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Renewable Natural Gas

What Role Will It Play in Building Decarbonization in B.C.?

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Introduction

As local governments across the Canadian province of British Columbia (B.C.) embark on the important but daunting task of trying to meet their carbon reduction targets, many are turning to the challenge of how to decarbonize the building sector. Certainly, fostering the process of electrification (or the shift away from carbon intensive fossil fuels to electric-based mechanical systems) will form a foundational strategy, given the low-carbon hydroelectricity that is available in this province. However, using renewable natural gas (RNG) as a solution is also being raised, since many buildings currently rely on natural gas-fired boilers or furnaces to provide heat and hot water to their occupants.

As such, RNG could be a low-carbon solution that requires no changes in the existing building systems and standard mechanical system design practices. With local governments needing to make important policy decisions on how best to support (or compel) building owners to reduce their emissions, unpacking the RNG option is crucial to understanding its potential. Since natural gas use in buildings accounts for as much as half of a community's carbon emissions, the attractiveness of RNG is understandable, given the effort and cost needed to switch buildings over to a new energy source. However, potential limitations in long-term availability of RNG must be understood before considering RNG as a viable pathway for decarbonizing building heating and hot water.

This white paper looks at RNG's potential by exploring the extent to which it can be expected to support building sector decarbonization in B.C.

In particular, we unpack how much RNG can be expected to supplement or displace the overall annual gas demand delivered through FortisBC's network, and with what implications for building policy at the local level.

RNG 101

Defining what we mean when we say RNG is an important starting point. Also called biomethane or biogas, RNG is produced from decomposing organic waste from landfills, agricultural waste, and wastewater from treatment facilities. This biogas is captured and cleaned to create RNG, which can then be used locally or distributed to customers. RNG is interchangeable with conventional natural gas and can be distributed on existing gas networks via pipeline injection. When distributed through existing gas networks, purchasers of RNG generally don't physically consume the same RNG gas molecules that they purchase, but instead more broadly support the utility's overall investment in more renewable fuels.

To be viable, RNG production sites must have an anaerobic digester tank and biogas upgrader that can connect to a local distribution pipeline to inject RNG into the local supply. RNG falls under the broader umbrella of "renewable gas", which can be broadly defined as gaseous fuels that are considered carbon neutral – i.e., they are produced in a way that net out any additional greenhouse gas emissions that are emitted into the atmosphere when they are used. This is of course what makes them of considerable interest to those concerned with reducing the carbon intensity of the energy we use.

Theoretically, several types of renewable gas could support decarbonization in B.C. besides RNG, including hydrogen and syngas[i]. However, RNG has been a primary subject of conversation to date since (unlike hydrogen) it can be directly used in the existing natural gas infrastructure as a replacement for natural gas (a fossil fuel). In their 2022 Long Term Gas Resource Plan (LTGRP), FortisBC noted that although both RNG and hydrogen will be relied on more heavily in the early stages of their carbon reduction transition, conventional natural gas and RNG will continue to make up most physical deliveries to customers up to 2030[ii].

Why are we talking about RNG in B.C.?

Addressing the carbon intensity of natural gas has been an issue under consideration in B.C. for the last several years. In the 2018 CleanBC Plan, the Province committed to making natural gas consumption cleaner by sourcing 15% from renewable gas, including RNG[1]. This approach was later changed in the 2021 CleanBC Roadmap to 2030, which introduced new policies to help close the gap on British Columbia's (B.C.) 2030 emissions goals. This included replacing the RNG percentage target with an overall emissions cap for gas utilities (otherwise known as the Greenhouse Gas Reduction Standard), intended to encourage new investments in low-carbon technologies and fuels and energy efficiency. This cap is set at approximately 6 Mt of CO_2e per year for 2030, or approximately 47% lower than 2007 levels[iii]. Gas utilities (i.e., FortisBC) will now be compelled to introduce a range of policies and programs to meet this emissions cap, which are likely to include RNG (and low-carbon gas in general) as a key strategy. However, the Province's Greenhouse Gas Reduction Regulation stipulates that within a calendar year, a public utility cannot acquire renewable gas that exceeds 15% of the total amount of natural gas provided by the public utility to its "non-bypass"[2] customers in 2019[iv]. In their 2022 Revised Renewable Gas Program Application to the British Columbia Utilities Commission (BCUC), FortisBC noted that the amount of renewable gas required to meet the new emissions cap will need to exceed 15%[v].

[1] Renewable gas" is an umbrella term for renewable and low-carbon gases made from renewable resources. The BC Greenhouse Gas Reduction (GGRR) considers hydrogen, renewable natural gas (RNG), synthesis gas made from biomass (syngas), and lignin (used to displace natural gas) to be forms of renewable gas.

[2] Non-bypass customer" means a customer of a public utility that receives service under a rate that is not specific to the customer.

How much RNG is there?

So how does FortisBC intend to meet this demand?

FortisBC has 28 existing and anticipated RNG supply agreements in place from projects within and outside of B.C. By the end of 2023, these projects are expected to supply 9.8 petajoules per year, including 2.9 petajoules (29%) from within B.C., 4.6 petajoules (48%) from other provinces in Canada, and 2.2 petajoules (23%) from the United States (U.S.)[3]. Overall, FortisBC's forecasts suggest that they will be able to supply 23 petajoules of RNG per year to their customers by 2032[vi]. To put that into context, these 23 petajoules forecast for 2032 represent approximately 10% of the current (2021) annual gas demand. As noted in the FortisBC Long Term Gas Resource Plan (2022), annual demand for natural gas was 228 petajoules in 2021[vii], which was used as the basis for three forecast energy scenarios to 2040, detailed in Table 1[viii].

Scenario	Description	Annual Gas Demand (PJ/year)				
		2021	2025	2030	2035	2040
Economic Stagnation	The B.C. economy tightens, leaving fewer financial resources available to the government and utility customers in BC to aggressively pursue decarbonization initiatives. The carbon tax is abolished, and some households and businesses switch from electric to gas-fired equipment.	228	202	203	202	204
Diversified Energy	Customer growth occurs for electric and gas utilities; existing gas infrastructure is used to deliver low-carbon energy solutions to customers that meets the 2030 GHG emissions cap for utilities and Provincial GHG reduction targets. By 2050, 25% of gas-fired space and water heating in the residential and commercial sector switches to electricity.	228	193	186	180	176
Deep Electrification	The B.C. government uses various policy levers to electrify the economy to achieve decarbonization. By 2050, all space and water heating systems are electric, with 100% reduction in market share of gas fuel for space and water heating.	228	173	146	119	101

Table 1 – FortisBC Annual Gas Demand Forecasts

[3] It is possible to 'move' RNG between jurisdictions by separating the environmental attributes from the gas molecules, using a certificate trading system similar to that used for Renewable Energy Credits (RECs) in electricity markets. Those purchasing the environmental attributes can claim the benefits for their conventional natural gas, whereas at the injection point the RNG is treated as though it were conventional natural gas, geographically decoupling RNG production and use. This process of procuring RNG is currently acknowledged by the BCUC and can contribute to a public utility's reductions under the GGRR.

How much RNG could there be?

While FortisBC has secured RNG supply from a range of projects within and outside of B.C., they have not published specific projections of RNG supply beyond 2032, noting that there is greater uncertainty in forecasts beyond this point. However, we can supplement this info using various studies that have been completed on the potential RNG supply across Canada and the U.S. These show that the current potential supply of RNG is 92[ix] to 155[x] petajoules per year in Canada and 353[xi] to 455[xii] petajoules per year in the U.S.[xiii].

A recent study prepared by Envint Consulting and Canadian Biomass Energy Research Ltd suggests that the potential supply of all types of renewable gas from within B.C. could total 25 to 50 petajoules by 2030, and 104 to 444 petajoules by 2050. It's important to note that in these estimates, hydrogen and syngas represent far greater proportions of the potential supply compared to RNG; in the 2050 estimates, RNG only accounts for 2% of the overall potential supply of renewable gas. The study estimates that the potential supply of RNG within B.C. was 8.9 petajoules per year in 2021 and can be expected to marginally increase to 9.5 petajoules per year by 2030 and 11.2 petajoules per year by 2050[xiv].

To put these numbers in context, these estimates suggest that the contracts that Fortis anticipates for 2023 will harvest approximately 32% of the total RNG potential in BC, and that if FortisBC was able to harness all the RNG potential in BC by 2032, local RNG would only meet approximately 41% of the 23 PJ that FortisBC plans to supply by 2032.

Despite these potential shortfalls in future RNG availability, in December 2021 FortisBC filed an application with the BCUC for a renewable gas program, which was revised in May 2022. The program proposes to provide the building and transportation sectors with additional RNG to help meet demand for lower emissions fuel sources, by[xv]:

- Providing 100% renewable gas for new residential construction, at the same cost as the fossil gas delivered to other customers
- Delivering a minimum blend of 1% renewable gas to all customers from 2024, increasing with time
- Continuing to offer voluntary renewable gas blends to sales customers, and
- Allowing Natural Gas Vehicle (NGV) customers and Transportation Service (T-Service) customers to purchase up to 100% renewable gas, paying a Low Carbon Gas Charge.

There are a few broad concerns that can be raised around this proposal.

01 First, the proposed program has not yet been approved by the BCUC, and it does not provide a clear "budget" of how available RNG will meet all the listed natural gas uses. Importantly, providing 100% RNG to owners/tenants of new residential buildings means that there will be less RNG available for other users to voluntarily purchase.

02 Second, there will likely be fewer opportunities to secure RNG produced outside of the province in the future as other states and provinces turn to RNG to support decarbonization in their own jurisdictions, making any reliance on other jurisdictions to share their excess RNG a risky strategy. A recent paper published by the Pembina Institute also recommended that the provincial government consider a 'made-in-B.C.' requirement for RNG to help to stimulate local economic development opportunities, avoid long-term supply risks and dependency on imported gas, and protect against volatile market rates[xvi].

03 Third, many stakeholders, including local governments, have pushed back in particular against the idea of a tariff for permanent RNG supply for residential new construction when residential new construction is relatively easy and cost-effective to build to all-electric standards, as acknowledged by the recent introduction of the Zero Carbon Step Code.

04 Finally (and relatedly), it is a widespread opinion that there are "higher and better" uses for RNG, and that RNG should be prioritized for sectors and end uses that are hard to electrify, and where other low-carbon alternatives are not readily available[xvii]. For instance, the Rocky Mountain Institute has argued that "the RNG pathway is simply not cost-effective or feasible for decarbonizing the buildings sector…relying on RNG to decarbonize buildings would require several problematic steps: [including] delivering the limited supply of biomethane[4] to buildings, rather than competing uses that have fewer zero-carbon alternatives[xviii].

An example of such uses is industrial heat, including cement production, steel and aluminum smelting, and some chemicals and fertilizers. It is worth noting here that the total natural gas consumption by the industrial sector in B.C. in 2020 was 150 PJ, or 51% of all natural gas demand in B.C., as well as the high end of estimated total RNG potential across all of Canada.[xix5]

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[4] Biomethane is another term for RNG.

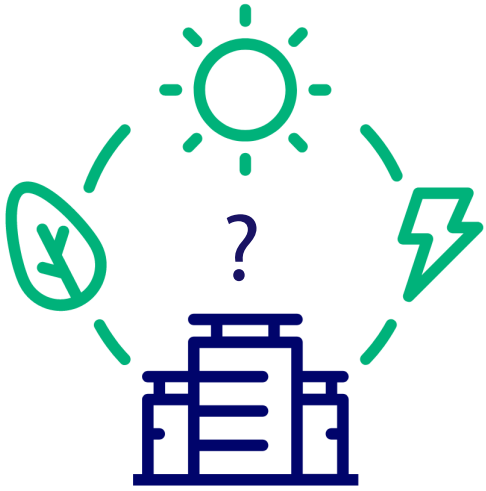
[5] That said, while serving heavy industrial customers may be the highest and best application for RNG from a technical perspective, such customers enjoy the lowest prices for conventional natural gas and are among the least likely to tolerate the higher rates RNG can command.

So, how much RNG can we count on for the building sector?

While FortisBC proposes to continue offering voluntary blends of renewable gas to all customers, it is easy to see that there will not be enough RNG supply to meet demand if all customers were to switch the 100% RNG. As such, it is important to understand what percentage of overall annual gas demand delivered through FortisBC's network can be met with RNG. It is also crucial to understand the implications of the proposal for new residential connections to receive 100% renewable gas (i.e., the environmental attributes for 100% RNG) on remaining supply for existing customers – including the existing buildings representing all current building sector emissions.

To figure this out, we first estimated the percentage of RNG that will be available to existing customers on FortisBC's network from 2021 through to 2050 based on different scenarios that explore different combinations of RNG supply availability and NG demand as a function of the following variables:

- Different FortisBC forecasts for overall annual gas demand (Economic Stagnation, Diversified Energy, Deep Electrification; see Table 1)
- New residential connections to FortisBC's network receiving 100% RNG? (Yes/No)
- The supply of RNG beyond 2032 (FortisBC has provided a forecast of RNG supply up to 2032 based on their secured supply agreements; from 2032 through 2050, it is considered that FortisBC either a) sustains the same level of RNG supply from 2032, or b) can only secure RNG from within B.C.).



[6] The gas demand of new residential connections was estimated based on the number of new homes that can be expected to connect to FortisBC's network and their thermal energy demand. The number of new homes that connect FortisBC's network is estimated to 50% of all new homes, derived from BC Household Projections. The average size of a new home was assumed to be 100m2 with a thermal energy demand intensity (accounting for space heating and DHW) assumed to be 50 kWh/m2.yr.

The combination of these options for each of the scenarios explored is summarized in Table 2.

Figure 1 compares these options graphically (i.e., how different forecasts for overall annual gas demand compare to the projections of RNG supply, and what the gas demand for new residential connections might look like)[6]. The percentage of RNG available to existing customers under each scenario is calculated by subtracting the gas demand of new residential connections (if they benefit from 100% RNG) from the potential supply of RNG each year and dividing the remainder by the overall annual gas demand for that year. The results of this calculation are shown in Figure 2.

Scenario	A	B	C	D	E	F	G	H	I	J	K	L
Which of FortisBC's forecasts for overall annual gas demand is considered?	Deep Electrification		Diversified Energy		Economic Stagnation		Deep Electrification		Diversified Energy		Economic Stagnation	
Do new residential connections to FortisBC's network benefit from 100% RNG?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
What is the supply of RNG beyond 2032?	FortisBC sustains the same level of RNG supply from 2032						FortisBC can only secure RNG from within B.C.					

Table 2 – Scenario Summary[7]

[7] Scenarios B and H are conceptually impossible as they combine zero natural gas use in buildings (deep electrification) with RNG being available for new construction. Results for these scenarios are not shown in Figure 2.

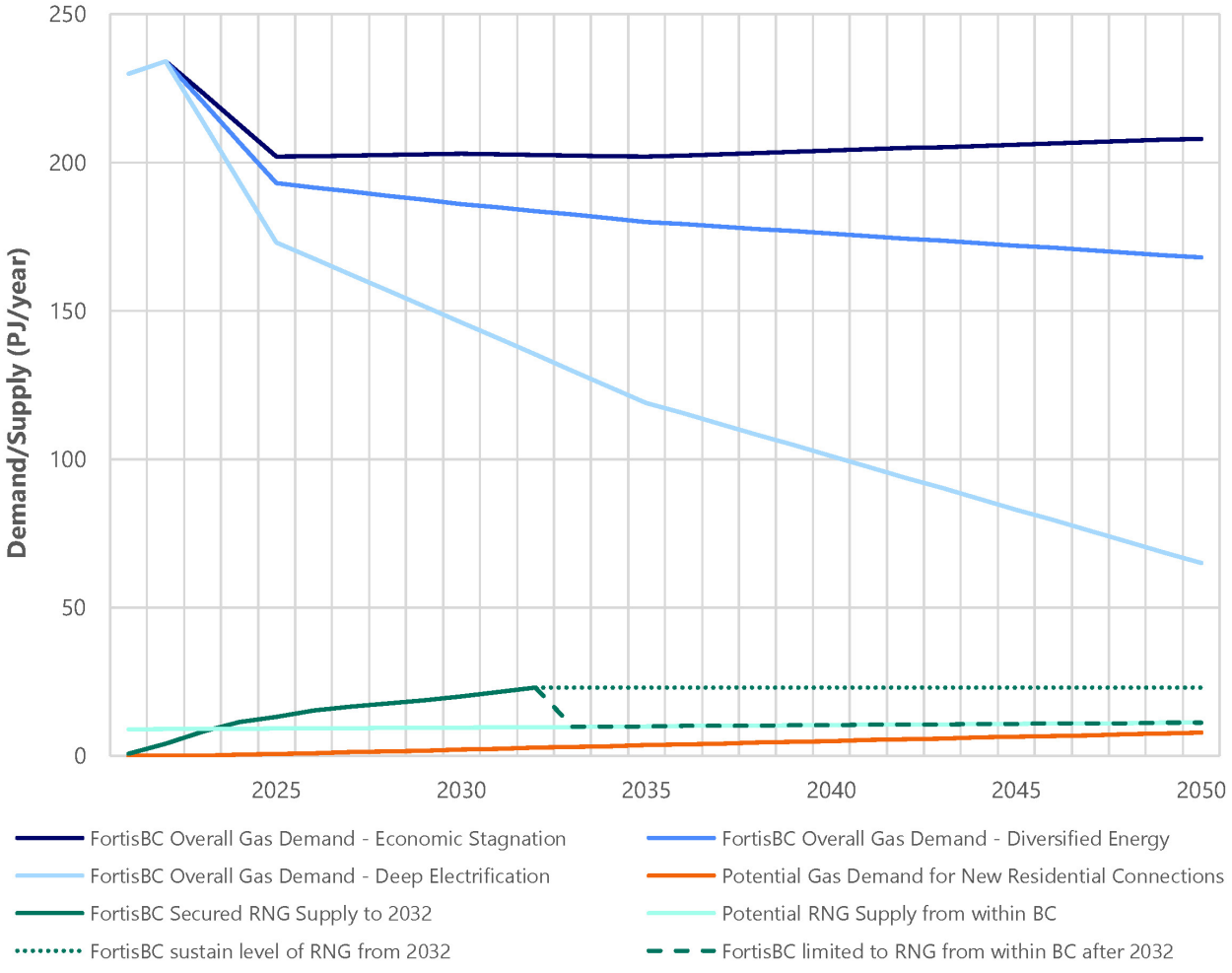


Figure 1 – Projections of Overall Annual Gas Demand and Annual RNG Supply

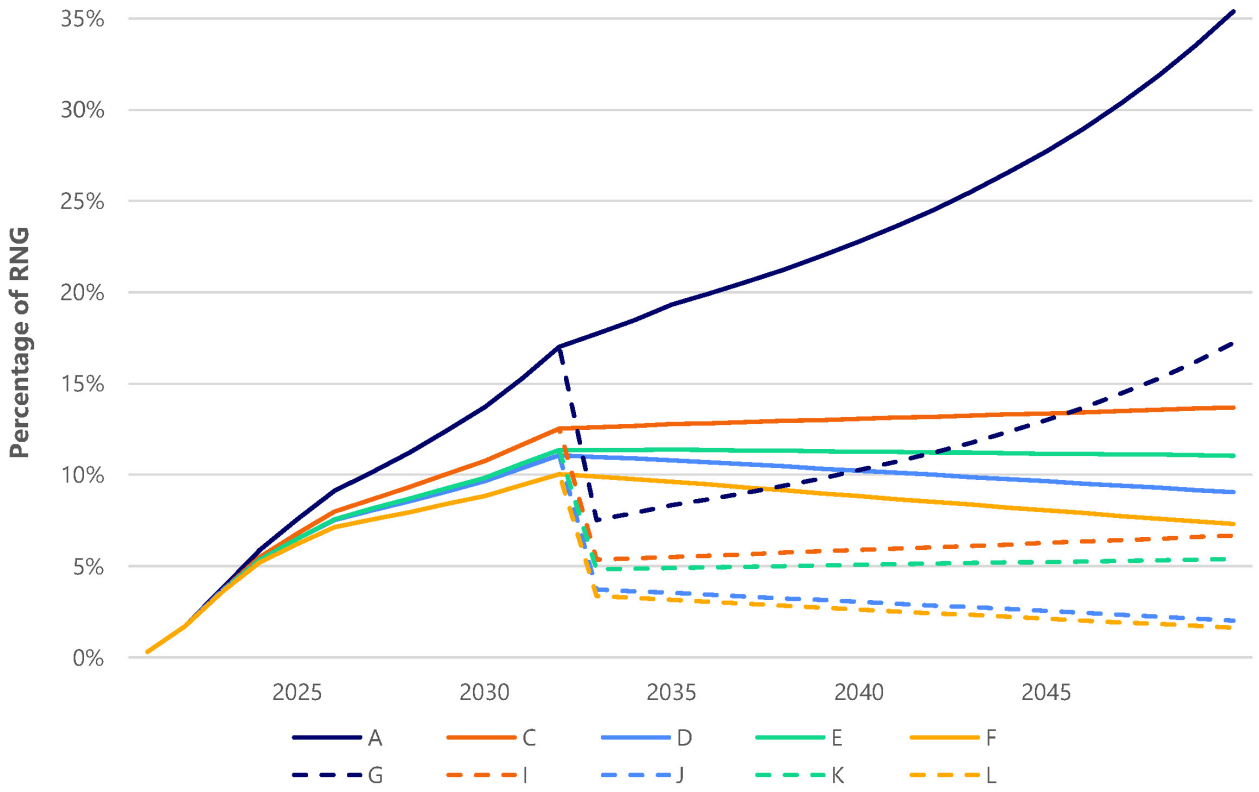
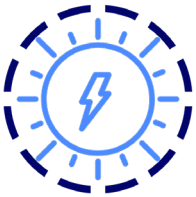


Figure 2 – Percentage of overall annual gas demand delivered to existing customers on FortisBC's network that can be met with RNG by Scenario.

This analysis shows a few key items worth considering:



LIMITATIONS IN SUPPLY:

The analysis shows that even under a scenario (i.e., Deep Electrification coupled with a high availability of RNG) in which no natural gas is used in buildings by 2050, available RNG supply will only be able to meet approximately 35% of the non-building natural gas uses. This number drops to 17% when we assume that only RNG from B.C. will be available for use within the province. These results speak to the overall limit on RNG's potential to displace the emissions associated with using natural gas.

THE BENEFITS OF DEEP ELECTRIFICATION:

Scenarios that follow FortisBC's deep electrification forecast (A and G) result in the greatest percentage of RNG in the overall natural gas system. This is because even though RNG is limited, overall annual gas demand significantly decreases. In the event that some buildings continue to use natural gas systems (as per the FortisBC proposal), this would move us closer to the "Diversified Energy" scenarios, resulting in overall RNG blends of 7-14% (as compared to the 17-35% in deep electrification scenarios). Not fully electrifying buildings significantly exacerbates the shortage of RNG to supply harder to electrify sectors.

VARIATIONS IN SUPPLY AFTER 2032:

There is a significant difference between scenarios in which FortisBC is assumed to sustain the same level of RNG supply from 2032 (A, B, C, D, E and F) and those in which RNG can only be secured from within B.C. (G, H, I, J, K and L). In the latter case, the percentage of RNG for existing customers drops in 2032 and remains lower by a fixed interval. FortisBC's contracts will likely have long timespans (10 to 15 years is typical for such power purchase agreements), so the drop-off will likely not be as steep as shown in Figure 2. However, by 2050, estimates for the percentage of RNG that will be available to existing customers range from 1% to 35%.

Accounting for RNG in the future

In addition to these key points, the analyses presented above demonstrate some important considerations for local governments (and others) to keep in mind when exploring the potential role of RNG in building sector decarbonization.

01

First, it is evident that there are significant limitations to future supply that may constrain its overall availability. While the total volume of RNG that FortisBC will be able to source from outside of B.C. after 2032 is unknown, it is reasonable to assume that demand for RNG in neighbouring provinces and states will increase through the 2030s and 2040s as other jurisdictions seek to reach their own carbon reduction targets.

Given limited supply, safeguarding what can be produced for sectors that are hardest to decarbonize seems a wise choice. As such, we believe it is important for local governments to use a conservative assumption when considering the availability of RNG in B.C. – one that likely slowly drops after 2032 as contracts for RNG imports from outside B.C. expire or are renegotiated.

02

Second, the thought exercise around some of the programs that FortisBC has proposed to the BCUC also showcases some of the implications of a limited supply of RNG to the building market in B.C. Under any scenario explored above, it appears that RNG will be a small contributor to the overall decarbonization of the building sector.

In the event that the BCUC approves FortisBC's proposal to allow new residential connections to benefit from 100% RNG, this would further constrain supply for existing buildings, which can be challenging to electrify.

Acting on these assumptions means that authorities interested in meeting climate targets should first and foremost continue to focus on the widespread electrification of the building stock to enable a greater availability of RNG to those sectors that are most in need (i.e., those hardest to electrify).

Our analysis shows that even in this case (i.e., the "Deep Electrification" scenario), the available RNG supply would only be sufficient to meet 17% of the natural gas demand by 2050, assuming resources must come from within B.C.

It should be noted that at this moment in time, local governments do not have control over the direction of RNG supply to specific sectors (i.e., using RNG for decarbonization in the industrial sector over residential and commercial buildings). However, they can use communications, programs and policy levers to encourage residents and businesses within their jurisdictions to move in certain directions, including electrification or the voluntary purchase of renewable gas blends on offer from FortisBC.

03

Third, local governments will also need to carefully consider whether and how RNG should be supported as a means of complying either with the greenhouse gas intensity targets that are incoming through the Zero Carbon Step Code, or with other incoming policies and pr ograms to decarbonize the existing building sector. In general, we believe that

RNG should be treated as a last resort option for new construction, given the growing capacity of the industry to design and build all-electric homes and buildings.

For existing buildings, supply will likely be significantly limited, but information and support that specifically encourages customers with hard-to-electrify buildings to pursue this option may be worth considering in the nearer term.

Finally, it is worth considering that given these limitations, it is likely that any building remaining on a gas-based system cannot rely on RNG to achieve full decarbonization and will continue to emit considerable greenhouse gases well into the future.

Shifting away from gas-based systems entirely is the most dependable strategy for significantly reducing building sector emissions and should remain the focus of local governments seeking to meet their own climate targets.

Endnotes

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The Stack, Vancouver, B.C.
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