas Distribution system.

The role of hydrogen production via P2G is also being explored by other provinces (including British Colombia) and countries (such as the United Kingdom) and is being driven by a host of factors, primarily the need for large scale storage to balance electricity supply and demand as a result of new intermittent renewable electricity supplies. Power to hydrogen and power to methane is one of many electricity storage and demand side management options, but is the only one that fully integrates the natural gas pipeline with the electricity grid, making use of existing infrastructure. Hydrogen can also be further refined through methanation to produce RNG.

3 Current Potential: Production, Use and Trade of Gaseous Low Carbon Fuels in Canada

There are over 570,000 km of natural gas distribution lines in Canada, which serve more than two-thirds of Canadians in over 7 million homes, businesses, industries. Natural gas utilities, represented by the CGA, are highly interested in lowering the GHG emissions related to energy delivery and end-use of their operations. Utilities see the introduction of RNG into their distribution systems as a pathway for decarbonization, which requires no changes to their infrastructure. Similarly, biogas can be used in the electricity grid and provide emission reductions, particularly in jurisdictions that have higher emitting electricity systems.

Canada has a significant and untapped renewable gas opportunity. As indicated in a 2010 report[1], RNG from wastes alone could account for 130% of Canada's residential natural gas demand. At present, there are over 100 operating biogas facilities, approximately 11 RNG projects, and one active P2G hydrogen project in Canada (as noted in Section 2.3).

Canada's current domestic RNG production capacity of approximately 7 PJ represents 0.18% of the total natural gas energy demand.
Currently, some Canadian operations export their RNG to the United States, primarily California, due to its lower carbon fuel policies, drivers and mandates. This shows that low carbon gaseous fuel production does present a strategic trade opportunity for Canada. However, as the Canadian market for low carbon gaseous fuels expands, the priority would be to utilize it domestically. Canada's wealth of forests, agricultural wastes and supplies, combined with an extensive and well established interprovincial and local distribution natural gas pipeline network, makes it very well positioned to be a world leader in this area.

4 Policies in Support of Gaseous Low Carbon Fuels Review

4.1 Canadian policy review

There are currently no federal policies or programs in place in support of low carbon gaseous fuels. Several provinces have implemented such policies, as show in the table below:

[1] The Potential Production of Methane from Canadian Wastes – Dr. Salim Abboud, Alberta Research Council, 2010.

Table 1: Provincial programs and policies in support of low carbon gaseous fuels.

Province	Policies and programs	
British Colombia	*Greenhouse Gas Reduction Regulation* (Renewable Portfolio Allowance)	The Renewable Portfolio Allowance (RPA) for RNG allows the gas utility to procure RNG up to 5% by volume per year and pay up to $30/GJ for the RNG supply (for context, the price of natural gas in B.C. can range from 1-7 $/GJ).
British Columbia	*CleanBC*	The BC Government launched its climate plan *Clean BC* in 2019 which included an renewable gas mandate of 15% supply by 2030.
Alberta	*Carbon Competitiveness Incentive Program* (Will be replaced with the TIER – Technology, Innovation, and Emissions Reduction program on January 1, 2020)	Emission offset projects must meet the requirements in the CCIP in order to generate flexible compliance mechanisms under the Alberta Emission Offset System. This system has several protocols that apply to biogas and quantify the generation of carbon offsets, however, RNG is not specifically included and the offsets are offered to the market for a little less than $30/t CO2e.
Quebec	*Regulation respecting the quantity of RNG to be delivered by a distributor*	Regulation sets a minimum amount of 1% RNG to be injected in Quebec's natural gas pipelines by 2020, and increasing to 5% by 2025.
Quebec	*The 2030 Energy Policy*	The government has adopted ambitious, demanding targets to be achieved by 2030. These targets will support the production and end-use of low carbon gaseous fuels: • Reduce by 40% the amount of petroleum products consumed; • Eliminate the use of thermal coal; • Increase by 25% overall renewable energy output; and • Increase by 50% bioenergy production.
Ontario	*Made in Ontario Environment Plan*	Will require natural gas utilities to implement a voluntary RNG option for natural gas customers.

4.2 International Policy Context

Around the world, leading economies such as Germany, France, Italy and the United States are all advancing policies that support broad-scale introduction of renewable gases into their existing natural gas pipeline networks. These countries have rightly realized that to achieve a lower emission future, low carbon gaseous fuel production and infrastructure are essential. Currently, there are over 500 RNG projects in Europe, and 50 in the United States. In contrast, as mentioned above, there are only 11 projects currently in operation in Canada. Further, unlike low carbon liquid fuels, which are largely produced globally and imported into Canada (mainly to meet the federal *Renewable Fuels Regulations*), policies favoring lower carbon gas deployments would mainly result in domestic benefits.

A favorable Canadian policy context would therefore create first-of-kind transactional relationships between natural gas companies and feedstock providers (farmers, municipalities, and wastewater and landfill operators). This in turn will promote a domestically-based circular economy.

5 Demand and Production Scenarios to 2030

The CFS will stimulate a market pull for low carbon gaseous fuels. Through modelling conducted by Navius for NRCan, projections for 2025 to 2030 show that demand for RNG will range between 1-6% of the current natural gas supply[2]. For context, a 5% RNG blend rate in the natural gas pipeline system is equivalent to 184 PJ of energy supplied form renewable content[3], which in turn is equivalent to the yearly natural gas demand from 1.7 million Canadian homes.

In addition to the CFS, provincial policies such as Quebec's 1% RNG blend by 2020 mandate, which increases to 5% by 2025, as well as B.C.'s low carbon gas blend mandate of 15% by 2030 will also create a large market pull for low carbon gaseous fuels. Federal support is required to meet these demand projections, as current domestic production capacity and end-use consumption must be significantly increased. Federal support can be provided through various mechanisms which are detailed in Section 7, *Policy Recommendations*.

5.1 Capital and Production Incentives

Federal funding is fundamental to increasing domestic production and consumption of low carbon gaseous fuels. This would be a measure similar to the ecoENERGY Biofuels Initiative, which invested $1.5 billion over 9 years to boost Canada's production of biofuels, in order to support the minimum renewable fuel blend requirements, mandate set by the Renewable Fuels Regulations.

The analysis has determined that $575M in federal funding is required to support financing of RNG projects, through incentives for capital, production or a combination of both. This is the funding required, through equal cost sharing between utilities, banks and the federal government, to make the price of RNG competitive with the price of natural gas.

[2] Navius was contracted by Natural Resources Canada to determine demand scenarios for low carbon fuels out to 2030.

[3] These numbers are based on the National Energy Board 2017 data on natural gas use in Canada.

It is worthy to note that not all end-uses of low carbon gaseous fuels were included in the model. Specifically, landfill gas used to generate electricity currently does not produce credits in this analysis (though it does exist in the model), and the model does not represent the use of biogas from anaerobic digesters for onsite heat and/or power production.

6 Barriers to Investments

Currently, there are no federal programs or policies to support development of renewable gases in Canada. While there are funding envelopes open to clean and low carbon energy projects, they do not always reduce the barriers to investments or provide the type of market transformation that is needed. Based on the input of various stakeholders within the low carbon gaseous fuels sector, the barriers to investments and project risks experienced by the industry are as follows:

6.1 Project Financing

Low Risk

Producers of low carbon gaseous fuels experience difficulties arranging financing, particularly for the first million dollars of development capital, including that associated with optioning land, initial engineering design and permits, energy purchasers, as well as the legal costs for feedstock providers.

Diversion policies for source separated organics from landfills (e.g. Quebec's landfill organics ban by 2022) support the business case for RNG through increased availability of organic feedstock. Lending institutions require clarity on the enforcement/compliance tools within these policies as they provide the backstop to the credit risk for this type of infrastructure. Lending institutions will typically only provide financing if the project can demonstrate that more than 100% of the required feedstock for operation of the facility is available, and that the feedstock portfolio is diversified. Lending institutions want to ensure the feedstock for a project is reliable and that there are alternative generators available within a specific geography. In addition, major lending institutions will be more likely to enter financing agreements with government partnerships in place, while regional banks, despite their financing envelope limitations, tend to show more interest.

6.2 Technology Performance

Low Risk

While the risk associated with technology and operations is low given proven implementation of some technologies, the operating expenses for low carbon gaseous fuel projects are often underestimated and can change during the first initial months of operation. There are also ramp-up times for commissioning projects that require consideration. Furthermore, there are varying levels of risk when considering off-the-shelf versus next-generation technologies.

6.3 Municipal and Provincial Permitting

Medium Risk

Municipal and provincial policies can create barriers when it comes to the facility permitting process, particularly those associated with waste diversion. Due to the perceived nuisances of RNG and biogas projects (noise and odour), and despite the fact that these problems are

manageable, the public is less inclined to approve of project construction/operation in close proximity to their communities.

6.4 Pipeline Connection and Implications Between Provincial Utilities and Regulators

Medium Risk

RNG and hydrogen mostly rely on natural gas infrastructure as a means to be distributed to its end users. This dependence on the pipeline connections can complicate project developments, as the natural gas pipeline system and respective regulations varies from region to region and there are many instances where a prime feedstock location (often in a rural area) is outside of the pipeline network, which complicates the injection of low carbon gases. In instances where on-site use of the renewable gas is considered, additional barriers exist in obtaining appropriate permits and approvals. Furthermore, unlike other clean fuel sectors, the natural gas distribution industry is a regulated monopoly, which means that while they are able to sell their product or service without competition, they are subject to rules and regulations of a provincial regulator. The role of the provincial regulator is to govern the utility's actions, provide checks and balances and protect the interest of the consumer. The utility must receive approval from the provincial regulator in order to provide new products, services, expand infrastructure or make significant investments, however, the regulator differs provincially. The costs associated with developing and distributing renewable gases needs to be standardized and transparent, making investments in projects more difficult.

6.5 Feedstock and the Reliability of Supply

High Risk

Renewable gas producers require certainty and reliability of their feedstock. Policies and regulations related to diversion of waste materials regionally are important to securing feedstock supply and ensuring a viable project. Policies developed should incentivize the use of these feedstocks to avoid the unintended consequences of having feedstock shipped to other jurisdictions, and to ensure clarity on how outcomes will be measured and enforced.

6.6 Policy Uncertainty

Highest Risk

When there is a lack of policy and regulatory uncertainty, whether it is municipal, provincial or federal, or based on a contentious relationship between provinces or the federal and provincial government, this causes instability and a weak policy "pull". Without a policy that provides an impetus for renewable gas development, there may be little appetite to invest in the feedstock and technology.

7 Policy Recommendations

Given the barriers facing renewable gas project proponents, it is essential to have a policy that reflects the realities of the industry and renewable gas projects. The overarching goals of these policy and program recommendations are to improve Canadian economic competitiveness; reduce GHG emissions and support clean fuel standard credit generation; facilitate the establishment of first-of-kind collaborations in renewable gas production; provide new market

opportunities for Indigenous Communities, municipalities, agricultural producers and forestry companies; and, accelerate the adoption of existing and commercialization of new renewable gas technologies.

The vision for this policy is that it will stimulate a market and put Canada on course to realize between 5-10% content of renewable gases in the Canadian energy system by 2030 and bring about a reduction in renewable gas costs of 25-30%. Further, the policy, via its technology component, will attract, over the medium term, new capital into Canada that will support next generation renewable gas patents and export opportunities. Finally, the policy will bring much needed federal leadership and policy stability for renewable gases in the same way federal leadership was needed for other clean fuels, such as renewable liquid fuels.

Policy Signal

First and foremost, the federal government needs to provide a clear signal to the market and in turn, the energy regulators, that demonstrates the direction it intends to move to with renewable gas development in Canada. This policy direction is necessary in order to signal to regulators the market opportunity and allow utilities the ability to develop renewable gas projects.

RNG from landfills and farms are often far from pipelines, so it is also important that policies to support renewable gas development also consider infrastructure support and on-site applications.

Funding mechanisms from both federal and provincial bodies play an important role in de-risking aspects of the supply chain.

Procurement Policies

Governments' procurement policies can also play a role in signalling investment and interest in renewable gas development. Government can be a procurer of gaseous fuels, providing long-term vitality in the market. This type of support, coupled with federal building goals, can be effective levers to kick-start the industry.

Grants, Loans and Production Incentives

Renewable gas projects usually take a couple of years to attain capacity. Mechanisms such as forgivable loans, capital cost contributions, and other grants can prove very effective to reduce the early project risk and ensure the market and feedstock are ready.

The natural gas industry, in consultation with all facets of the renewable gas industry, recommend a funding program to support near-term production opportunities that can demonstrate technical feasibility and fiscal stability. Each project would have the stated goal of injecting their renewable gases into the Canadian natural gas pipeline system or utilising the renewable gas for on-site purposes. Exceptions would include projects where the renewable gas is used as a transportation fuel (LNG or CNG) or for a remote end user seeking to benefit from

the use of a renewable gas (remote power generation or a dedicated/distributed natural gas grid). The details of the fund and its streams are below[4]:

(1) Renewable Gas Technology Commercialization Fund (total: $175 million over 6 years).

This fund would include two separate funding blocks: a $150 million Technology Demonstration Fund; and a $25 million Laboratory Fund. The Technology Demonstration Fund would support $150 million in renewable gas technology demonstrations across Canada. Funding would be awarded to innovative project concepts including commercial scale renewable gas production and end use demonstrations (e.g., RNG or hydrogen networks feeding dedicated end uses, including transportation), agricultural/forestry waste gasification projects, co-digestion of feedstocks (e.g., biomass and municipal waste), and next generation renewable gas clean up technologies (e.g., advanced tar removal, low cost membranes, etc.). It is proposed that the Natural Gas Innovation Fund (NGIF) act as the third-party vehicle for delivery of the $150 million in partnership with Natural Resources Canada (NRCan). NGIF is an industry-led funding organization with a rigorous, fair and transparent due diligence process comparable in principle to Natural Resources Canada funding programs for assessing, approving and managing projects, and reporting on results from Government contributions.

In addition, NGIF has trusted partnerships in place with federal and provincial funding agencies for the confidential sharing of information to streamline the co-funding of gas technology projects. NRCan and NGIF would launch joint funding calls and open competitions soliciting project opportunities for the de-risking of renewable gas technology providers that can demonstrate a strong value proposition for innovation, a highly skilled team, a sound business model, strong commercial uptake and good policy alignment. Funding decisions would be made by both NRCan and NGIF/industry. Funding amounts would include up to 30% of eligible project costs in the form of non-repayable grants for technology demonstrations with Technology Readiness Levels (TRL 4-7) and up to 50% of eligible project cost in the form of repayable loans for first of kind commercial demonstrations (TRL 8-9).

The Laboratory Fund would see an allocation of $15 million to support the creation of a world class hub for renewable gases at CanmetENERGY federal laboratories in Ottawa and $10 million would be made available via competitive process for collaborative academia/government/industry support that addresses specific gaps in capacity building, codes and standards and bench scale research. In an effort to effectively target funds where they are most needed, the Government of Canada (select departments, TBD) would collaborate with industry to conduct a pan-Canadian renewable gas R&D/technology needs assessment. From that assessment, the funding priorities would be determined. Ultimately, strategic laboratory enhancements would play an important role in providing both domestic and global renewable gas technology manufacturers with a Canadian-led renewable ‘hub’ to test and collaborate along the renewable gas value chain. At the same time, industry recognizes the important role government

[4] These mechanisms are being reiterated from Canadian Gas Association’s 2018 Federal Proposal for a Renewable Gas Innovation Program.

laboratories play in the innovation value chain by providing important third party, non-biased research capabilities combined with a recognized reputation and brand.

(2) Renewable Gas Commercialization Fund ($575 million).

The Fund, to be managed by NRCan, would support repayable financing of renewable gas projects of up to $25 million per project. The project applicant would have three separate funding options available. These options are meant to address local policy and market needs. The project proponent would select their preferred option.

a. Option A is a production incentive. In this scenario, a producer of renewable gases would have a pre-determined value ($TBD/GJ or equivalent) attributed to their renewable gas production volume. This term of the incentive would have a minimum of 5 years and may include a sliding scale where the initial contribution is higher and declines over time. Projects that can demonstrate a lower GHG profile renewable gas will secure a higher production incentive. This will incent projects with the greatest GHG impact.

b. Option B is a capital cost contribution to a project. In this scenario, a project developer may already have a long-term production incentive with a gas utility but is looking to 'buy down' the price of that contract. Option B does that. In doing so, Option B allows the utility to further the reach of their renewable gas program and also allows the developer to secure early stage repayable grant funding to build their project. This funding limits exposure to non-government (e.g., lending institution) interest/borrowing costs.

c. Option C is hybrid of A and B. This option would see a smaller capital cost contribution combined with a smaller production incentive. In this scenario, the proponent seeks to diversify their funding approach.

In all three cases, the value of funds provide to the project would be the same. No one option will be more financially beneficial than another. As noted, the maximum total federal contribution for any of the options and for any project would be $25 million. By structuring the policy with optionality, it will serve to meet the needs of market actors who have different policy tools at their disposal. The optionality complements existing and (potential) future provincial/utility renewable gas funding. It will send a strong signal to the market that will enable improved access to private third-party capital. Federal contributions would be repayable upon project profitability. To determine profitability, a specific formula will have to be developed. The Fund would be open to renewable gas project developers including municipalities, Indigenous communities, forestry or agricultural operators, utilities or third-party project developers of RNG and renewable/green hydrogen projects. It should also be clear that this program would not require the environmental attributes from the biogas, RNG, hydrogen to be provided to the government as the project applicant would be required to sell them with the fuel to the end customers.

Finally, the commercialization Fund would support important renewable gas training/education activities, project feasibility studies and front-end engineering and design (FEED) work.