Renewable Natural Gas Supply and Demand in North America

INDEPENDENT EXPERT REPORT ON FORTISBC ENERGY INC. BIOMETHANE ENERGY RECOVERY CHARGE METHODOLOGY AND COMPREHENSIVE REVIEW OF REVISED RENEWABLE GAS PROGRAM

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Executive Summary

In December 2021, FortisBC Energy Inc. (FEI) filed a petition before the British Columbia Utilities Commission (BCUC) to revise its Renewable Gas Program, consistent with the Province's climate and energy goals to reduce greenhouse gas (GHG) emissions by blending renewable natural gas (RNG) into the gas supply. RNG is an alternative fuel source to natural gas produced from the decay of organic matter and is deemed carbon-neutral by British Columbia. FEI's proposed revisions to the Program will (1) allow all customers to opt in to various levels of RNG blending; (2) provide 100% RNG to all customers in new residential dwellings; and (3) provide a 1% blend to all sales customers starting in 2024 and increasing thereafter.

The CleanBC Plan and Roadmap to 2030, a key planning document for British Columbia's clean energy transition, introduced an annual emissions cap of 6 million tonnes of CO_2 equivalent (CO_2e) across all BC gas utilities, or about 47% GHG emissions reduction below 2007 levels. In addition, the Roadmap set a goal to blend up to 15% low-carbon fuels into the Province's gas supply.[1] To meet these requirements, utilities can procure local RNG for physical delivery into the British Columbia gas distribution system. Alternatively, utilities, like FEI, can purchase notional RNG supplies that are produced in Canada, the United States, or elsewhere but not physically delivered to British Columbia.

FEI projects that it will need approximately 30 Petajoules (PJ) per year to achieve the company's goal of displacing 15% of natural gas supply with RNG by 2030.[2] By the end of 2022, FEI expected to purchase 4 PJ of RNG supply (less than 3% of its total annual natural gas demand).[3] FEI's RNG supply will need to grow at an annual rate of 29% from 2022 to 2030 to meet the 15% volume target. [4] To meet the CleanBC Roadmap emissions cap, the company will need 45 and

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1 CleanBC, "Roadmap to 2030," Government of British Columbia. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

2 FortisBC Energy Inc. (FEI), "Biomethane Energy Recovery Charge (BERC) Rate Assessment Report – British Columbia Utilities Commission (BCUC) Order G-35-21, Stage 2 Comprehensive Review and Application for a Revised Renewable Gas Program," December 17, 2021 (FEI Application), p. 29.

3 *Id.*, p.73. Reported RNG supply in FEI's Fourth Quarter Gas Cost Report 2022 is closer to 2.3 PJ, meaning our growth rate estimate is more conservative. FortisBC Energy, "Commodity Cost Reconciliation Account (CCRA) and Midstream Cost Reconciliation Account (MCRA) Quarterly Gas Cost Report and the Biomethane Energy Recovery Charge (BERC) Rates and Biomethane Variance Account (BVA) Annual Report, 2022 Fourth Quarter Gas Cost Report," Tab 4, Page 1 https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

4 The compound annual growth rate is calculated based on a 2022 volume of 4 PJ and a 2030 volume of 30 PJ.

65 PJ per year of RNG by 2030, with equivalent annual growth rates of 35% to 42%.[5] For comparison, FEI customers' demand for RNG grew from 124 TJ in 2014 (after FEI's RNG program was made permanent)[6] to about 1.3 PJ in 2022, equivalent to an annual average growth rate of 34% per year.[7] If growth continues at this rate, demand for RNG will reach 14 PJ in 2030.

At the moment, the Greenhouse Gas Reduction Regulations allows FEI to purchase up to about 31 PJ per year with an acquisition price cap to $31 per Gigajoule (GJ).[8] As of January 1, 2023, the rate for FEI's RNG customers is $13.718/GJ (long-term contracts) to $14.718/GJ (short-term contracts).[9]

One of the primary risks related to FEI's ability to meet its anticipated near-term and longer-term RNG demand is the availability of RNG. A 2017 study estimated that at a price level of $28/GJ, the short-term theoretical RNG potential within British Columbia is 7.6 PJ per year, and the short-term achievable RNG potential is 4.4 PJ per year.[10] Another study indicates that the province's annual RNG potential is about 8 PJ at a similar price level.[11] In order for FEI to meet the clean energy requirements under the Clean BC Plan, the company will need to secure the majority of its RNG supplies from outside of British Columbia.

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5 The lower band of the emissions cap is 45 PJ. For the total RNG volume to grow from 4 PJ in 2022 to 45 PJ in 2030, the compound annual growth rate (CAGR) of the RNG volume would need to be 36%. The upper band of the emissions cap is 65 PJ. For the total RNG volume to grow from 4 PJ in 2022 to 65 PJ in 2030, the CAGR of the RNG volume would need to be 42%.

6 FortisBC Energy, "2014 Fourth Quarter Report on the Biomethane Variance Account (BVA) and Biomethane Energy Recovery Charge (BERC) (the 2014 Fourth Quarter BVA Report)," Tab 1, Page 3 https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/141022_fei-bva-2014-q4-report_ff.pdf

7 FortisBC Energy, Quarterly Gas Cost Report, Tab 4, Page 3.

8 Unless otherwise noted, all values are reported as Canadian dollars. Conversion assumes 1 USD to 1.33 CAD exchange rate.

9 British Columbia Utilities, "Order Number G-347-22: FortisBC Energy Inc. 2022 Fourth Quarter Gas Cost Report and Rate Changes effective January 1, 2023 for the Mainland and Vancouver Island Service Area, and the Fort Nelson Service Area,", December 1, 2022, https://www.ordersdecisions.bcuc.com/bcuc/orders/en/521385/1/document.do

10 Hallbar Consulting Inc. and the Research Institute of Sweden, "Resource Supply Potential for Renewable Natural Gas in B.C.", March 2017, https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/renewable-low-carbon-fuels/resource_supply_potential_for_renewable_natural_gas_in_bc_public_version.pdf

11 BC Bioenergy Network, FortisBC, Government of British Columbia, "B.C. Renewable and Low-Carbon Gas Supply Potential Study," January 28, 2022, https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/renewable-gas-study-final-report-2022-01-28.pdf.

The feasible RNG production potential of Canada is 155 PJ per year,[12] or about 3.6% of Canada's current natural gas consumption and 1.3% of Canada's total energy consumption. Most volume can be produced in the $25-$55/GJ range. RNG production potential in the U.S. is approximately 380 PJ in 2025, growing to 2,200 PJ in 2030 and 4,800 PJ in 2040.[13] This U.S. supply is quite large relative to FEI's requirements, though when considering this large potential supply, it is also important to consider the competing sources of demand, and U.S. demands could be comparably large, or larger.

FEI and utilities in British Columbia can purchase notional supplies produced outside of Canada or carbon offsets to meet the province's clean energy requirements.[14] Notional supplies are not physically delivered to the FEI system but instead delivered to end-users near to the production facility. Doing so, however, exposes FEI to additional competition from other natural gas utilities in North America who may also have a need for RNG to decarbonize their own gas supplies. Moreover, care must be taken to ensure that carbon reduction benefits are real (meaning lowered atmospheric GHG), and that emissions reduction measurement, accounting, reporting, and verification must adhere to standards informed by best available scientific understanding and data. Similarly, at $2.6-$27 per tCO_2e (or $0.1-1.4/GJ), carbon offsets can be an inexpensive tool to reach climate goals, especially when compared to more expensive alternatives such as RNG.[15] However, reliance on offsets must be carefully reviewed and evaluated to ensure that offsets are used as intended, and that offset purchase would result in real climate benefits.

In the near term, RNG demand is expected to grow considerably from its current low levels. RNG is a suitable drop-in fuel that can readily displace natural gas without requiring major

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[12] TorchLight BioResources, "Renewable Natural Gas (Biomethane) Feedstock Potential in Canada," https://www.enbridge.com/~/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20(1).pdf.

[13] For upper range of estimate range, the majority of the RNG produced is available in the $9-$27/MMBtu range. *See* American Gas Foundation, "Renewable Sources of Natural Gas: Supply and Emission Reduction Assessment," December 2019, https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

[14] British Columbia Utilities Commission, "Inquiry into the Acquisition of Renewable Natural Gas by Public Utilities in British Columbia, Phase 1 Report," June 28, 2022, pp. 19-25, https://docs.bcuc.com/Documents/Other/2022/DOC_67310_Final-RNG-Report.pdf

[15] Oregon Department of Transportation Operational Greenhouse Gas Reductions: Best Practices and Recommendations, December 2021, https://www.oregon.gov/odot/Programs/TDD%20Documents/ODOT%20Operational%20GHG%20Reductions%20-%20BPs%20and%20Recs%20--%20FINAL%202022.01.05.pdf. Conversion assumes carbon intensity of 52.91 kg of CO_2 per MMBTU for natural gas. *See* U.S. Energy Information Administration, Carbon Dioxide Emissions Coefficients, https://www.eia.gov/environment/emissions/co2_vol_mass.php

changes to the gas transmission and delivery systems. As jurisdictions around the world move ahead to decarbonize their economies, the demand for clean fuels, including RNG, will increase. A number of regional gas utilities have explicit plans to blend RNG for some or all of their customers, or to offer RNG on a voluntary basis to customers. For example, Énergir has set a target of 5% of its total gas supply to come from RNG by 2025, with the share increasing to 7% in 2028 and 10% by 2030. According to the Canadian Gas Association, Canada's natural gas utilities have set an aspirational target of 5% RNG blended into natural gas streams by 2025, and 10% by 2030. A growing number of jurisdictions in the U.S. have set goals to fully decarbonize their economies, and gas utilities operating in these jurisdictions will need to significantly reduce their GHG emissions in no small part by acquiring more RNG.

Beyond demand from gas distribution companies, there may be additional RNG demand from the transportation and industrial sectors as well. One notable source of demand is the U.S. Environmental Projection Agency (U.S. EPA) Renewable Fuel Standard (RFS) Program, which allows RNG blending to meet GHG emissions reduction obligations. Under the RFS program, the production of RNG generates a Renewable Identification Number (RIN) that can be traded amongst obligated parties to achieve compliance. RINs are currently worth up to $50/GJ. Financial incentives for lowering the carbon intensity of transportation fuels (ranging from $28/GJ-$50/GJ) offered by the California's Low Carbon Fuel Standard and British Columbia Renewable & Low Carbon Fuel Regulation programs will further drive demand for RNG. Likewise, demand for RNG from the industrial sector will likely increase as the pressure to reduce GHG emissions intensifies.

Aggregate RNG demand may outpace the limited RNG supplies, maintaining upward pressure on RNG prices and potentially creating shortages in the medium- to long-term. Based on available data, the current RNG prices range from $10/GJ to $50/GJ depending on the feedstock and production region. Regulatory price caps and credit prices indicate that utility RNG contracts prices may be in the upper half of this range.[16] Higher price signals may induce greater investments in RNG development, though expanding RNG production capability will require time. In addition, there are limits to how much RNG can be produced through conventional methods, and without significant technological breakthroughs, RNG supply is unlikely to meet the growing demand for RNG in the future.

[16] Regulators have imposed regulatory price caps as high as $36/GJ. Price for RNG-based credits in the low carbon fuel markets in British Columbia and the U.S. are $28/GJ and $50/GJ, respectively.

Related to the availability risks is the potential cost risk; the combination of limited availability and higher production cost can create cost risk to customers. FEI charges its voluntary RNG customers a premium above the cost of natural gas to partially recover these higher supply costs. The current premium is $7/GJ, which is based on studies, and FEI's experiences with the premium customers are willing to pay for RNG. Under the proposed revision to the Renewable Gas Program, the remaining RNG costs will be recovered through a Storage and Transportation Low Carbon rider charged to FEI's sales customers. As FEI's RNG supply portfolio expands, annual bills for residential and commercial customers are expected to increase by $18 and $123, respectively, for a 1% RNG blend. At a 15% blend and $31/GJ acquisition cost cap, the annual bill increases by $305/year (45%) for residential customers. The bill impacts could be even greater if FEI's acquisition cost cap increases beyond $31/GJ or if FEI's blend cap increases beyond 15%. In the short-term, non-voluntary customers may reduce their overall gas demand, though the reduction may be modest due to relatively inelastic demand for natural gas. Long-term, customers could switch to available alternatives, depending their energy demand needs. If this occurs, it will further complicate the cost recovery of FEI's RNG supply portfolio.

I. Introduction

A. Purpose of the Report

The British Columbia Utilities Commission (BCUC) retained the Brattle Group (Brattle)[17] to provide an independent expert report on FortisBC Energy Inc.'s (FEI's) Biomethane Energy Recovery Charge (BERC) Rate Methodology and Comprehensive Review of Revised Renewable Gas Program (BERC Stage 2 Review) proceeding.[18] In this report, we provide independent analysis related to:

- The short-term forecast demand for renewable natural gas (RNG) or biomethane and the feasibility of FEI's proposed renewable gas (RG) program to meet this demand;[19]
- The short-term forecast supply of RNG, in consideration of price regarding the RNG supply and supply substitutes, such as carbon offsets; and
- The price elasticity of demand for conventional natural gas and RNG.

Our report is organized as follows: Section 0 (this section) provides background on British Columbia's regulatory policies and objectives related to renewable natural gas and FEI's existing Renewable Gas Program. Section II provides a brief background on RNG production methodologies and discusses the forecasted supply and price of RNG. Section III discusses the forecasted demand for RNG. Section IV provides an overview of recent studies on price elasticity for natural gas and RNG. Section V summarizes our conclusions.

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17 British Columbia Utilities Commission, "British Columbia Utilities Commission Independent Expert Report Terms of Reference," August 30, 2022,

18 FortisBC Energy, Inc., "Comprehensive Review and Application for Approval of a Revised Renewable Gas Program," December 17, 2021 (FEI Application).

19 In this report, we focus on renewable natural gas sourced from biological feedstocks. Therefore, we use the terms renewable natural gas and biomethane interchangeably. However, FEI includes RNG/biomethane, hydrogen, synthesis gas, and lignin in its broader definition of "renewable gas."

B. Regulatory and Policy Background

Federal and provincial governments in Canada have enacted aggressive policy measures to reduce greenhouse gas (GHG) emissions. At the Federal level, Canada is committed to reducing GHG emissions by 40-45% below 2005 levels by 2030.[20] In addition, nine provinces have adopted their own GHG emission targets.[21] British Columbia (BC) passed the Climate Change Accountability Act in 2017, which set a goal of reducing GHG emissions by 40% by 2030 and 80% by 2050, compared to 2007 levels.[22] In the following year, British Columbia's Ministry of Environment and Climate Change published the CleanBC Plan and Roadmap to 2030, which committed to reduce GHG reductions by 75% below 2014 levels by 2030 and achieve net-zero emissions by 2050, and established sector-specific GHG emissions reduction targets and strategies.[23] CleanBC also affirmed the Climate Solutions Council's recommendation to increase the province's carbon tax to $45/tonne, escalating annually by $15/tonne to $170/tonne by 2030.[24]

The Roadmap to 2030 provided specific recommendations related to the Province's natural gas distribution system and the role of renewable natural gas (RNG). For all BC gas utilities, the Roadmap introduced an annual emissions cap of 6 million tonnes of CO_2 equivalent (CO_2e), or about 47% lower than 2007 emissions levels. The Province aims to achieve these climate targets through investments in energy efficiency, low-carbon technologies, and low-carbon fuels (biomethane, green and waste hydrogen, lignin, and synthetic gas).[25] Notably, the Roadmap set a goal to blend up to 15% low-carbon fuels into the Province's gas supply.[26]

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[20] Government of Canada, "Government of Canada confirms ambitious new greenhouse gas emissions reduction target," July 12, 2021, https://www.canada.ca/en/environment-climate-change/news/2021/07/government-of-canada-confirms-ambitious-new-greenhouse-gas-emissions-reduction-target.html

[21] Center for Climate and Energy Solutions, "Canadian Province Climate Policy Maps," https://www.c2es.org/content/canadian-province-climate-policy-maps/

[22] Government of British Columbia, "Climate Change Accountability Act", https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/07042_01.

[23] British Columbia, "Roadmap to 2030," https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

[24] *Id*., p. 22. Unless otherwise noted, all values are reported as Canadian dollars. Conversion assumes 1 USD to 1.33 CAD exchange rate.

[25] British Columbia, "Roadmap to 2030," p. 29 https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf The British Columbia Clean or Renewable Resource Regulation defines waste hydrogen as "hydrogen gas produced by a commercial process the primary purpose of which is not the production of hydrogen gas." *See* Clean or Renewable Resource Regulation, BC Reg 291/2010, https://canlii.ca/t/l2sl

[26] *Id.*, p. 60.

Utilities can procure local RNG for physical delivery into the British Columbia gas distribution system, or they can alternatively purchase notional RNG supplies produced in Canada, the United States, or elsewhere. Instead of physically being delivered to British Columbia, the purchased RNG is delivered to end-users near the production facility, displacing natural gas use in that area.[27]

The Roadmap also offered specific strategies to decarbonize current end uses of natural gas. The Roadmap calls for changes in the BC Building Code in 2024, requiring new buildings to meet zero-carbon performance standards starting in 2030.[28] All new space heating equipment sold and installed in the Province after 2030 must be at least 100% efficient.[29]

In the transportation sector, the 2008 Greenhouse Gas Reduction (Renewable & Low Carbon Fuel Requirements) Act and the Renewable & Low Carbon Fuel Regulation (collectively, the BC-LCFS) allow the blending of RNG or other low-carbon fuels to reduce the carbon intensity of fossil-based fuels.[30] Importantly, under the BC-LCFS, blending low-carbon fuels generates credits that can be traded to meet compliance obligations. Each credit represents one tonne of carbon dioxide equivalent (CO_2e)[31] and is currently worth about $433/credit, or about $28 per Gigajoule (GJ).[32] This means that obligated parties either pay the market price of RNG (or other low carbon fuels) or purchase a credit to satisfy their obligation under the BC-LCFS program. Building upon the BC-LCFS program, the Roadmap to 2030 calls for 90% of all new light-duty vehicles to be zero-emission vehicles (ZEV) by 2030 and aligns the province's goal for new medium- and heavy-duty ZEV vehicles with California.[33] Finally, the Roadmap for 2030 includes

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27 British Columbia Utilities Commission, "Inquiry into the Acquisition of Renewable Natural Gas by Public Utilities in British Columbia Phase 1 Report," January 28, 2022, pp. 7-8.

28 British Columbia, "Roadmap to 2030," p. 67 https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

29 *Ibid*.

30 British Columbia Government, "Renewable & Low Carbon Fuel Requirements Regulation", https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels

31 FEI Application, p. 30.

32 Province of British Columbia, "Monthly Credit Market Report – October 2022", November 1, 2022, https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/renewable-low-carbon-fuels/monthly_credit_market_report_-_2022-10_2.pdf. 1,000 GJ is equal to 64 credits per FEI Application, p. 69. Price reflects Category A average price for October 2022.

33 British Columbia, "Roadmap to 2030," p. 8.

requirements for new large industrial facilities to have in place plans to achieve net-zero emissions by 2050.[34]

The Roadmap to 2030 provided a multi-pronged framework to enable British Columbia to achieve its ambitious climate and energy goals. Under this framework, RNG is just one component of the Province's broad decarbonization solution portfolio. In certain applications, RNG will have to compete with other proposed solutions in the Roadmap (*e.g.*, electric heat pumps for space heating). On the other hand, RNG serves as an alternative for high-value applications that currently lack cost-effective alternatives, such as industrial processes that require high temperature input. To reduce GHG emissions in the most cost-effective way, future Provincial or local policies may need to ensure RNG and other decarbonization technologies are directed to the highest value applications.

C. FEI Renewable Gas Program and Proposal

As part of its strategy to meet the CleanBC requirements, FEI plans to increase the renewable content of its gas stream to 15% by 2030 by expanding its existing Renewable Gas Program. The company's original Biomethane Program, deployed in 2010, served as a direct response to the objectives outlined in the 2010 Clean Energy Act (CEA).[35] The initial program allowed FEI to purchase up to 0.25 Petajoules (PJ) per year with an acquisition price cap of $15.28/GJ.[36] By late 2012, FEI had enrolled over 4,600 customers in the program.[37]

In 2013, the BCUC made the program permanent and allowed FEI to purchase up to 1.5 PJ/year at the same price cap.[38] However, by 2014, the premium charged to customers to recover the RNG supply costs had increased to $8.11/GJ above the price of natural gas—this was too high to incentivize enrollment, and customer participation declined.[39] This apparent price sensitivity by customers prompted FEI's 2015 BERC Application, in which the company requested approval

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34 *Ibid.*

35 The program was later renamed by FEI to the "Renewable Gas Program".

36 FEI Application, p. 11

37 *Id.*, p. 12

38 *Id.*, pp. 12-13

39 FortisBC Energy, Inc., "Application for Approval of Biomethane Energy Recovery Charge Rate Methodology," August 28, 2015, p. 1. https://docs.bcuc.com/Documents/Proceedings/2015/DOC_44484_B-1_FEI_BERC-Rate-Methodology-Application.pdf

from the BCUC to change the rate setting methodology, and resulted in a new price premium set to $7.00/GJ above the price of natural gas, plus carbon tax.[40]

The provincial government has amended the Greenhouse Gas Reduction (Clean Energy) Regulation (GGRR) to further support RNG blending. The 2017 GGRR amendment increased annual RNG volumes to 8.9 PJ and the acquisition price cap to $30/GJ[41]. Another amendment in 2021 further increased the acquisition price cap to $31/GJ and permitted FEI to purchase RNG up to 15% of the amount of gas the company supplies to its non-bypass customers.[42] As of January 1, 2023, the rate for FEI's RNG customers is $13.718/GJ (long-term contracts) to $14.718/GJ (short-term contracts).[43]

The number of participating RNG customers has fluctuated over time. Starting in 2015, customer enrollment steadily increased, reaching high of approximately 11,200 in mid-2019 (see Figure 1 below).[44] Since then, the number of Renewable Gas Program participants has steadily declined to approximately 10,000 customers.[45] On the other hand, FEI's RNG supplies have steadily increased over time (see Figure 2 below). In 2021, RNG supplies increased approximately 280% year-over-year, from 250 TJ to 700 TJ.[46] FEI projected that annual RNG supplies will grow further to 4,000 TJ in 2022, or about 16 times the 2020 supply.[47] In instances where FEI's RNG supply purchases are greater than its RNG sales to customers, unsold inventory and costs accumulate in a Biomethane Variance Account (BVA) and are deferred for future recovery. According to FEI, the BVA's current balance is 1,204 TJ ($30 million, after tax),

[40] FEI Application, p. 18.

[41] *Id.*, p. 15

[42] *Id.*, p. 16. *See* also The Lieutenant Governor in Council, *Order in Council No. 306*, May 25, 2021 https://www.bclaws.gov.bc.ca/civix/document/id/oic/oic_cur/0306_2021

[43] British Columbia Utilities, "FortisBC Energy Inc. 2022 Fourth Quarter Gas Cost Report and Rate Changes effective January 1, 2023 for the Mainland and Vancouver Island Service Area, and the Fort Nelson Service Area," Order Number G-347-22, December 1, 2022, https://www.ordersdecisions.bcuc.com/bcuc/orders/en/521385/1/document.do

[44] FEI Application, p. 19.

[45] *Ibid.*

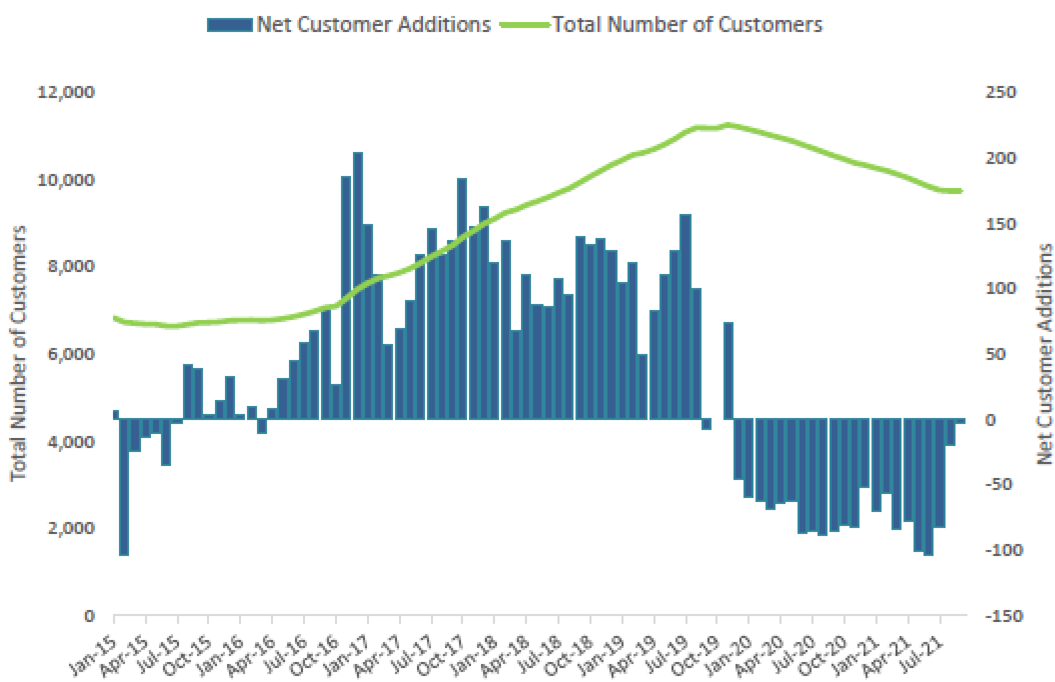
[46] FEI Application, p. 72.

[47] *Id.,* p. 73. A recent report indicates a more modest 2022 supply of 2,293 TJ, or 9 times the 2020 level. *See* Fortis BC Energy, Inc., "2022 Fourth Quarter Gas Cost Report," Tab 4, p. 1. https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

representing about 30% of the 4,000 TJ of the forecast 2022 RNG supply.[48] The BVA balance is expected to further increase to 1,623 TJ ($47 million) in 2023 and 2,397 TJ ($83 million) in 2024.[49]

FIGURE 1: FEI RENEWABLE GAS PROGRAM MONTHLY NET RNG CUSTOMER ADDITIONS AND TOTAL RNG CUSTOMERS

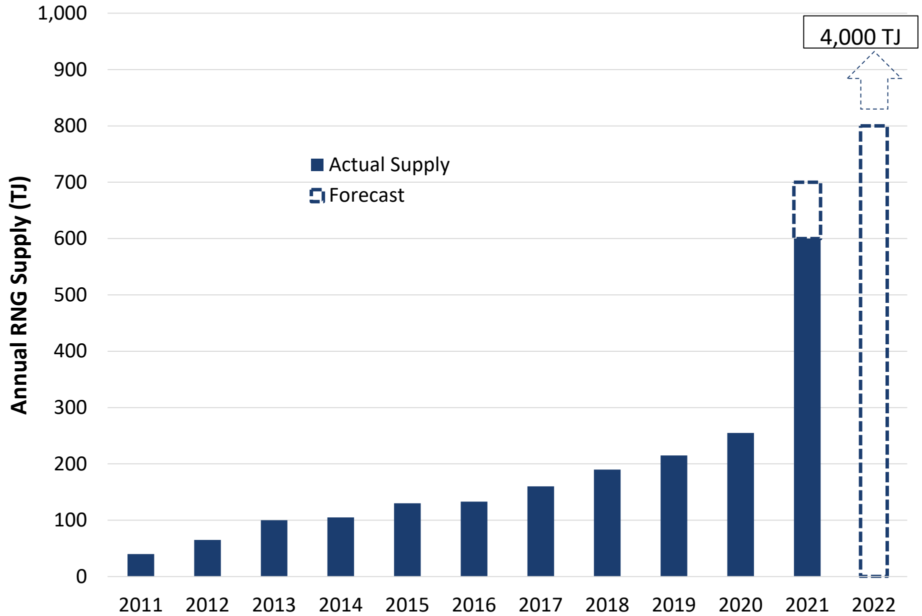
(Replication of Figure 2-2 in FEI's Application)



[48] Fortis BC Energy, Inc., "2022 Fourth Quarter Gas Cost Report," Tab 4, pp. 1-2. https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

[49] *Ibid*.

FIGURE 2: FEI TOTAL RNG SUPPLY HISTORY AND SHORT TERM FORECAST
(Replication of Figure 6-2 in FEI's Application)



In response to recent energy policy changes at the federal, provincial, and local level (as well as increasingly heterogeneous motivations for investing in RNG) as described above, FEI proposes a comprehensive update to the existing Renewable Gas Program offerings. FEI maintains that RNG can provide a low-carbon energy solution that meets the goals and mandates outlined in the CleanBC Plan and the Roadmap to 2030.[50] As part of the current proceeding, FEI proposes to modify its RNG program as follows:

- Introduce a new Renewable Gas Blend requirement for sales customers: all customers purchasing gas from FEI will be provided with a base level of RNG as part of their regular gas service, beginning with a 1% blend on January 1, 2024. All sales customers will be charged a new Storage and Transport Low Carbon (S&T LC) rider that reflects the under recovery of RNG supplied to Renewable Gas Connections and Voluntary Renewable Gas customers.[51]
- Introduce a new Residential Gas Connections service: FEI will permanently provide 100% RNG to new residential dwellings attaching to the system by a service line installed on or after the date of implementation of the service. Residential Gas Connection customers are first charged the S&T LC rider applicable to all sales customers.[52] They would then be

[50] FEI Application, p. 1.

[51] *Id.*, pp. 118-121.

[52] *Id.*, pp. 118-121.

charged a Low Carbon Gas Charge (LCG Charge), equivalent to the Commodity Cost Recovery Charge plus BC Carbon Tax. The LCG Charge equals the same rate charged to other gas customers not participating in the voluntary RNG program.[53]

- Modify the existing Voluntary RNG Program: customers in all rate schedules can choose to purchase up to 100% RNG. Under this program, Transpiration Service and natural gas vehicle (NGV) are charged a rate equivalent to the average cost of the RNG supply.[54] Other Voluntary RNG Program customers are first charged the S&T LC rider applicable to all sales customers.[55] Then the other Voluntary RNG Program customers are charged a premium of $7.0/GJ above the Commodity Cost Recovery Charge and the BC Carbon Tax.[56]

II. Short-term Supply of Renewable Natural Gas

A. Production Methodologies

Renewable natural gas (or biomethane) is a gaseous hydrocarbon produced from the breakdown of biological matter, such as municipal solid waste, wastewater solids, or animal manure.[57] The production of RNG from decaying biological matter is a mature technology and has been used for years at landfills and wastewater treatment facilities. At these facilities, biogas (a combination of methane, carbon dioxide, and other gases) is produced from the decomposition of organic waste. Biogas can then be "upgraded" by removing CO_2 and other impurities to produce RNG (biomethane). The upgraded RNG meets pipeline quality standards and can then be injected directly into the natural gas distribution system and used in existing natural gas applications.[58] Alternatively, RNG can also be produced by breaking down animal manures, food scraps, bio-solids, and other organic feedstocks in an oxygen-free (anaerobic) environment. Anaerobic digesters or biodigesters are sealed vessels that facilitate and can even

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53 *Id*., p. 2.

54 *Id*., p. 104.

55 *Id*., pp. 118-121.

56 *Id*., pp. 102-103.

57 U.S. EPA, "An Overview of Renewable Natural Gas from Biogas," EPA 456-R-21-001, January 2021, p. 1 https://www.epa.gov/sites/default/files/2021-02/documents/lmop_rng_document.pdf

58 *Id*. pp. 1-3.

accelerate this decomposition in a controlled environment. Anaerobic digestion similarly produces biogas that can be upgraded to pipeline quality RNG.[59]

The costs associated with each RNG production method will vary depending on the availability of feedstocks, production technology, and facility size. Feedstock collection and transportation costs can be significant, making local availability a key driver in determining the overall cost.[60] Some feedstocks, like wastewater and municipal wastes, need to be collected regardless if they are used in RNG production or not.[61] Moreover, facility size affects upgrading costs. Larger facilities will have higher operating costs, but lower per unit upgrade costs due to economies of scale.[62] Other factors such as interconnection costs, other potential markets for waste products, and policy incentives all affect RNG production costs. Cost effectiveness by feedstock or technology requires analysis at the project level for the most accurate comparison.[63]

It is important to note that the common RNG production methods are not necessarily entirely free of GHG emissions.[64] The GHG intensity of RNG can depend on fossil fuels utilized in the collection and transportation of feedstocks, the release of methane in the production, and processing and transportation of the RNG. The net RNG's GHG footprint is measured *relative to the methane releases that would occur in the absence of RNG production*.[65] In some cases, the production process may achieve negative GHG emissions.[66]

Other advanced conversion technologies can be used to produce RNG, but current technological and cost challenges limit their potential.[67] These advanced technologies include

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59 *Id.* pp. 3-5.

60 The Coalition for Renewable Natural Gas, "Economic Analysis of the US Renewable Natural Gas Industry," December 2021, https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/61ba25c889b4fb7566404e6c/1639589328432/RNG+Jobs+Study.pdf

61 *Id*. p. 21.

62 *Id*. p. 23.

63 American Gas Foundation, "Renewable Sources of Natural Gas," December 2019, pp. 50-51, https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

64 For example, see California Air Resources Board, "LCFS Pathway Certified Carbon Intensities," https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities

65 U.S. EPA, "An Overview of Renewable Natural Gas from Biogas," EPA 456-R-21-001, January 2021, pp. 11-12 https://www.epa.gov/sites/default/files/2021-02/documents/lmop_rng_document.pdf

66 *Ibid*.

67 U.S. Department of Energy, "Renewable Natural Gas Production," https://afdc.energy.gov/fuels/natural_gas_renewable.html

converting woody biomass to RNG using gasification or pyrolysis, or the production of synthetic methane using clean electricity and a low-carbon source of CO_2.[68]

B. Availability of RNG Supply Accessible to FEI

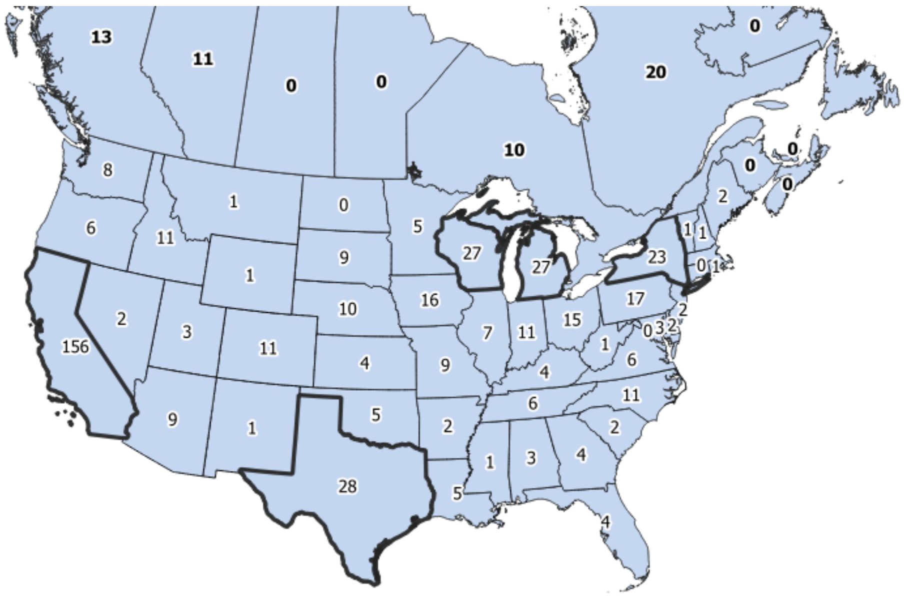
Renewable natural gas (RNG) is a well-established and mature technology and has been commercially available in North America for decades.[69] As noted above, potential RNG feedstocks include livestock manure, wastewater, landfills, crop residues, and wood waste. Figure 3 below shows the location of the 540 RNG production facilities at various stages of development across Canada and the United States. Current production of RNG in Canada is primarily located in southern Canada, particularly in Alberta, British Columbia, Ontario, and Quebec.[70] Southwest Ontario and Quebec have large quantities of corn silage, livestock manure, and landfill gas. The cropland regions of Saskatchewan and Alberta produce large potential feedstocks of crop residues and corn silage. California, Texas, Wisconsin, Michigan, and New York have the largest concentration of RNG facilities.

68 The Royal Society, "Sustainable Synthetic Carbon Based Fuels for Transport," September 2019, Figure 1, https://royalsociety.org/-/media/policy/projects/synthetic-fuels/synthetic-fuels-briefing.pdf

69 United States Environmental Protection Agency, "Renewable Natural Gas", https://www.epa.gov/lmop/renewable-natural-gas.

70 TorchLight BioResources, "Renewable Natural Gas (Biomethane) Feedstock Potential in Canada," Pages 12 – 18 & 32, https://www.enbridge.com/~/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20(1).pdf.

FIGURE 3: RNG FACILITIES BY PROVINCE AND STATE[71]



RNG AVAILABILITY IN BRITISH COLUMBIA

A 2017 study estimated that the short-term theoretical RNG potential within British Columbia is 7.6 PJ per year, and the short-term achievable RNG potential is 4.4 PJ per year.[72] Of the 4.4 PJ of feasible RNG potential, urban organic feedstock and landfill account for 1.9 PJ and 1.4 PJ, respectively. The remaining 1.1 PJ comes from livestock manure and wastewater feedstocks. In the long term, the achievable RNG production potential in the province is projected to increase to 11.9 PJ per year. Figure 4 below compares the short-term and long-term achievable RNG production potential. For comparison, FEI expected to secure around 4 PJ per year by the end of 2022 to serve its RNG commitments. To achieve the company's goal of displacing 15% of natural gas supply with RNG by 2030, FEI estimates that it will need approximately 30 PJ of RNG

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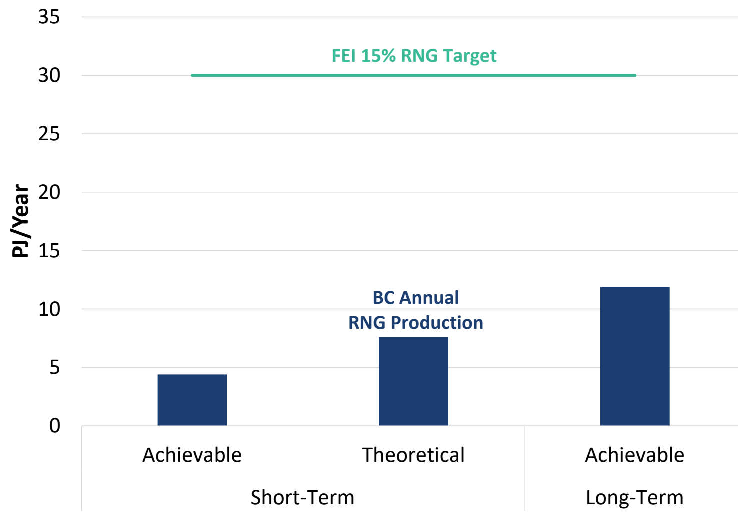
[71] The Coalition for Renewable Natural Gas, "Renewable Natural Gas Infographics," https://www.rngcoalition.com/infographic

[72] Hallbar Consulting Inc. and the Research Institute of Sweden, "Resource Supply Potential for Renewable Natural Gas in B.C.", March 2017, https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/renewable-low-carbon-fuels/resource_supply_potential_for_renewable_natural_gas_in_bc_public_version.pdf. This study reports the "theoretical" and "achievable" potential associated with a maximum price level of $28/GJ. In general, theoretical potential refers to the maximum amount of a resource that could be produced using the broadest and most favorable assumptions. Technical potential takes into account for constraints such as feedstock availability or production capacity, but like theoretical potential, it does not take economic competitiveness. Achievable or feasible, potential estimates the amount of resource produced only when it is cost effective to do, and is typically reported with an associated price level. However, some studies may use these terms interchangeably. Wherever possible, we clarify these terms in the report.

per year. Similarly, the company expects it will need 45 and 65 PJ per year of RNG by 2030 to meet the Roadmap to 2030 emissions cap.[73] Put differently, local British Columbia RNG supplies alone will not be nearly enough to meet FEI or the Province's clean energy goals in 2030.[74]

FIGURE 4: BRITISH COLUMBIA SHORT-TERM AND LONG-TERM RNG PRODUCTION POTENTIAL AT $28/GJ, VS FEI'S 15% RNG TARGET[75]



A separate study commissioned by the BC Bioenergy Network, FortisBC, the Province of British Columbia in 2022 estimated the RNG supply potential in British Columbia at various price levels.[76] The study's findings are broadly consistent with findings from the aforementioned 2017 study. The province's RNG supply potential at $32/GJ is approximately 7 PJ in 2021, 8 PJ in 2030, and 10PJ in 2050.[77] The maximum achievable RNG supply potential is about 9PJ in 2021, 10 PJ in 2030, and 11 PJ in 2050 at price levels about $50/GJ.[78] The RNG supply curve for 2030 from the study is shown below in Figure 5. This study results confirm that in order for FEI to meet the clean energy requirements under the Clean BC Plan, the company will need to secure the majority of its RNG supplies from outside of British Columbia.

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73 FEI Application, p. 29.

74 FEI's acquisition cost cap of $31/GJ is above the study's assumed price of $28/GJ and therefore can induce some additional RNG production and increase the supply potential somewhat. The study does not provide supply potentials for prices above $28/GJ.

75 Government of British Columbia, "Resource Supply Potential for Renewable Natural Gas in B.C."

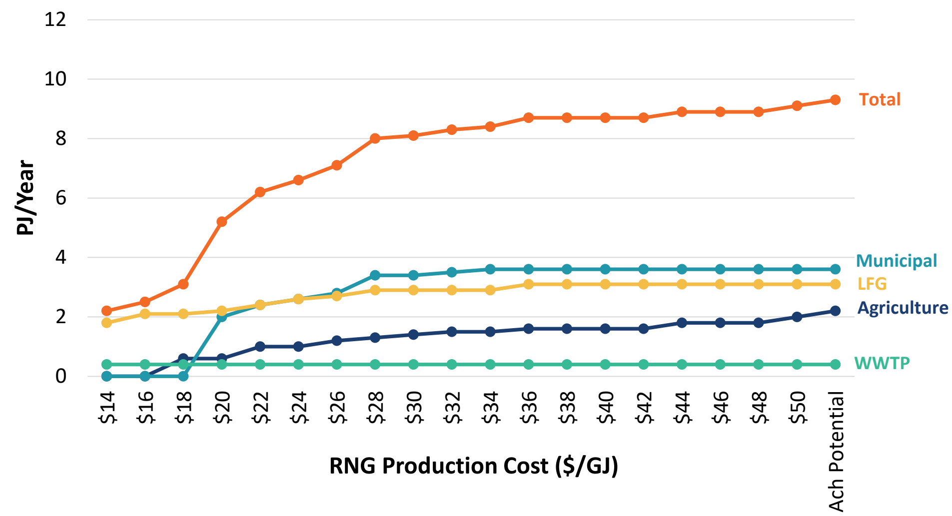
76 BC Bioenergy Network, FortisBC, Government of British Columbia, "B.C. Renewable and Low-Carbon Gas Supply Potential Study," January 28, 2022, https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/renewable-gas-study-final-report-2022-01-28.pdf.

77 *Id.* p. 27-30.

78 *Ibid*.

FIGURE 5: BRITISH COLUMBIA PRODUCTION COST CURVE - 2030[79]

(Replication of Figure 5 in BC Renewable Low-Carbon Gas Supply Potential Study, 2022)



Note: LFG refers to landfill gas, and WWTP refers to wastewater treatment plant.

RNG AVAILABILITY IN CANADA

There have been several studies assessing Canada's RNG production potential. A study commissioned by Natural Resources Canada (NRC) in 2020 found that Canada's theoretical production potential of RNG is about 809 PJ per year.[80] More than half of this potential comes from crop residues (straw and corn silage, which farmers grow for animal feed) and wood waste (see Figure 6 below).[81] However, due to technological and feedstock constraints, the actual RNG production potential of Canada is much lower, at 155 PJ per year.[82] This equates to approximately 3.6% of Canada's current natural gas consumption and 1.3% of Canada's total energy consumption.[83] FEI 's demand for RNG under the CleanBC 15% Renewable Gas target represents about 20% of Canada's supply potential, and demand under the emissions cap represents about 30-42% of this supply potential.

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[79] BC Bioenergy Network, FortisBC, Government of British Columbia, "B.C. Renewable and Low-Carbon Gas Supply Potential Study."

[80] TorchLight BioResources, "Renewable Natural Gas (Biomethane) Feedstock Potential in Canada," https://www.enbridge.com/~/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20(1).pdf.

[81] *Id.*, p. 27

[82] *Id.*, p. 56. The study found that RNG could cost up to $55/GJ to produce, with most volume available in the $25-$55/GJ range.

[83] Canada Energy Regulator, "Canada Energy Future 2021 Data Appendices – End-Use Demand," https://apps.rec-cer.gc.ca/ftrppndc/dflt.aspx?GoCTemplateCulture&GoCTemplateCulture=en-CA. Note, based on "Current Policies" case for 2021.

FIGURE 6: THEORETICAL & FEASIBLE ANNUAL RNG POTENTIAL BY RESOURCE (CANADA)[84]

Resource	Theoretical RNG Potential (PJ)	Feasible RNG Potential (PJ)
Animal Manure	41	20
Crop Residues	536	82
Urban Waste	71	53
Wood Waste	161	0
Total	**809**	**155**

The estimated feasible RNG production (155 PJ per year) from the NRC study aligns with findings from several prior studies (see Figure 7, below), which found a range of annual RNG production potential from 90 PJ to 218 PJ per year. When compared with Canada's annual natural gas consumption (approximately 4,300 PJ per year), this range implies that future RNG production in Canada could meet about 2-5% of the country's current natural gas consumption. When compared with British Columbia's annual natural gas consumption (approximately 400 PJ per year), this range implies that future RNG production could meet 23-55% of the province's current natural gas consumption.[85]

[84] TorchLight BioResources, "Renewable Natural Gas (Biomethane) Feedstock Potential in Canada," pp. 23 and 56, https://www.enbridge.com/~/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20(1).pdf.

[85] Canada Energy Regulator, "Canada Energy Future 2021 Data Appendices – End-Use Demand," https://apps.rec-cer.gc.ca/ftrppndc/dflt.aspx?GoCTemplateCulture&GoCTemplateCulture=en-CA. Note, based on "Current Policies" case for 2021.

FIGURE 7: SUMMARY OF RESULTS FROM RNG POTENTIAL STUDIES FOR CANADA

Study	Published by	Geography, Year	Scope/Sector	Current RNG Potential (PJ)	Assumed RNG Price	% of BC's Gas Consumption[86]
Potential Production of Methane from Canadian Wastes[87]	Canadian Gas Association	Canada, 2010	All residuals, but crop residuals limited to 20%; corn silage and pulp mill sludge excluded	218	N/A	55%
Canadian Biogas Study Benefits to the Economy, Environment and Energy[88]	Canadian Biogas Association	Canada, 2013	All residuals, including crop residues; corn silage and pulp mill sludge excluded	89.5	N/A	22%
Renewable Natural Gas (Biomethane) Feedstock Potential in Canada[89]	Natural Resources Canada	Canada, 2020	All residuals; crop residues, livestock manure, urban organics and landfill gas	155	Not provided; Production cost ranges from $6-$55/GJ[90]	39%
Resource Supply Potential for Renewable Natural Gas in B.C[91]	Gov't of BC, FortisBC, Pacific Northern Gas	British Columbia, 2017	All residuals; feasible estimated at 4.4 PJ in near term and 11.9 PJ in long term	4.4	$28/GJ	1%
Renewable natural gas production in Québec[92]	Énergir	Quebec, 2018	Crop residues, agri-food residuals, landfills; manure and pulp mill sludge excluded	25.8	$38/GJ	6%
B.C. Renewable and Low-Carbon Gas Supply Potential Study[93]	B.C. Bioenergy Network	British Columbia, 2022	Crop residues, livestock manure, landfill gas and urban organics	8	$32/GJ	2%

86 *Ibid.*

RNG AVAILABILITY IN UNITED STATES

FEI can also rely on production facilities located United States to meet its demand for RNG. With the appropriate pipeline capacity contracts, FEI can have RNG physically delivered to its system through interstate pipelines. Alternatively, the company can purchase the supplies and have them injected into local gas distribution systems in the U.S.; the company then takes credit for that supply. However, care must be taken to not double count the environmental attributes. This is also true for RNG supplies sourced from other Canadian provinces. (For more information, please refer to the notional RNG supply discussion below.)

The U.S. has approximately 230 operating RNG production facilities with an operational production capacity of approximately 63 PJ as of the end of 2021.[94] The American Gas Foundation (AGF) estimates that under the high resource potential scenario, the feasible RNG production potential in the U.S. is approximately 380 PJ in 2025, growing to 2,200 PJ in 2030 and 4,800 PJ in 2040 (see Figure 8 below).[95] Under AGF's low resource potential scenario,

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87 Canadian Gas Association, "Potential Production of Methane from Canadian Wastes," https://www.researchgate.net/publication/268341359_Potential_Production_of_Methane_from_Canadian_Wastes.

88 Canadian Biogas Association, "Canadian Biogas Study – Benefits to the Economy, Environment and Energy," https://bcbioenergy.ca/wp-content/uploads/2013/12/2013-11-Canadian-Biogas-Study.pdf.

89 TorchLight Bioresources, "Renewable Natural Gas (Biomethane) Feedstock Potential in Canada," https://www.enbridge.com/~/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20(1).pdf.

90 The range in production costs reflects the cost of obtaining and processing various RNG feedstocks. The all-in production cost (including capital expenses, operating expenses and feedstock procurement) for landfill gas is estimated to be between $6 and $16 per GJ. By contrast, the all-in production cost of straw is estimated at around $55 per GJ. Source: TorchLight BioResources, Page 49, "Renewable Natural Gas (Biomethane) Feedstock Potential in Canada," https://www.enbridge.com/~/media/Enb/Documents/Media%20Center/RNG-Canadian-Feedstock-Potential-2020%20(1).pdf.

91 Government of British Columbia, "Resource Supply Potential for Renewable Natural Gas in B.C.," resource_supply_potential_for_renewable_natural_gas_in_bc_public_version.pdf (gov.bc.ca).

92 Énergir, "Renewable natural gas production in Quebec: A key driver in the energy transition", https://www.energir.com/~/media/Files/Corporatif/Publications/181120_Potentiel%20GNR_Rapport%20synth%C3%A8se_ANG.pdf?la=en.

93 BC Bioenergy Networks, FortisBC, Government of British Columbia, FortisBC, "B.C. Renewable and Low-Carbon Gas Supply Potential Study," January 28, 2022, https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/renewable-gas-study-final-report-2022-01-28.pdf.

94 Argonne National Laboratory, "Turning waste to energy," April 12, 2022, https://www.anl.gov/article/turning-waste-to-energy-tracking-renewable-natural-gas-transportation-projects

95 This include potential from Power to Gas/Methanation. The study reports that the U.S. RNG potential without economic and technical constraints to be 14,729 PJ. American Gas Foundation, "Renewable Sources of Natural

landfill gas is the primary source of RNG supplies through 2040, whereas in the high resource potential scenario, the AGF forecasts a greater potential for other feedstocks, primarily animal manure, agricultural waste, and energy crops. The study estimated that the majority of the RNG in the high resource potential study would cost between $9/GJ to $25/GJ[96] This U.S. supply is quite large relative to FEI's requirements, though when considering this large potential supply, it is also important to consider the competing sources of demand, and U.S. demands could be comparably large, or larger (see Section IV below).

Taken together, the AGF study suggests that the short-term RNG potential can only serve a small fraction of the total U.S. residential natural gas demand of about 5,100 PJ.[97] Not shown in Figure 8 below is demand from other sources of natural gas demand—commercial, industrial, power generation, and transportation, which together likely create significant additional demand for U.S. RNG supplies. One notable source of demand is the U.S. Environmental Protection Agency (U.S. EPA) Renewable Fuel Standard (RFS) Program, which allows RNG blending to meet GHG emission reduction obligations. Under the RFS program, the production of RNG generates a Renewable Identification Number (RIN) that can be traded amongst obligated parties to achieve compliance. RINs in the U.S. EPA RFS market are currently worth up to $50/GJ, creating a strong incentive for RNG producers to use their supplies to meet demands from the transportation fuel market.[98]

Gas: Supply and Emission Reduction Assessment," December 2019, https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

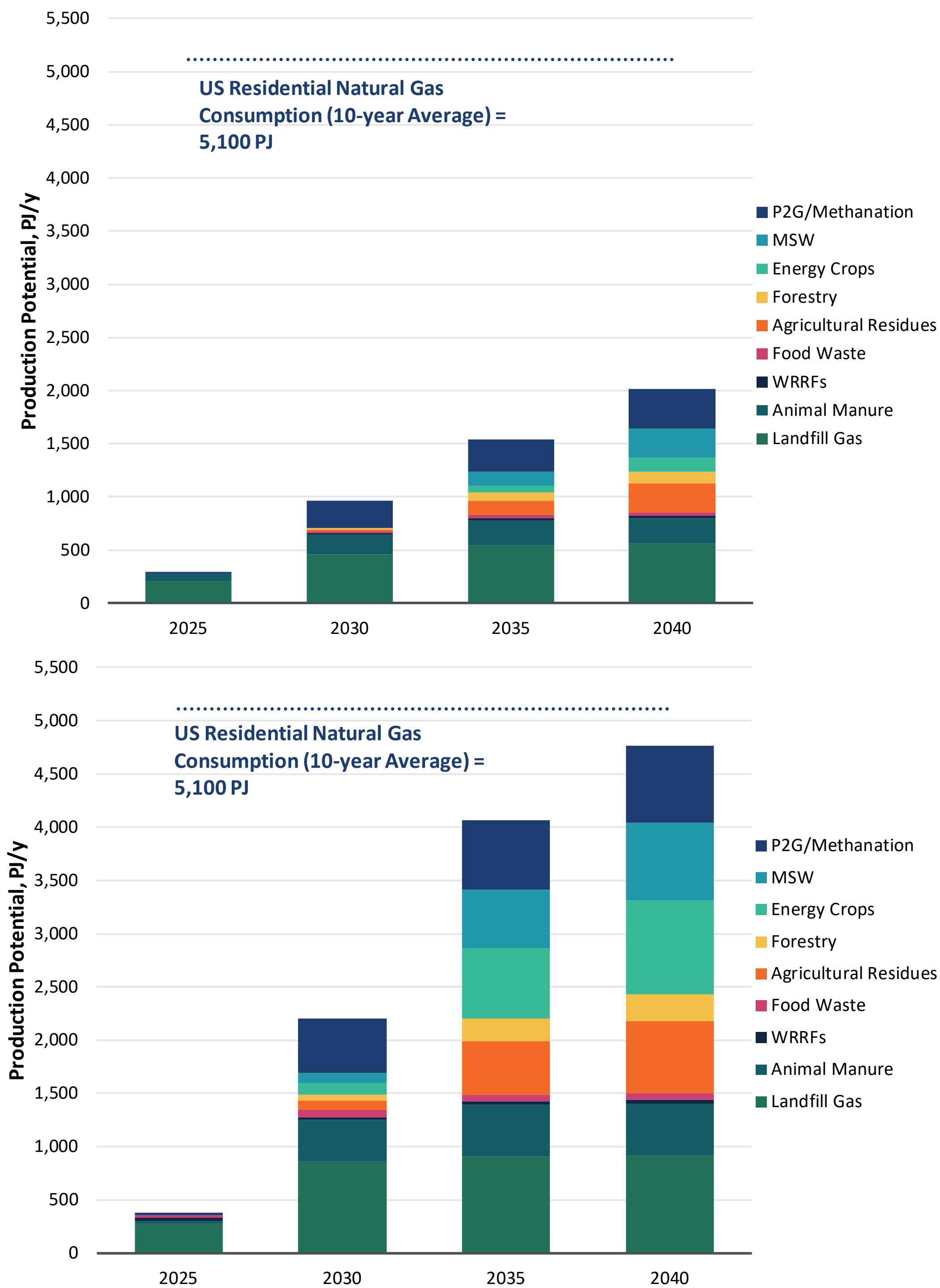
96 *Id*. p. 63. Converted from $7/MMBtu to $20/MMBtu

97 *Id.*, p. 2

98 One unit RIN is based on the energy content in one gallon of ethanol. 1 MMBTU of RNG generates about 12 RINs, per M.J. Bradley & Associates, "Renewable Natural Gas Project Economics", https://www.mjbradley.com/sites/default/files/RNGEconomics07152019.pdf. Estimate is based on price of $3.5/RIN for D3 fuel, per U.S. EPA, "RIN Trades and Price Information," https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rin-trades-and-price-information. RNG from landfills, municipal wastewater treatment facility digesters, agricultural digesters, and separated municipal solid waste digesters qualifies for D3 RINs. RNG from waste digesters qualifies for D5 RINs, which are traded at a lower price level.

FIGURE 8: ESTIMATED U.S. RNG POTENTIAL (AGF)

From American Gas Foundation study, showing Low Resource Potential (Top) and High Resource Potential (bottom)



Note: WWRF refers to water resource recovery facility. MSW refers to municipal solid waste

The composition of FEI's RNG supply contracts reflects the characteristics of RNG production potential and production activities in North America. To serve its current RNG obligations, FEI has secured 1.3 PJ of RNG supplies (based on expected annual volumes).[99] The majority of this RNG supply (74% or 1 PJ) is sourced outside of British Columbia through notional supplies (see Table 6-1 FEI's Application); roughly half of this RNG supply comes from other Canadian Provinces (Ontario or Alberta) and the other half from the United States (Iowa). FEI has approved contracts for an additional 8.4 PJ of RNG supplies coming online in 2022 and 2023, for a total RNG supply portfolio of 9.8 PJ (based on expected annual volumes).[100] Similarly, 70% of this additional supply is sourced from outside of British Columbia, primarily from Ontario, Alberta, Pennsylvania, and Illinois.

GLOBAL RNG AVAILABILITY

In the future RNG markets may become global, similar to current natural gas markets. For example, liquefied RNG could be shipped across the globe displacing current volumes of liquefied natural gas (though this arrangement is extremely limited at the moment). Alternatively, utilities could purchase notional RNG from global suppliers and avoid global shipping logistics and costs. According to the International Energy Association, global RNG demand in 2018 was 1,466 PJ, with over 60% of supply produced in Europe and North America at an average price of $24/GJ.[101] Today, RNG is produced primarily from crops and animal manure feedstocks.[102] The study estimates the current global supply potential to be about 29,330 PJ at a price of approximately $38/GJ, which amounts to 20% of global natural gas demand.[103] Generally, the cheapest sources of supply are in Asia Pacific, North America, and to a lesser extent Europe ($25/GJ or less).[104] By 2040, IEA estimates the global supply potential could reach 41,900 PJ at a price of approximately $29/GJ and a global average production cost

[99] FEI notes in its Application that new supply projects may not operate at full capacity at the beginning and take time to ramp up to maximum production volumes (p. 74).

[100] FEI Application, p. 74

[101] International Energy Agency, "Outlook for biogas and biomethane," 2020, pp. 10, 48, https://iea.blob.core.windows.net/assets/03aeb10c-c38c-4d10-bcec-de92e9ab815f/Outlook_for_biogas_and_biomethane.pdf. Energy units converted at 41.9 PJ per 1 Mtoe, as stated in IEA report.

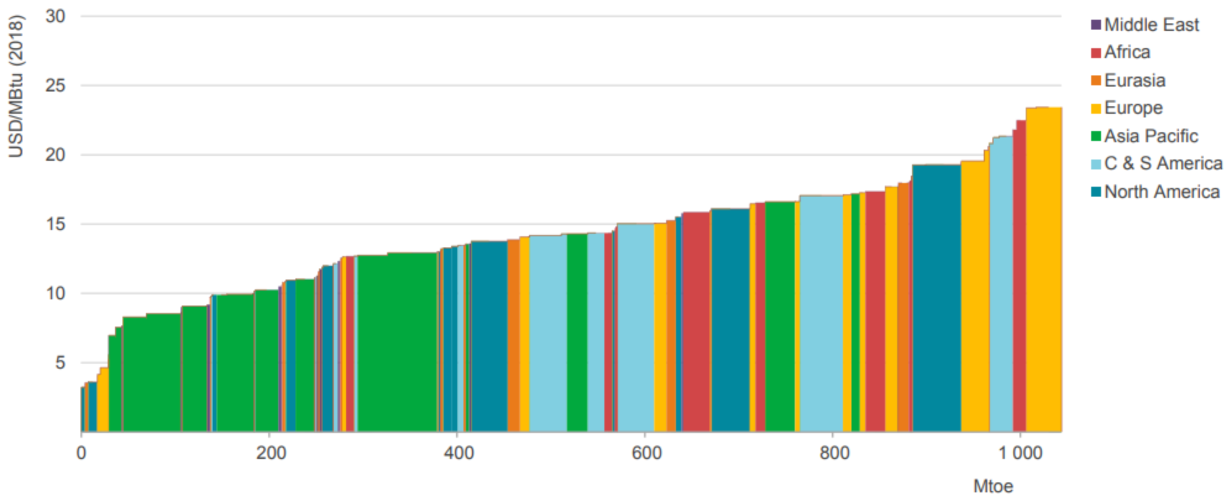
[102] *Id*. p. 16.

[103] *Id.* p. 35.

[104] *Ibid*.

of $19/GJ (see Figure 9 below).[105] Most of the world's cheapest RNG production would be located in Asia Pacific.

FIGURE 9: COST CURVE OF GLOBAL RNG SUPPLY POTENTIAL BY REGION 2040 (IEA)[106]



C. Notional RNG Supplies

To satisfy their RNG requirements, utilities in British Columbia can purchase locally produced RNG that can be injected into province's gas distribution system, or to purchase notional supplies produced elsewhere in Canada, the United States, or potentially anywhere in the world.[107] Notional supplies are not physically delivered to the FEI system but instead delivered to end-users near to the production facility. FEI can take credit for these notional supplies in their supply portfolio.

Notional RNG supply markets provide FEI with additional flexibility to meet the company's or the Provinces' blending goals; but notional RNG contracts also expose FEI to a broader set of competitive pressure and risks. Through notional supply arrangements, FEI can acquire environmental attributes from RNG producers located in a wider geographic area. The company also does not need to reserve transmission capacity to transport the acquired RNG, and does

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105 *Id.* p. 36.

106 *Ibid*. Note 1 Mtoe = 41.9 PJ. 1 UST/MMBtu is approximately equal to 1.27 CAD/GJ using a conversion rate of 1.33 CAD per USD and 1.05 GJ per MMBtu.

107 British Columbia Utilities Commission, "Inquiry into the Acquisition of Renewable Natural Gas by Public Utilities in British Columbia Phase 1 Report," July 28, 2022, pp. 7-8.

not incur midstream transportation charges. However, FEI will have to compete with other gas utilities in North America who may also have a need for RNG to decarbonize their own gas supplies.[108] For example, Oregon recently passed Senate Bill 98 enabling gas utilities to blend increasing amounts of RNG into their gas system and recover the higher supply costs from customers.[109] California—which has the most RNG facilities in North America (156)—recently established a 2025 biomethane target of 17.6 billion cubic feet per year (18 PJ/year) for utilities operating in the state.[110] Beyond government initiatives, utilities like Énergir,[111] National Grid,[112] Spire,[113] and Nicor Gas[114] are voluntarily pursuing RNG blending opportunities. Because the estimated RNG supply potential is insufficient to displace a significant portion of current Canadian or U.S. gas demand (as discussed above), utilities will compete for available supplies, keeping RNG prices elevated. FEI may pursue notional supply arrangements with RNG producers located outside of North America, though the company may experience the same competitive forces (but now international in nature) and potentially heightened legal or regulatory risks in the future.

At present, we are not aware of any legal or regulatory restrictions governing notional RNG supply arrangements in British Columbia. However, care must be taken to ensure that carbon reduction benefits are real (meaning lowered atmospheric GHG levels) and not double counted.[115] Emissions reduction measurement, accounting, reporting, and verification must adhere to standards informed by best available scientific understanding and data. Therefore,

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[108] Likewise, other gas utilities elsewhere can purchase notional in British Columbia, and FEI would face competition for local supply, even if FEI limited its supply procurements to just British Columbia.

[109] Oregon Legislative Assembly, Senate Bill 98, p. 3, https://olis.oregonlegislature.gov/liz/2019R1/Downloads/MeasureDocument/SB98/A-Engrossed

[110] CPUC, "Decision Implementing Senate Bill 1440 Biomethane Procurement Program," R13-02-008, p. 60, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M454/K335/454335009.PDF

[111] Énergir, "Renewable Natural Gas," https://www.energir.com/en/about/our-energies/natural-gas/renewable-natural-gas/

[112] National Grid, "National Grid Seeks Renewable Natural Gas and Hydrogen Supply," May 16, 2022, https://www.nationalgridus.com/News/2022/05/National-Grid-Seeks-Renewable-Natural-Gas-and-Hydrogen-Supply/

[113] Spire, "Protecting Our Environment," https://www.spireenergy.com/protecting-our-environment

[114] Nicor Gas, "Renewable Gas," https://www.nicorgas.com/sustainability/renewable-gas.html

[115] Some regulators require RNG producers to track their production to avoid double counting. For example, the California Public Utilities Commission requires producers to register injected RNG volumes, which will generate a unique, traceable, digital renewable thermal certificate for each dekatherm of RNG produced. Source: Buck Endemann, Molly Barker, Matthew Clark, "Calif's Renewable Natural Gas Standard: Tips for Suppliers," April 13, 2022, https://marketingstorageragrs.blob.core.windows.net/webfiles/Law360_Endemann_Barker_Clark_Elles_2.pdf

clear guidance, including penalty for non-compliance, is needed to ensure that notional supply contract arrangements are designed and executed to accomplish decarbonization objectives.

D. Price Projections for RNG Supplies

Because RNG is generally more costly than natural gas, regulators have imposed various acquisition price caps, or review thresholds for supply contracts, when approving RNG-related programs. In Oregon, Senate Bill 98 established an RNG supply cost cap equivalent to 5% of a utilities annual revenue requirement.[116] The California Public Utilities Commission established different levels of review depending on the RNG contract price, with higher price levels subject to stricter scrutiny. The California thresholds are:

- Below $22/GJ;
- Between $22/GJ and $33/GJ; and
- Above $33/GJ.[117]

In British Columbia, the supply acquisition cost cap was first set at $15.28/GJ in 2010 but has since increased to $31/GJ.[118] Demand for RNG will come from other sectors as well (see Section III below). It is also important to recognize that the U.S. EPA's RFS market is another source of RNG demand.[119] These utility price caps (and low carbon fuel markets) are likely to drive near- to medium-term prices for RNG, given the competition for available supplies and guaranteed recovery of prudently incurred supply costs up to these caps. Indeed, under tight supply conditions, RNG producers have little incentive to sell RNG at price levels below regulator-approved price caps.

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116 Oregon Legislative Assembly, Senate Bill 98, p. 3, https://olis.oregonlegislature.gov/liz/2019R1/Downloads/MeasureDocument/SB98/A-Engrossed

117 CPUC, "Decision Implementing Senate Bill 1440 Biomethane Procurement Program," R13-02-008, p. 59. Note the thresholds were set at $17.70/MMBtu, between $17.70/MMBtu and $26/MMBtu, and above $26/MMBtu.

118 FEI Application, p. 11.

119 As noted earlier, while no price cap exists in this market, obligated parties are currently willing to pay up to $50/GJ for RNG-generated credits to satisfy their obligations under the program. Similarly, credits in the BC-LCFS program are worth approximately $28/GJ.

FEI's implied annual average RNG cost has steadily increased in recent years and is currently approximately $22/GJ.[120] Figure 10 below shows the implied annual average RNG supply cost for FEI through 2022 and forecasts what future costs might be if its RNG costs grow at a 2% annual inflation rate (gray line).[121] Figure 10 also includes additional estimates from other studies, displaying various cost forecasts for different regions and feedstocks. Ranges on the graph are color coded by feedstock to describe specific prices. Production costs in the U.S. Northwest region (Idaho, Montana, Oregon, and Washington) range from $10/GJ to $50/GJ for RNG depending on technology differences, feedstock, and capital costs.[122] This level of production costs is expected to remain relatively stable going forward. A study specific to supplies in Michigan estimated 2030 costs to range from $13/GJ to over $90/GJ.[123] A separate study projects that RNG costs will range from $9/GJ to $41/GJ in 2040, depending on the production method.[124] The study found that RNG produced from agriculture is the most expensive, followed by agriculture and municipal waste; landfill waste is the cheapest source of RNG.

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[120] Fortis BC Energy, Inc., "2022 Fourth Quarter Gas Cost Report," Tab 4, Page 4, https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

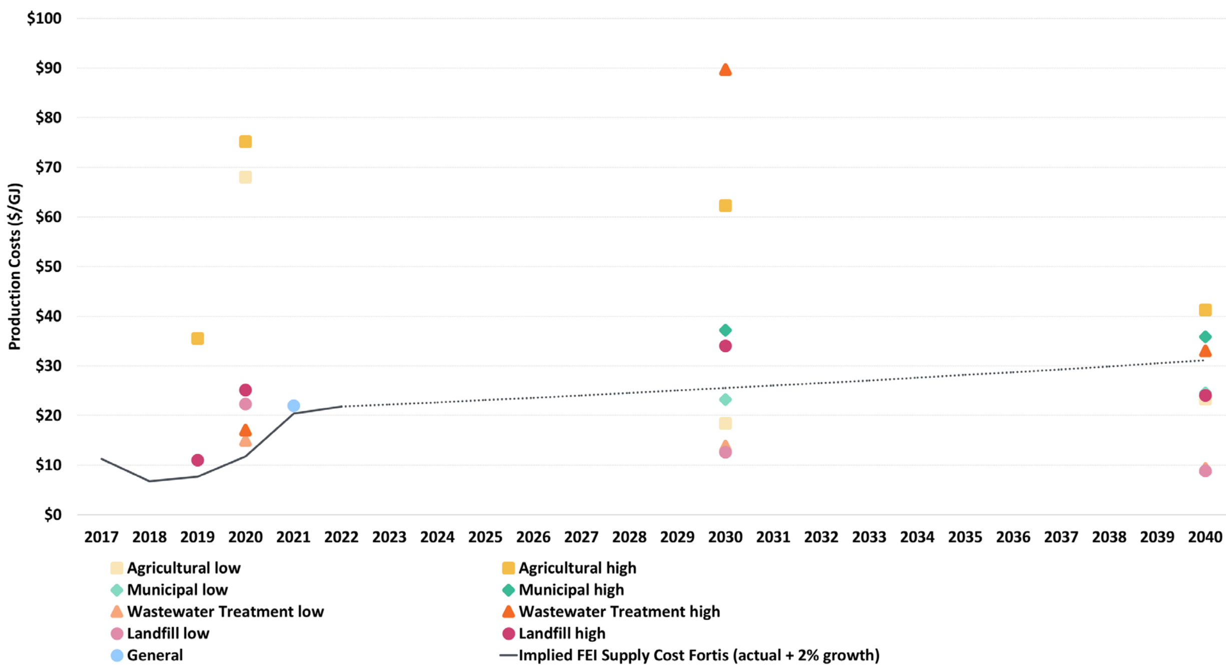
[121] We conservatively assume a 2% inflation rate for this analysis based on observable terms in available RNG contracts. However, high demand for available RNG supplies may cause RNG prices to increase at a higher rate.

[122] Northwest Council, "Renewable Natural Gas," https://www.nwcouncil.org/2021powerplan_renewable-natural-gas/

[123] Michigan Public Service Commission, "Michigan Renewable Natural Gas Study," September 2022, https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/workgroups/RenewableNaturalGas/MI-RNG-Study-Final-Report-9-23-22.pdf?rev=213e31ab46c24ce1b799eeb8a42f0824&hash=5B8C2CEB98C8F8F20C7D65F4C4153CE1

[124] American Gas Foundation, "Renewable Sources of Natural Gas," December 2019, pp. 53-55, https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

FIGURE 10: PUBLISHED RNG SUPPLY COSTS AND FORECASTS



Currently, there are no transparent or liquidly traded RNG markets. As such, the discovery of actual market-based RNG prices is based on buyers or sellers disclosing the terms of the transaction. Figure 11 below summarizes recent reported RNG contract prices. For example, the University of California reports the median offer price of $17/GJ for their recent RNG Request for Proposal, primarily reflecting anaerobic digester projects.[125] Liberty Utilities in Massachusetts recently reported a landfill gas contract that starts at $11.7/GJ and increases at a 2% inflation adjuster per year.[126] In addition, we calculated the implied average RNG prices for DTE Gas and FEI's RNG prices based on reported total RNG costs and total volumes.

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[125] University of California, "Strategies for Decarbonization: Replacing Natural Gas," February 2018, p. 54, https://wcec.ucdavis.edu/wp-content/uploads/2018-Meier-et-al.-University-of-California-Strategies-for-Decarboniz.pdf

[126] Massachusetts Department of Public Utilities, "Petition of Liberty Utilities for Approval to Purchase Renewable Natural Gas," D.P.U. 22-32, March 2021, p. 1,

FIGURE 11: RNG CONTRACT PRICES ($/GJ)[127, 128, 129, 130]

Year	University of California	DTE Gas	Liberty Utilities	FEI Implied Average	FEI Acquisition Cost Cap
2017	17	-	-	11	15
2018	-	-	-	7	30
2019	-	-	-	8	30
2020	-	-	-	12	30
2021	-	40	-	20	31
2022	-	-	12	22	31

E. Existing Markets, Demand, Supply, and Pricing for Carbon Offsets as an Alternative to RNG

FEI proposes to rely on carbon offsets as a tool to manage risks associated with potentially volatile customer demand for RNG (presumably, when demand exceeds the actual RNG supply available to FEI within the price cap).[131] In general, organizations can purchase offsets in tons of carbon dioxide equivalent (tCO_2e) to balance GHG emissions from their activities.[132] Funds from the offset purchase help develop projects that verifiably keep GHG out of the atmosphere or remove GHG from the atmosphere.[133] One unit of carbon offset generally represents one

[127] University of California, "Strategies for Decarbonization: Replacing Natural Gas," February 2018, Figure 3.1, https://wcec.ucdavis.edu/wp-content/uploads/2018-Meier-et-al.-University-of-California-Strategies-for-Decarboniz.pdf

[128] DTE Gas, "Natural Gas Balance U-20839 Program Update and 2021 Annual Report," March 2022, p.6, https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y000002U2pfAAC

[129] Massachusetts Department of Public Utilities, "Petition of Liberty Utilities for Approval to Purchase Renewable Natural Gas," D.P.U. 22-32, March 2021, p. 1, https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/14748115

[130] Fortis BC Energy, Inc., "2022 Fourth Quarter Gas Cost Report," Tab 4, Page 4, https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

[131] FEI Application, p. 125-126

[132] When a carbon offset is used by the purchaser to compensate for their own emissions, the offset is "retired."

[133] Example of qualified projects may include nature-based solutions (*e.g.*, afforestation, reforestation, and avoided grassland conversion) and technology-based solution such as direct air capture and storage.

metric tonne of carbon dioxide equivalent (tCO_2e) avoided or sequestered from the atmosphere. In the context of FEI's proposal, the company would attach the environmental attributes acquired from purchased offsets to conventional natural gas delivered to its customers, and the offset gas would have the GHG footprint of RNG (*i.e.*, zero). FEI would purchase the offset based on the emissions reductions equivalent to one GJ of biomethane.

Carbon offsets are currently produced and sold in compliance markets or voluntary markets. The Clean Development Mechanism (CDM) is a regulated compliance market that was established by the Kyoto Protocol. Under the CDM framework, developed countries can comply with their binding emissions reduction targets under the Protocol by purchasing carbon credits (or offsets) generated by projects in developing countries.[134] The voluntary offset market exists as an informal market currently governed by a mix of non-governmental and private sector organizations, and it is through this type of market that FEI proposes to purchase carbon offsets.

Participation in the voluntary market has grown substantially in the last decade, driven in part by growing concerns over the impacts of climate change. An increasing number of companies have pledged to reduce their carbon footprint in part due to pressure from investors (and regulators in some instances).[135] To date, over 1,000 companies have announced emissions reduction targets, and over 800 companies have reported a company-wide net zero target compared to fewer than 10 just five years ago.[136] For companies with difficult-to-decarbonize operations, purchasing carbon credits is one way to meet their climate goals. Indeed, the voluntary market for carbon offset has grown significantly over the past decade. According to one estimate, the amount of retired carbon offsets grew from 34 million tCO_2e in 2016 to 95 million tCO_2e in 2020, a nearly 3-fold increase, and the projected demand will remain elevated in the near term.[137]

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[134] Though designed for countries to meet their emissions reduction commitments, companies such as FEI can also voluntarily purchase Certified Emission Reductions generated from the CDM program. https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism.

[135] Attracta Mooney, "Investors learn to exert pressure on heavy CO2 emitters," *Financial Times*, November 1, 2021, https://www.ft.com/content/52cb466c-2ed6-40d3-85c3-3a292aeff8d3

[136] Companies Table, Net-Zero Tracker, https://zerotracker.net/#companies-table

[137] Taskforce on Scaling Voluntary Carbon Markets, Final Report, January 2021, https://www.iif.com/Portals/1/Files/TSVCM_Report.pdf

Supply of carbon offsets has historically outpaced demand. Annual issuance of carbon credits was consistently higher than the amount of retired credits, and there were 321 million tCO_2e credits in inventory by the end of 2020. Because the offset is not limited by international boundaries (*e.g.*, a company in Canada can purchase offsets generated in Nepal), this dynamic has led to relatively low carbon offset prices, ranging from $2.6-$27 per tCO_2e, or $0.1-1.4/GJ.[138] Price tends to be higher for high-quality offsets, or offsets that follow certain compliance protocols (see below). This price range is consistent with the values that FEI reports[139], and is consistent with the prices that other gas utilities pay to acquire offsets for similar programs.[140]

While there is unlikely a risk of supply shortage of carbon offset in the short term, there are a number of concerns over whether and to what extent carbon offsets lead to real and verifiable climate benefits. Companies that use carbon offsets typically buy them from one of the many third-party verification organizations. However, not all offsets are created equal. There is no single definition for carbon offset, and there are several competing standards for how voluntary offset projects should be set up and managed. Therefore, there is wide variation in emissions reduction measurement, accounting, verification, and reporting across voluntary markets.[141] A number of studies have documented severe shortcomings of carbon offset programs in places such as California and the Brazilian Amazon due to flaws in program design and measurement methods.[142] At face value, inexpensive carbon offsets can be an attractive tool to meet GHG emissions reduction or net zero target, especially when compared to the more expensive

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[138] Oregon Department of Transportation Operational Greenhouse Gas Reductions: Best Practices and Recommendations, December 2021, https://www.oregon.gov/odot/Programs/TDD%20Documents/ODOT%20Operational%20GHG%20Reductions%20-%20BPs%20and%20Recs%20--%20FINAL%202022.01.05.pdf. Conversion assumes carbon intensity of 52.91 kg of CO_2 per MMBTU for natural gas. *See* U.S. Energy Information Administration, Carbon Dioxide Emissions Coefficients, https://www.eia.gov/environment/emissions/co2_vol_mass.php

[139] FEI Application, page 126

[140] For example, DTE pays about $10/$tCO_2e$ for offsets used in its Voluntary Renewable Gas program, and Northwest Natural Gas pays about $18/$tCO_2e$ for offsets used in its Smart Energy program. *See* https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y000002U2pfAAC https://edocs.puc.state.or.us/efdocs/HAQ/rg2haq14103.pdf

[141] Among other things, high-quality offsets must be real, additional (the project would not have happened anyway without funds from the offset), permanent (GHG emissions must be eliminated or sequestered for a long time), quantifiable, and enforceable (where the offset is backed by a legal instrument that establishes ownership and liability).

[142] Badgley G. et al, "Systematic over-crediting in California's forest carbon offsets program", Global Change Biology, October 2021, https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.15943. *See also* West T. et al, "Overstated carbon emission reductions from voluntary REDD+ projects in the Brazilian Amazon," September 2020, https://www.pnas.org/doi/abs/10.1073/pnas.2004334117

alternatives such as RNG. However the reliance on offsets to meet decarbonization targets must be carefully reviewed and evaluated to ensure that offsets are used as intended, and that offset purchase would result in real climate benefits.

III. Short-Term Demand for Renewable Natural Gas

RNG markets are global. As jurisdictions around the world move ahead to decarbonize their economies, the demand for clean fuels, including RNG, will increase. Technological improvements may eventually enhance access to low-carbon fuels such as hydrogen and synthetic electrofuels, but at the moment, RNG is a suitable drop-in fuel that can readily displace natural gas without requiring major changes to the gas transmission and delivery systems. As the existing North American natural gas pipeline network can blend an increasing share of RNG and transport it to regional (or international) RNG markets, we expect to see RNG price dynamics that reflect those of current natural gas markets. In addition, some buyers may purchase notional supplies in other geographic regions and take credit for reducing GHG emissions without taking physical delivery of the RNG. Buyers in British Columbia and in other parts of North America will increasingly compete for available supplies across broader geographic regions. New demand from the transportation and industrial sectors will also place additional pressure on RNG supplies, and as these sectors are relatively less price sensitive, this is likely to result in higher price levels. These dynamics may make it more challenging for gas utilities to rely on RNG as a primary strategy to reduce their GHG emissions.

A. Drivers of Future RNG Demand

An increasing number of jurisdictions in North America are setting more stringent climate goals, and many of them will need significant amounts of low-carbon fuels to meet these goals. RNG is one of several candidate fuels to enable decarbonization, driven in no small part by targeted policies to promote RNG as a climate-friendly alternative for heating and vehicle transportation applications.[143] Future RNG demand will depend on the role the fuel can play in decarbonizing these sectors, as well as the continuation and/or development of policy support.

The CleanBC Roadmap to 2030 establishes specific guidelines for the building (residential and commercial) and industrial sectors, and FEI identifies each of these sectors as potential sources for future RNG demand. However, the ultimate future demand for RNG will depend on various

[143] Note, for vehicle transportation, other low carbon fuels like ethanol and biodiesel are used in greater volumes than natural gas or RNG.

sector-specific factors with potentially competing effects (see Figure 12 below) both within British Columbia and across the globe.

In the buildings sector, the BC Building Code will be updated to support zero-carbon new construction by 2030. This performance standard can be met with low carbon fuels and/or new equipment standards. Current technology can electrify residential and commercial natural gas use through the installation of heat pumps, electric water heaters, and induction stoves. Price competition between RNG and these other technologies will be important for determining customer adoption trends. Local government regulations will also affect the demand for RNG. As of January 1, 2022, the City of Vancouver requires zero-emission equipment for space and hot water heating in new low-rise residential buildings, allowing RNG to qualify.[144] Similar equipment emission requirements or bans have recently passed in Quebec,[145] California,[146] and Washington.[147]

[144] City of Vancouver, "Zoning amendments to support the Climate Emergency Response," https://vancouver.ca/green-vancouver/zoning-amendments-to-support-climate-emergency.aspx

[145] Government of Quebec, "Press release: Quebec adopts a regulation to eliminate the use of fuel oil for residential heating," November 17, 2022, https://www.environnement.gouv.qc.ca/Infuseur/communique.asp?no=4687

[146] Tom DiChristopher, "Los Angeles proposes natural gas ban in most new construction," *S&P Global*, October 4, 2022, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/los-angeles-proposes-natural-gas-ban-in-most-new-construction-72375727

[147] Tom DiChristopher, "Washington state to require electric heating in building code update," *S&P Global*, April 25, 2022, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/washington-state-to-require-electric-heating-in-building-code-update-69960737

FIGURE 12: DRIVERS FOR CHANGES IN RNG DEMAND IN BRITISH COLUMBIA[148]

Sector	Factors that Increase RNG Demand	Factors that Decrease RNG Demand
Buildings	Zero-carbon new construction and other policies can increase RNG demand; voluntary demand	Heat pumps, electric water heaters, and induction stoves can reduce demand for gas and thus RNG
Industrial	RNG and other low-carbon fuels are used for high-temperature applications	Some processes may be cost-effectively electrified
Transportation	RNG demand may increase due to demand for clean transportation fuel	Improved economics for electric vehicles may drive higher adoption and displaces compressed natural gas vehicles

New industrial facilities are required to develop net-zero plans that align with the province's interim and 2050 goals.[149] Industrial customers often rely on natural gas for high-temperature applications or other special requirements; many of these currently lack cost-effective electrification options. RNG, hydrogen, or other low carbon fuels will likely serve these industrial applications.

Other sectors, such as transportation, may create additional sources of demand. Provincial decarbonization goals are paving the way for RNG to take up a larger share of the growing market for natural gas-fueled vehicles in British Columbia. RNG was approved for inclusion as a transportation fuel in 2019.[150] Shortly thereafter, the Low-Carbon Fuel Standard set a goal of achieving a 20% reduction in the carbon intensity of transportation fuels by 2030.[151] British

[148] Report authors' analysis.

[149] CleanBC, "Roadmap to 2030," Government of British Columbia, p. 50, https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

[150] The Coalition for Renewable Natural Gas, "RNG Now Part of British Columbia's Low Carbon Fuel Standard," April 23, 2019, https://www.rngcoalition.com/news/2019/4/23/rng-now-part-of-british-columbias-low-carbon-fuel-standard

[151] The Government of British Columbia, "LCFS Requirements," https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels/requirements

Columbia's TransLink responded with plans to reduce emissions by fueling 20% of its bus fleet with RNG by 2025.[152] As of 2021, there were 900 total natural gas-powered vehicles in BC.[153] Looking forward, recent declines in electric vehicle prices make them more cost-competitive alternatives for light-duty vehicles, which may limit the growth potential for light-duty RNG vehicles.[154] However, heavy transport is more difficult and costly to electrify and therefore is more likely to rely on low carbon fuels (*e.g.*, as compressed national gas, liquefied natural gas, or blended transportation fuels).

B. Demand for RNG from FEI's Existing and Potential Customers

To meet Clean BC GHG emissions requirements, FEI plans to reduce the GHG emissions associated with the company's gas distribution system by displacing existing natural gas supplies with less carbon-intensive RNG. Under FEI's proposed Renewable Gas Program, certain customers will receive baseline RNG supplies while other customers can opt in to receive RNG for a selected portion of their gas supply. The demand for RNG in British Columbia will vary by sector based on the price and availability of RNG and other gas decarbonization technologies. Some applications currently have relatively economically competitive alternatives to natural gas, such as air source heat pumps (ASHP) for heating. At the same time, other sectors have high-temperature or other special requirements that limit the decarbonization technologies available to them.

Total end-use energy demand in British Columbia is approximately 1,336 PJ per year in 2021 according to the Canadian Energy Regulator.[155] Of this, natural gas serves 402 PJ (30%) of total end-use energy demand.[156] Industrial customers, though fewer in number, account for the

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[152] TransLink, "Translink introduces Renewable Natural Gas to its bus fleet," April 25, 2019, https://www.translink.ca/news/2019/april/translink%20introduces%20renewable%20natural%20gas%20to%20its%20bus%20fleet

[153] Holly Quan, "B.C.'s natural gas-powered vehicle fleet is growing," *Canadian Association of Petroleum producers,* January 29, 2021, https://context.capp.ca/energy-matters/2021/itn-natural-gas-vehicles/

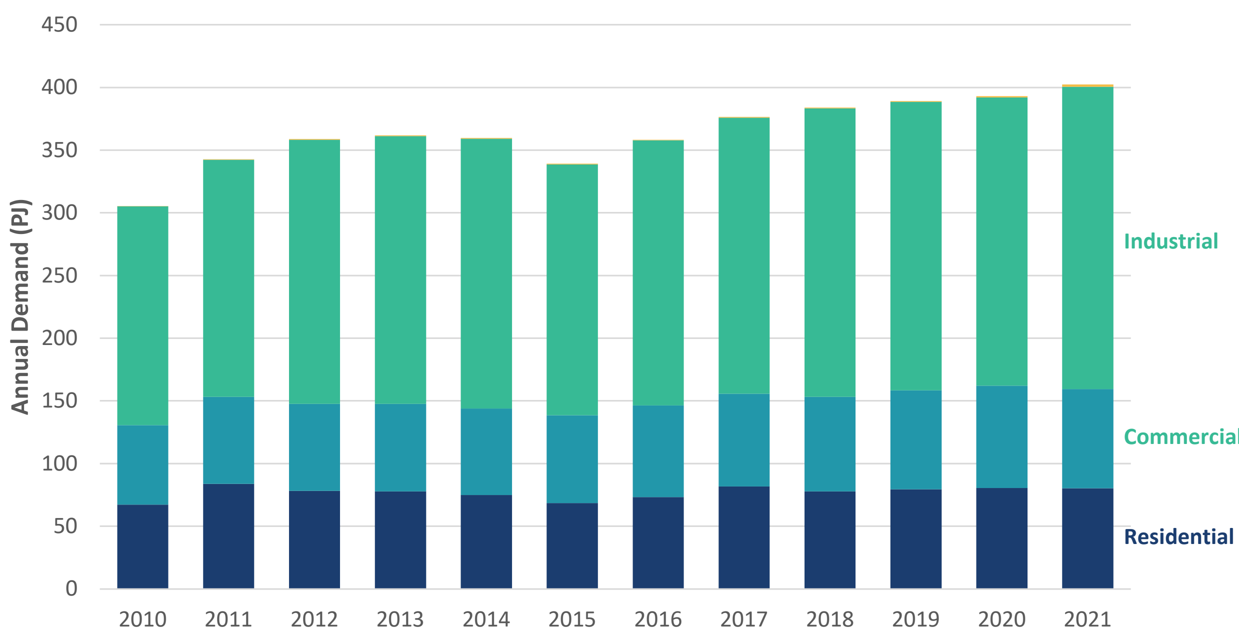
[154] Jacqueline Holman, "Global light duty EV sales to rise to 26.8 mil by 2030: Platts Analytics," *S&P Global*, February 16, 2022, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/021622-global-light-duty-ev-sales-to-rise-to-268-mil-by-2030-platts-analytics

[155] Canada Energy Regulator, "Canada Energy Future 2021 Data Appendices – End-Use Demand," https://apps.rec-cer.gc.ca/ftrppndc/dflt.aspx?GoCTemplateCulture&GoCTemplateCulture=en-CA. Note, based on "Current Policies" case for 2021.

[156] *Ibid.*

largest sectoral demand for natural gas.[157] Industrial demand has grown steadily over the past decade (with a modest decline around 2015; see Figure 13 below). Demand from residential and commercial customers is roughly the same, about 80 PJ in 2021.[158] There is some demand for natural gas from the transportation sector, though it is small at this point (about 2 PJ per year).

FIGURE 13: BRITISH COLUMBIA ANNUAL NATURAL GAS CONSUMPTION (PJ)[159]



FEI is the largest regulated natural gas distributor in British Columbia, serving over 135 communities in the province, and providing about 228 PJ of natural gas to its customers in 2021.[160,161] Unlike British Columbia as a whole, FEI's demand comes primarily from residential and commercial customers, accounting for 37% and 28% of FEI's total distribution volumes, respectively.[162] The industrial sector accounts for about 34% of annual demand. The remaining 1% of annual demand comes from Low-Carbon Transportation (LCT) and Global Liquefied

[157] *Ibid.*

[158] *Ibid*.

[159] *Ibid*.

[160] Fortis 2021 Annual Report, p. 63.

[161] *Id*. p. 22.

[162] FEI, "2022 Long Term Gas Resource Plan (LTGRP)," May 9, 2022, p. 4-3, https://docs.bcuc.com/Documents/Proceedings/2022/DOC_66503_B-1-FEI-2022-LongTermGasResourcePlan.pdf

Natural Gas (LNG) customers.[163] FEI's current annual demand is approximately 200 PJ, which FEI forecasts will remain nearly constant through 2030.[164]

To achieve the goal of displacing 15% of its natural gas supply with RNG established in the CleanBC Roadmap, FEI will need approximately 30 PJ of RNG supply by 2030.[165] However, to meet the annual emissions cap of 6 Mt of CO_2e, FEI estimates that the company will need between 45 PJ and 65 PJ of RNG by 2030.[166] By the end of 2022, FEI expected to purchase 4 PJ of RNG supply (less than 3% of its total annual natural gas demand).[167] To put this in perspective, we estimate that FEI's RNG supply will need to grow at an annual rate of 29%[168] from 2022 to 2030 to meet the 15% volume target, whereas meeting the emissions cap will require a higher annual growth rate of 35% to 42%.[169]

FEI currently sells 1.3 PJ of RNG to customers per year, approximately one-third of its annual supply purchases.[170] Of this, residential and commercial customers account for 0.1 PJ (8.5%) and 0.4 PJ (30.7%) of FEI's annual RNG sales, respectively. The remaining 0.8 PJ (60.8%) are purchased by transportation service customers and off-system sales customers.[171] FEI's current RNG supply (4PJ) would need to grow by 29% per year to reach 30 PJ by 2030 (15% blending target) and by 35-42% per year to reach 45-65 PJ by 2030 (2030 emission cap goal). In contrast, demand for RNG grew from 124 TJ in 2014 (after FEI's RNG program was made permanent)[172] to about 1.3 PJ in 2022, equivalent to an annual average growth rate of 34% per year. If growth

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163 *Ibid*.

164 *Id*. p. 4-12.

165 FEI Application, p. 29.

166 *Ibid*.

167 *Id.* p. 73 and Fortis BC Energy, Inc., "2022 Fourth Quarter Gas Cost Report," Tab 2, Page 1, https://www.fortisbc.com/about-us/corporate-information/regulatory-affairs/our-gas-utility/gas-bcuc-submissions/fortisbc-energy-inc.-gas-submissions/GasCost

168 Based on FortisBC's 2021 sales volume, a 15% volume target implies a sales target of 30 PJ. The 29% compound annual growth rate (CAGR) figure is based on a 2022 volume of 4 PJ and a 2030 volume of 30 PJ.

169 The lower band of the emissions cap is 45 PJ. For the total RNG volume to grow from 4 PJ in 2022 to 45 PJ in 2030, the compounded annual growth rate of the RNG volume would need to be 35%. The upper band of the emissions cap is 65 PJ. For the total RNG volume to grow from 4 PJ in 2022 to 65 PJ in 2030, the CAGR of the RNG volume would need to be 42%.

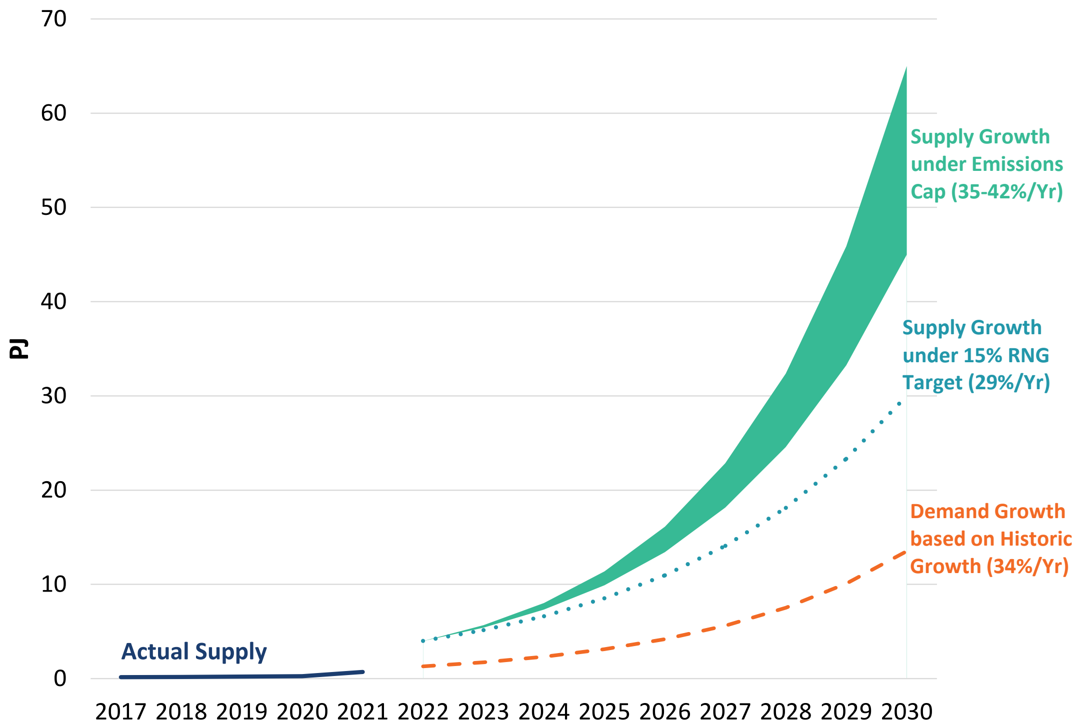
170 *Id.* 2022 Fourth Quarter Gas Cost Report, Tab 4, Page 3.

171 *Ibid*.

172 FortisBC Energy, "2014 Fourth Quarter Report on the Biomethane Variance Account (BVA) and Biomethane Energy Recovery Charge (BERC) (the 2014 Fourth Quarter BVA Report)," Tab 1, Page 3 https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/141022_fei-bva-2014-q4-report_ff.pdf

continues at this rate, demand for RNG will reach 14 PJ in 2030. The RNG supply and demand growth trajectories for FEI are shown in Figure 14 below.

FIGURE 14: FEI'S SUPPLY AND CUSTOMER DEMAND GROWTH TRAJECTORIES[173]



C. Demand for RNG between FEI's RNG Programs

FEI's proposed revision to the Renewable Gas Program will increase the demand for RNG in its service territory through several particular programs. These include a new Renewable Gas Connections Program (supply 100% RNG to new residential buildings for the life of the building); a new Renewable Gas Blend program (supply all sales customers with an increasing blend of RNG, starting with 1% by 2024); and a modified Voluntary Renewable Gas program (customers in all rate schedules can voluntarily purchase up to 100% RNG). The company forecasts that the RNG demand from these offerings will reach 30 PJ by 2030 (see Figure 15 below).

[173] Report authors' projections based on FEI data.

FIGURE 15: FORECASTED DEMAND FOR REVISED RENEWABLE GAS PROGRAM[174]

Renewable Gas Connections	11.8 PJ
Voluntary Renewable Gas	6.4 PJ
Renewable Gas Blend	11.8 PJ
Total	**30.0 PJ**

While each offering under the Renewable Gas Program is likely to increase the demand for RNG from current levels, the pace and extent of the demand increase will depend on the sector-specific drivers discussed above, as well as the relative economics of RNG for the customer.

The new Renewable Gas Connections Program is premised on serving new residential buildings that select gas service with 100% RNG. The structure of this new program insulates customers from RNG's higher cost by spreading the incremental cost across all sales customers, skewing the economics that new customers face. Per FEI's proposal, Renewable Gas Connections Program customers would be charged a Low Carbon Gas Charge (LCG Charge) equivalent to the rate other natural gas customers pay.[175] FEI forecasts that this program will account for about 11.8 PJ of its 2030 RNG demand; yet, residential demand now accounts for only 0.1 PJ of FEI's current RNG sales.[176] In British Columbia, more than 1,800 new residential buildings were constructed annually between 2012-2021, reflecting an annual growth rate of 5%.[177] New residential construction can be readily electrified with current technologies, such as heat pumps. However, the choice to install gas versus electric appliances in new construction will largely depend on local building codes and the costs facing customers. Vancouver City has already enacted a zero-emissions limit on new appliances, which will lend support to the adoption of electric heat pumps. The upfront cost of heat pumps can be significantly higher than gas-based appliances; however, the annual operating costs of heat pumps can be lower (when comparing electric to natural gas commodity costs).

For comparison, existing residential customers could enroll in the Voluntary Renewable Gas Program at a 100% blend and receive similar service to Renewable Gas Connections Program

174 FortisBC, Response to British Columbia Utilities Commission (BCUC) Information Request (IR) No. 2, Request 46.0, September 12, 2022, p. 4.

175 FEI Application, p. 2.

176 2022 Fourth Quarter Gas Cost Report, Tab 4, Page 3.

177 BC Housing, British Columbia's Monthly New Homes Registry Report, October 2022, https://www.bchousing.org/sites/default/files/media/documents/New-Homes-Registry-Report-October-2022.pdf. From Table 1: Registered New Homes. Estimates include both detached homes and homes in multi-unit buildings.

customers. FEI projects that demand from this program will grow to 6.4 PJ by 2030. The Voluntary Renewable Gas Program would pay the Biomethane Energy Recover Charge (BERC) rate reflecting a $7/GJ premium above the cost of natural gas.[178] As a result, the gas cost paid by a Voluntary customer would exceed that paid by a Connections customer, and the operating savings of a heat pump would be greater (though the installation costs for a heat pump retrofit may be higher than for a heat pump in a new building).

Lastly, all sales customers would be enrolled in FEI's Renewable Gas Blend program, which FEI states is necessary to achieve its GHG emissions reduction targets and to sell the large volumes of RNG that the company is acquiring.[179] Renewable Gas Blend customers will receive a 1% blend in 2024, which will increase afterwards, reflecting the supply in excess of Voluntary Renewable Gas and Renewable Gas Connections demand. All sales customers will be charged the new S&T LC rider that accounts for the under recovery of RNG supplies from FEI's other RNG programs.[180] Therefore, the demand from this program is a function of FEI's RNG blending goals and the pace required to reach those goals by 2030.[181] As increasing amounts of higher-priced RNG are blended into the gas supply, customers may choose to consume less gas (due to customers' demand sensitivity to rising supply prices). Longer-term, Renewable Gas Blend customers could similarly switch to alternative lower-cost forms of energy.

D. Demand for RNG from Other Utilities

As gas utilities across North America press ahead to reduce their GHG emissions in response to clean energy policies, many will rely on RNG as a key component of their decarbonisation strategies. For example, Énergir has set a target of 5% of its total gas supply to come from RNG

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[178] Fortis Energy Inc., "Cost of Gas Report for Q4 2022," p. 4 https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

[179] FEI Application, p. 96.

[180] *Id*. pp. 116-117.

[181] *Id*. p. 98.

by 2025, with the share increasing to 7% in 2028[182] and 10% by 2030.[183] According to the Canadian Gas Association, Canada's natural gas utilities have set an aspirational target of 5% RNG blended into natural gas streams by 2025, and 10% by 2030. Assuming the current growth rate, this target is equivalent to an annual demand of 413 PJ for RNG from Canadian natural gas utilities by the end of the decade.[184] Even if the 10% by 2030 target is applied to residential demand only, that translates to an annual demand for RNG of more than 64 PJ.

Similar developments are happening in the United States, where clean energy goals will drive the need for gas utilities to decarbonize their systems. A growing number of states have set goals to fully decarbonize their economies, and gas utilities operating in these states will need to significantly reduce their GHG emissions (see Figure 16 below). For instance, in response to California's goal to be 100% carbon neutral by 2045, SoCalGas has committed to delivering 20% RNG to its core customers by 2030.[185] Likewise, Washington Gas proposes in its Climate Business Plan to reduce GHG emissions in sourcing and supply by 31% relative to 2006 levels by facilitating the development of and access to non-fossil gas supply.[186] A major component of the utility's strategy involves increasing the RNG volume on its system from 0.5 PJ in 2025 to about 3 PJ in 2032, and 7 PJ in 2050. Several other gas utilities have established net zero goals, including Puget Sound Energy, Consolidated Edison Company, National Grid, and Xcel Energy.

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[182] Énergir, "Énergir welcomes the amendment to the Regulation respecting the quantity of renewable natural gas to be delivered by a distributor," *Newswire Canada*, August 31, 2022, https://www.newswire.ca/news-releases/energir-welcomes-the-amendment-to-the-regulation-respecting-the-quantity-of-renewable-natural-gas-to-be-delivered-by-a-distributor-800300647.html.

[183] Matthew Veazey, "Archaea Ups Canada RNG Sales with Long-term Énergir Deal," *Natural Gas Intelligence*, August 19, 2022, https://www.naturalgasintel.com/archaea-ups-canada-rng-sales-with-long-term-energir-deal/.

[184] Assuming 4,125 PJ total natural gas demand. *See* Canada Energy Regulator, "Canada Energy Future 2021 Data Appendices – End-Use Demand," https://apps.rec-cer.gc.ca/ftrppndc/dflt.aspx?GoCTemplateCulture&GoCTemplateCulture=en-CA. Note, based on "Current Policies" case for 2021.

[185] SoCalGas, "Aspire 2045: Sustainability and Climate Commitment to Net-Zero," March 2021, https://www.socalgas.com/sites/default/files/2021-03/SoCalGas_Climate_Commitment.pdf. For reference, SoCalGas delivered 14 BCF of RNG via its pipeline system in 2022. *See* https://newsroom.socalgas.com/press-release/2021-brings-more-renewable-natural-gas-into-socalgas-pipelines.

[186] Washington Gas, "Natural Gas and its Contribution to a Low Carbon Future," March 2020, https://washingtongasdcclimatebusinessplan.com/wp-content/uploads/2020/04/Climate-Business-Plan-March-16-2020-FOR-WEB.pdf

FIGURE 16: SUMMARY OF U.S. STATE CLIMATE AND ENERGY COMMITTMENTS[187]

State	Decarbonization goals and targets
Arizona	50% below 2000 levels by 2040
California	100% by 2045
Colorado	90% below 2005 levels by 2050
Connecticut	80% below 2001 levels by 2050
Washington D.C.	50% below 2006 levels by 2032; 80% by 2050
Florida	80% below 1990 levels by 2050
Hawaii	100% by 2045
Illinois	60% below 1990 levels by 2050
Louisiana	100% by 2050
Maine	100% by 2045
Maryland	95% below 2006 levels by 2050
Massachusetts	100% below 1990 levels by 2050
Michigan	100% by 2050
Minnesota	80% below 2005 levels by 2050
Montana	100% by 2050
Nevada	100% by 2050
New Hampshire	80% below 1990 levels by 2050
New Jersey	80% below 2006 levels by 2050
New York	100% by 2050 (85% below 1990 levels and offset 15%)
Oregon	80% below 1990 levels by 2050
Pennsylvania	80% below 2005 levels by 2050
Puerto Rico	100% by 2050
Rhode Island	100% below 1990 levels by 2050 (80% below 1990 levels by 2040)
Vermont	80% below 1990 levels by 2050
Virginia	100% by 2045
Washington	100% by 2050

Driven by clean energy policy and utilities' net zero goals, demand for RNG is likely to increase substantially in the future. If a 10% by 2030 target were applied to every natural gas utility in North America, this would lead to a total 2030 RNG demand of 2,300 PJ (see Figure 17

187 Berkeley California-China Climate Institute, "States Climate Action Map," https://ccci.berkeley.edu/states-climate-action-map

below).[188] For comparison, the total North American RNG supply today is about 84 PJ.[189] It is very unlikely that combined RNG demand in North America will be this high in 2030, as it would require rapid growth in demand for RNG across each sector. A 2022 report from Bates White indicates that transportation demand for RNG, the primary driver of US demand for RNG, will grow by less than 10% from 2021 to 2025.[190] [191]

[188] See U.S. Energy Information Administration, "Natural gas explained: Use of natural gas," https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php and Statistics Canada, "Supply and disposition of natural gas, monthly (data in thousands)," Table 25-10-0055-01, November 7, 2022, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510005501.

[189] In 2021, US renewable natural gas production was 78 GJ. See Coalition for Renewable Natural Gas, "Economic Analysis of the US Renewable Natural Gas Industry", https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/61ba25c889b4fb7566404e6c/1639589328432/RNG+Jobs+Study.pdf. In 2021, Canada's renewable natural gas production was 5.95 PJ. See Canadian Gas Association, "Canada's Growing Renewable Natural Gas Supply," https://www.cga.ca/energy-magazine-post/canadas-growing-renewable-natural-gas-supply/.

See U.S. Energy Information Administration, "Natural gas explained: Use of natural gas," https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php and Statistics Canada, "Supply and disposition of natural gas, monthly (data in thousands)," Table 25-10-0055-01, November 7, 2022, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510005501.

[190] Bates White, "Renewable Natural Gas: Transportation Demand," p. 37, https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/626c52a437caa619cddf533b/1651266213212/Bates+White+RNG+Transpo+Demand+Study+Feb+2022+plus+April+2022+Supplement.pdf.

[191] In 2021, US renewable natural gas production was 78 GJ. See Coalition for Renewable Natural Gas, "Economic Analysis of the US Renewable Natural Gas Industry", https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/61ba25c889b4fb7566404e6c/1639589328432/RNG+Jobs+Study.pdf. In 2021, Canada's renewable natural gas production was 5.95 PJ. See Canadian Gas Association, "Canada's Growing Renewable Natural Gas Supply," https://www.cga.ca/energy-magazine-post/canadas-growing-renewable-natural-gas-supply/.

FIGURE 17: POTENTIAL DEMAND FOR RNG UNDER VARIOUS TARGETS[192]

DEMAND FOR RNG (PJ) 2021			
Jurisdiction	Current	10%	15%
FEI	4	24	36
British Columbia	4	28	42
Canada		456	684
Canada + US		2,350	3,525

Note: Based on natural gas consumption in 2021.

DEMAND FOR RNG (PJ) 2030			
Jurisdiction	2030	10%	15%
FEI	30	20	**30**
British Columbia	30	36	**53**
Canada		408	**611**
Canada + US		2,300	**3,450**

Note: Based on forecasted natural gas consumption in 2030.

E. Demand for RNG from Vehicle Transportation and Industrial Sectors

VEHICLE TRANSPORTATION SECTOR

While RNG may face competition from electrification for building decarbonization, RNG price remains competitive relative to diesel and gasoline, making it an economically attractive fuel option in the transportation sector. Indeed, RNG is well positioned to displace natural gas for use in the transportation sector, as governments and regulators increase their efforts to decarbonize this sector. Such displacement is already in progress in California where, as of

[192] Report authors' analysis based on data from Canada Energy Regulator and U.S. Energy Information Administration, "Natural Gas Explained", https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php. For our calculations, we include natural gas consumption from the residential, commercial and industrial sectors but exclude natural gas consumption from the electric power and transportation sectors.

2020, 92% of all on-road fuel used in natural gas vehicles was RNG.[193] A major driver of the transition is California's LCFS program, which offers financial incentives for lowering the carbon intensity of fuels. By some measures, RNG fuel has the lowest carbon intensity of any on-road motor fuel.[194] More broadly, the U.S. EPA's Renewable Fuels Program (RFS) mandates the blending of alternative fuels (such as RNG) into transportation fuels to achieve specific GHG emission reductions. As of October 2021, RNG fueled 64% of the existing NGVs nationwide, a 13% increase over 2020 volumes.[195] RNG use as a transportation fuel has increased 234% over the last 5 years.

The BC Low-Carbon Fuel Standard (BC-LCFS) could facilitate a similar transition to low carbon-intensity transportation fuels like RNG. The BC-LCFS implements two primary requirements aimed at reducing BC's reliance on non-renewable fuels. First, the regulation sets increasingly stringent carbon intensity reduction targets for both diesel and gasoline, falling from 84.08 and 78.20 gCO_2e/MJ in 2022 to 75.81 and 70.51g CO_2e/MJ in 2030 and beyond, respectively.[196] Second, the legislation requires an annual average renewable content of 5% in gasoline and 4% in diesel.[197]

More broadly, there is significant growth potential for RNG as the clean fuel option in the transportation sector, especially in the U.S. According to industry trade group NGV Americas, there are over 23 million natural gas vehicles (NGVs) on the road across the world, including over 175,000 in the United States.[198] High-mileage medium- and heavy-duty fleets are the primary consumers of RNG in the transportation sector, with transit agencies, school districts, and other entities rapidly switching to natural gas powered fleets. Over 11,000 transit buses,

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193 The Coalition for Renewable Natural Gas, "California fleets fueled with RNG achieve carbon-negativity," *Biomass Magazine*, June 2, 2021, https://biomassmagazine.com/articles/18043/california-fleets-fueled-with-rng-achieve-carbon-negativity

194 Daniel Gage, "RNG as Transportation Fuel On-Road Volume Grows to 39%," May 7, 2020, https://www.act-news.com/news/rng-as-transportation-fuel-on-road-volume-grows-to-39/ Note, the carbon intensity is adjusted by the energy economy ratio, which reflects the efficiency of a fuel relative to a reference fuel, and the efficiency of the fuel per passenger mile.

195 The Coalition for Renewable Natural Gas, "Decarbonizing Transportation with Renewable Natural Gas," https://ngvamerica.org/wp-content/uploads/2022/05/NGV-RNG-Decarbonize-2022-5.2.22.pdf

196 British Columbia, "Renewable and Low Carbon Fuel Requirements Regulation" B.C. Reg. 394/2008, Part 2.1, https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/394_2008

197 *Ibid*, Part 2.

198 Blue Flame Alliance, "Natural Gas Vehicle Total Reaches 175,000 in the US", July 27, 2021, https://blueflamealliance.com/natural-gas-vehicle-total-reaches-175000/.

17,000 refuse trucks, and 5,500 school buses run on natural gas across the U.S. today.[199] The cost advantage and positive public perception are cited as key benefits to making the switch. While Canadian numbers are much smaller, RNG can play an important role in Canada's transportation sector as well. There are about 12,500 NGVs in Canada, most of which are medium-duty vehicles (MDVs) and heavy-duty vehicles (HDVs).[200]

INDUSTRIAL SECTOR

The industrial sector remains one of the most difficult-to-decarbonize sectors, in part due to the diversity of industrial needs and applications. Electrification as a strategy is not straightforward in many cases; electrified industrial processes are currently more expensive than existing technologies, and many processes are not currently amenable to electrification at all. This dynamic creates an opportunity for RNG to play a key role in replacing natural gas as an industrial fuel and as a primary feedstock.[201]

Four major industries contribute about 45% of total industrial sector emissions: cement, steel, ammonia, and ethylene.[202] Decarbonization through means other than RNG would require a dramatic restructuring of each of these industries. Using low-carbon hydrogen or electricity would require extensive and expensive retrofits (though for some applications, biomass might replace fossil fuels, *e.g.*, to fire cement kilns).

Demand for RNG will likely come from industrial customers with corporate climate and energy goals or industrial customers obligated to reduce emissions through regulatory or legislative mechanisms. Currently, there are limited specific policies to motivate decarbonization in the industrial sectors. For example, the Roadmap to 2030 only requires new large industrial facilities to have plans to achieve net-zero by 2050. No similar requirements were established for existing industrial facilities or new small- to medium-sized industrial facilities.

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[199] NVG America, https://ngvamerica.org/vehicles.

[200] Natural Resources Canada, "Natural Gas Use in the Medium and Heavy-Duty Vehicle Transportation Sector", June 2019, https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/oee/pdf/transportation/alternative-fuels/resources/pdf/NRCan_NGRoadmap_e_WEB.pdf.

[201] Resources for the Future, "Electrification 101," https://www.rff.org/publications/explainers/electrification-101/

[202] McKinsey & Company, "Decarbonizing industry will take time and money-but here's how to get a head start," December 14, 2018, https://www.mckinsey.com/capabilities/sustainability/our-insights/sustainability-blog/decarbonizing-industry-will-take-time-and-money-but-heres-how-to-get-a-head-start

F. Risk Factors that May Impose Challenges for FEI to Meet Existing and Future RNG Demand

One of the primary risks related to FEI's ability to meet its anticipated near-term and longer-term RNG demand is the availability of RNG. In the near term, RNG demand is expected to grow considerably from its current low levels due not only to FEI's RNG plans but also to the plans of other gas systems, both in Canada and in the U.S. As discussed above, a number of regional gas utilities have explicit plans to blend RNG for some or all of their customers, or to offer RNG on a voluntary basis to customers. Beyond demand from gas distribution companies, there may be additional RNG demand from the transportation and industrial sectors as they decarbonize.

Aggregate RNG demand may outpace the limited RNG supplies, maintaining upward pressure on RNG prices and potentially creating shortages in the medium- to long-term. Based on available data, RNG supply costs range from $10/GJ to $50/GJ depending on the feedstock and production region (see Figure 10 above). High demand for RNG coupled with regulatory price caps and credit prices suggest that RNG prices may be in the upper half of that range. Higher price signals may induce greater investments in RNG development, though expanding RNG production capability will require time. In addition, there are limits to how much RNG can be produced through conventional methods, and without significant technological breakthroughs, RNG supply is unlikely to meet the growing demand for RNG in the future.

Carbon offsets may serve as an inexpensive tool for FEI to meet the company's and the province's clean energy requirements, but reliance on carbon offsets is not without risks. High levels of supply in the carbon market indicate that short-term prices will continue to be low (lower than RNG on a carbon abatement basis). However, the lack of measurement, reporting, and verification standards as well as the lack of regulatory oversight mean that carbon offsets do not always achieve the intended goal of reducing atmospheric GHG.

In the longer term, beyond the questions of whether RNG production infrastructure can be developed quickly enough, there are limits to the availability of the biological feedstocks needed to produce RNG. While there are a number of potential biological sources – crop and forest waste, food waste and wastewater, landfills – their total quantity is limited, and is well below what would be required to replace a significant share of total natural gas use.

Related to the availability risks is the potential cost risk; the combination of limited availability and higher production cost can create cost risk customers. This risk may be avoidable for voluntary customers, but is not avoidable for sales customers subject to blending requirements, or in the case of FEI's Connections and Voluntary programs, for general sales customers who must bear a significant share of voluntary RNG program costs even though they did not choose those programs.

IV. Price Elasticity of Demand for Conventional Natural Gas and Renewable Natural Gas

The demand for RNG under FEI's proposed Renewable Gas program will depend on upon customers' willingness to pay a higher commodity price, and may be particularly relevant to voluntary customers. RNG is more expensive than natural gas due to its production methods and lower economies of scale. British Columbia authorized FEI to purchase RNG at prices up to a cap of $31/GJ for contracts signed after March 2021, increasing with inflation thereafter.[203] Currently, FEI can charge voluntary customers a $7.00/GJ premium above the cost of natural gas to recover the cost of the higher RNG supplies, which can substantially increase customers' bills. FEI's commodity cost for RNG is $14.718/GJ for short-term contracts and $13.718 for long-term contracts; these are approximately twice FEI's commodity cost for natural gas ($5.159/GJ + $2.559/GJ in carbon tax).[204] For Voluntary Renewable Gas customers, depending on the blending percentage, this translates to a monthly bill increase of $2 to $40 (residential), $8 to $151 (small commercial rate 2), and $84 to $1,678 (large commercial rate 3) according to FEI.[205]

The higher prices can affect customers' demand in various ways. One way is that customer may reduce their overall energy demand in response to higher gas prices; the amount will depend on how sensitive they are to the pricing difference. Another way is that customers will seek alternative technologies to satisfy their energy demands (*e.g.*, natural gas, ASHPs, etc.). On the other hand, some customers may be willing to pay more for RNG because of the associated environmental benefits. Each of these factors will have important implications for the level of participation in the various components of FEI's proposed Renewable Gas Program, the amount of contracted RNG supplies, and ultimately the success of achieving the Roadmap to 2030's goals.

[203] FEI Application, p. 38.

[204] Fortis Energy Inc., "Cost of Gas Report for Q4 2022," p. 4 https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1 and British Columbia Utilities Commission, "FortisBC Energy Inc. 2022 Fourth Quarter Gas Cost Report and Rate Changes effective January 1, 2023 for the Mainland and Vancouver Island Service Area, and the Fort Nelson Service Area," Order Number G-347-22, December 1, 2022, https://www.ordersdecisions.bcuc.com/bcuc/orders/en/521385/1/document.do

[205] FortisBC, "How much does Renewable Natural Gas cost?" https://www.fortisbc.com/services/sustainable-energy-options/renewable-natural-gas/how-much-does-renewable-natural-gas-cost

A. The Impact of RNG Price on RNG Demand

Simply put, if the price of RNG is too high, customers will be less willing to consume it, given a choice. This effect will be most obvious in the Voluntary RNG and the RNG Connections Programs, but will also materialize in the Renewable Gas Blend Program. The magnitude of this effect depends upon the price elasticity of demand for RNG. A good is considered "elastic" if demand for that good is more sensitive to changes in price or "inelastic" if demand is less sensitive to price changes.[206] In general, energy is considered an inelastic good in the short-run because of the central role that energy plays in our lives – it can be considered a necessity, and consumption responses are often limited to behavioral changes (e.g., lowering the thermostat). Over the longer term, however, customers do have options to reduce their energy consumption (energy efficiency improvements, switching to a lower blending percentage in the case of RNG, etc.) or switching to a substitute form of energy (converting from natural gas heat to electric heat).

Recent studies have measured the price elasticity of demand for natural gas in the residential and commercial sectors.[207] In 2018, Auffhammer and Rubin calculated residential natural gas demand elasticities using a sample of approximately 300 million utility bills in California.[208] The study found the average price elasticity for residential gas customers in California ranges from negative 0.17 to negative 0.23, meaning that a 1% increase in natural gas prices would lead to a 0.17% to 0.23% decrease in natural gas demand. A similar study in 2017 found the short-term elasticity for natural gas was negative 0.18.[209] These low elasticities indicate that customers are essentially captive for energy use in the near-term. For comparison, the price elasticity of demand for food and non-alcoholic beverages ranges between 0.27 to 0.81 in absolute terms,[210] and the price elasticity of motor gasoline ranges from negative 0.2 to negative 0.4 in

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206 A good is considered inelastic when the absolute value of its own price elasticity is less than 1.

207 We are not aware of any studies estimating the price elasticity of demand for natural gas in the industrial sector.

208 Auffhammer and Rubin, "Natural Gas Price Elasticities and Optimal Cost Recovery Under Consumer Heterogeneity: Evidence from 300 million natural gas bills," January 2018, https://haas.berkeley.edu/wp-content/uploads/WP287.pdf.

209 Labandeira X, Labeaga JM, Lopez-Otero X, 2017. A meta-analysis on the price elasticity of energy demand. Energy Policy 102: 549-568.

210 Andreyeva T, Long MW, Brownell KD, "The Impact of Food Prices on Consumption: A Systematic Review of Research on the Price Elasticity of Demand for Food," American Journal of Public Health, February 2010, 100: 216-222. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2804646/pdf/216.pdf

the short term.[211] However, over the longer-term customers become more sensitive to fluctuations in price as they have options to pursue alternative energy sources (this is most applicable to FEI's opt-in RNG programs). The 2017 study found the long-term elasticity of demand for natural gas increased to -0.6.[212] The U.S. Energy Information Administration (EIA) relies on similar elasticity values in the National Energy Modeling System (NEMS) to produce the Annual Energy Outlook (see Figure 18 below).[213]

FIGURE 18: OWN-PRICE ELASTICITY – EIA AEO

	Short Run		Long Run	
	Year 1	Year 2	Year 3	Year 30
Residential				
Electricity	-0.13	-0.22	-0.26	-0.50
Natural Gas	-0.08	-0.13	-0.15	-0.23
Distillate Fuel	-0.09	-0.16	-0.19	-0.24
Commercial				
Electricity	-0.08	-0.13	-0.15	-0.18
Natural Gas	-0.03	-0.18	-0.25	-0.28
Distillate Fuel	-0.13	-0.22	-0.26	-0.30

Only in recent years has RNG played a role in fully or partially displacing customer's natural gas supplies. As such, we are not aware of peer-reviewed academic studies that estimate the price elasticity of RNG. The current body of evidence primarily comes from utilities with RNG programs. For example, FEI conducted a survey of current and potential FEI Renewable Gas Program customers, where the company evaluated the willingness of potential Voluntary Renewable Gas Customers to choose various blending percentages, based on a given price

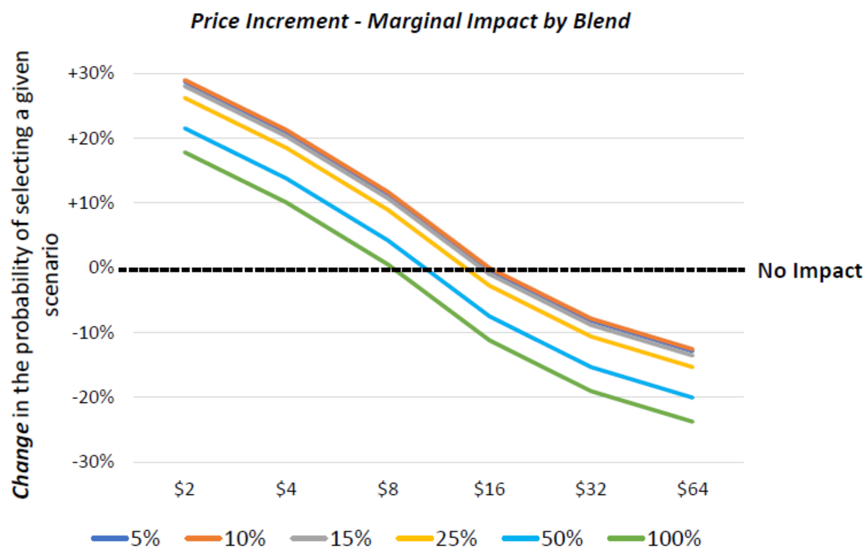
[211] U.S. Energy Information Administration, "Gasoline prices tend to have little effect on demand for car travel," December 2014, https://www.eia.gov/todayinenergy/detail.php?id=19191

[212] Labandeira X, Labeaga JM, Lopez-Otero X, 2017. A meta-analysis on the price elasticity of energy demand. Energy Policy 102: 549-568.

[213] U.S. Energy Information Administration, "Price Elasticity for Energy Use in Buildings in the United States," January 2021, p. 3, https://www.eia.gov/analysis/studies/buildings/energyuse/pdf/price_elasticities.pdf

increment above the cost of natural gas.[214] The results of the study are replicated graphically in Figure 19 below.

FIGURE 19: PRICE INCREMENT – MARGINAL IMPACT BY BLEND
(Replication of FEI Figure in Appendix B-1)



Generally, the graphic shows that at an RNG premium below $8, participants are willing to pay for RNG blending up to a maximum of 100%. Between $8 and approximately $16 participants changed from "more likely" to "less likely" to pay for each RNG blend amount. The higher blending shares of 100% and 50% have lowest switching points, whereas blends 25% and below are tightly clustered around $16. Beyond $16, participants were less willing to pay for any RNG blending amount. FEI and Innovative Research Group summarized their conclusion as:

> *"The results show that customers are sensitive to the premium paid for RNG over conventional gas. As the cost for RNG increases – especially due to a higher premium over conventional gas, but also due to a higher blend – customers' reported likelihood of signing up declined consistently."*[215]

[214] FEI Application, Appendix B-1.

[215] *Ibid*.

This finding is further supported by a change in customer enrollment patterns for FEI's Renewable Gas Program. According to FEI, following the BCUC's 2013 Decision, the BERC rate increased from $11.696/GJ to $14.414/GJ for customers voluntarily enrolled in the program.[216] The new rate was approximately $11/GJ above the cost of gas at that time.[217] As the rates increased, the number of customers enrolling declined. At the risk of not recovering RNG supply costs, FEI reset the BERC to $7.00/GJ (the Short Term BERC Rate).[218]

FEI and Innovative Research Group conducted a second survey to evaluate FEI's Renewable Connections Program. The survey asked participants their level of support for requiring 100% RNG purchase for new buildings based on different RNG prices ($4/GJ, $8/GJ, $16/GJ, or $32/GJ which equates to $24, $48, $96, and $192 per month, respectively).[219] The survey results are replicated in Figure 20 below. The study found that the level of support for a 100% RNG requirement in new buildings declines after $4/GJ. This finding broadly supports the findings from the Voluntary Renewable Gas Program—that beyond a certain premium (in this case $48 per month), the willingness to enroll in a 100% RNG blend turns negative.

FIGURE 20: PRICE SENSITIVITY FOR REQUIRING RNG IN NEW BUILDINGS[220]
(Replication of FEI Figure in Appendix B-1, p. 14)

BC Adults

Price Shown	Pre-post change in net support
Additional **$24** per month [n=389]	+11%
Additional **$48** per month [n=362]	-11%
Additional **$96** per month [n=367]	-14%
Additional **$192** per month [n=382]	-29%

RNG Customers

Price Shown	Pre-post change in net support
Additional **$24** per month [n=121]	+4%
Additional **$48** per month [n=134]	0%
Additional **$96** per month [n=127]	-15%
Additional **$192** per month [n=119]	-53%

Small Business Customers

Price Shown	Pre-post change in net support
Additional **$113** per month [n=44]	+17%
Additional **$227** per month [n=42]	-14%
Additional **$453** per month [n=41]	-19%
Additional **$907** per month [n=48]	-30%

*Note: Results in **blue**/**red** significant at 95% confidence

[216] FEI Application, p. 14 and British Columbia Utilities Commission, "Order – An Application by FortisBC Energy Inc. regarding its 2013 Fourth Quarter Cost Report and Rate Changes effective January 1, 2014 for Lower Mainland, Inland and Columbia Service Areas," November 28, 2013, p. 2.

[217] *Ibid*.

[218] FEI Application, p. 14.

[219] It is not clear from the survey who would pay for the cost of RNG. As proposed in the Renewable Gas Connection program, RNG costs would be socialized.

[220] FEI Application, Appendix B-1, p. 14.

Given the above information about customer's elasticity of demand for natural gas and RNG, it is important to consider the potential bill impacts from FEI's RNG blending goals. At the current price cap for renewable natural gas ($31/GJ), a 15% RNG supply blend would result in a 58% increase in the annual gas supply costs for both residential and commercial customers.[221] Based on a short-term price elasticity of -0.18 for natural gas consumption,[222] this would reduce annual natural gas use by 8%. The combined effect of the increase in gas supply cost and fall in use would increase annual natural gas bills by 45%. On a monthly basis, this would imply a bill increase of $25/month for residential and $170/month for commercial.[223] This suggest that, barring a significant change in customer's price sensitivity, FEI's customer demand would likely decrease their gas demand or switch to alternative forms of energy in the longer-term.

However, as discussed above, competition for the limited available RNG supplies will likely put upward pressure on RNG supply prices in the medium-to long-term. Our analysis shows that with a 50% higher acquisition cost cap ($46.5/GJ) and the 15% RNG supply blend, residential and commercial customers would see their gas supply costs increase by 88%. The increase in gas supply costs would reduce natural gas use by 11%. The combined effect of the increase in gas supply cost and fall in use would increase annual bills by 68%. On a per month basis, this would imply a bill increase of $38/month for residential and $252/month for commercial. FEI also indicated that it would need to purchase considerably more RNG supplies beyond the 15% to achieve the emissions cap in the Roadmap to 2030. If the current acquisition cost cap ($31/GJ) is maintained, and the supply blend doubled to 30%, both customer segments would see a 87% increase in their bills. These scenarios would lend further pressure to FEI's ability to achieve its RNG volume goals. The bill impacts of these illustrative price caps and blend caps are summarized in Figure 21 below.

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[221] The total RNG acquisition cost is recovered through two mechanisms: (1) FEI's sales of a portion of the acquired RNG to customers who opt-in to the voluntary program and (2) A rider that all customers much pay to recover the remaining acquisition cost. This rider (which is in $/GJ) is calculated by dividing the unallocated acquisition cost by the total natural gas sales volume. We then calculate the percentage increase in the gas supply costs by dividing the rider cost (in $/GJ) over the current natural gas supply cost.

[222] Labandeira X, Labeaga JM, Lopez-Otero X, 2017. A meta-analysis on the price elasticity of energy demand. Energy Policy 102: 549-568.

[223] We base these bill impacts on an annual residential consumption of 87 GJ, an annual commercial consumption of 579 PJ and an average all-in natural gas price of $7.72/GJ. Source: Statistics Canada, "Canadian monthly natural gas distribution," https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2510005901.

FIGURE 21: CUSTOMER GAS SUPPLY COST IMPACT SCENARIO ANALYSIS[224]

Price Cap	RNG Supply Blend Cap	Annual Bill Increase			
		Residential		Commercial	
		$	%	$	%
Current Price Cap ($31/GJ)	Current Supply Blend Cap (15%)	$305	45%	$2,035	45%
50% Increase in Price Cap ($47/GJ)	Current Supply Blend Cap (15%)	$453	68%	$3,024	68%
Current Price Cap ($31/GJ)	100% Increase in Supply Blend Cap (30%)	$584	87%	$3,896	87%
50% Increase in Price Cap ($47/GJ)	100% Increase in Supply Blend Cap (30%)	$865	129%	$5,767	129%

B. Considerations For Differences In Customer Factors Such As (Not Limited To) Environmental Consciousness And Socio-Economic Status

The above studies show that customers are willing to pay some modest premium over natural gas to receive a portion of their gas supply as RNG. The willingness to pay a premium stems from the environmental characteristics of the supply and customers' interest in reducing their GHG footprint.[225] Numerous studies have addressed the question of customers' willingness to pay extra for green energy sources. These studies are informative in providing support for these premiums in a broader range of contexts.

CERE - RESIDENTIAL DEMAND FOR RENEWABLE ENERGY: RESULTS FROM WEB SURVEY

In a survey to determine the willingness to pay of customers located in OECD-10 countries to use only renewable energy, researchers found that 43% of Canadian households surveyed would be willing to a pay premium for renewable energy, 33% would not be willing to pay any premium, and 24% reported that they did not know.[226] Further, 23% of Canadian households

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224 Report authors' analysis. We assume that the average residential customer in British Columbia consumes 87 GJ per year and the average commercial customer consumes 579 GJ per year. We also assume an annual sales volume of 155,133 TJ. Source: Statistics Canada, "Canadian Monthly Natural Gas Distribution," https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2510005901.

225 FEI Application, Appendix B.

226 Bengt Kriströ, "Residential Demand for Renewable Energy: Results from the web-survey," CERE, https://www.oecd.org/env/consumption-innovation/43039188.pdf. OECD-10 countries refer to Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States.

reported that they would be willing to pay a premium of less than 5% on their annual bills, while 16% of Canadian households reported that they would be willing to pay a premium of between 5% and 15% on their annual bills. The average Canadian surveyed indicated that they would be willing to a pay premium of 6.8% for renewable energy.

YALE PROGRAM ON CLIMATE CHANGE COMMUNICATION – WHO IS WILLING TO PAY MORE FOR RENEWABLE ENERGY?

A team of Yale researchers in 2019 investigated the common characteristics among Americans who are willing to pay more for renewable energy, and how much more they are willing to pay. [227] The survey results found that 47% of American adults are willing to pay an additional $22 (US$16.25) per month for renewable energy.

STEVENS INSTITUTE OF TECHNOLOGY – GREEN ENERGY PERCEPTIONS AND USAGE

The Stevens Institute of Technology conducted a poll of American adults to examine their view on a wide range of green energy-related issues.[228] The poll found that the median respondent was willing to pay 10% more in their utility bills for green energy. As part of the poll, respondents sorted themselves into four categories of green energy perception: Green Energy Evangelists, Green Energy Promoters, Green Energy Passives and Green Energy Detractors. Respondents describing themselves as 'Evangelists' expressed were the most likely to seek out green energy technologies for personal use in their everyday life and expressed the highest willingness to pay for green energy. The median 'Evangelist' was willing to pay 19% more in their utility bills for green energy.

NREL – COMMERCIAL AND INDUSTRIAL WILLINGNESS TO PAY FOR RENEWABLE ELECTRICITY

A National Renewable Energy Laboratory (NREL) study examined customers' willingness to pay for renewable electricity. [229] The study found that 61% of commercial customers surveyed were at least somewhat likely to pay more for electricity from renewable energy sources on a voluntary basis. Additionally, 41% of industrial respondents were willing to pay 5% or more for

[227] Yale Program on Climate Change Communication, "Who is willing to pay more for renewable energy?" July 16, 2019, https://climatecommunication.yale.edu/publications/who-is-willing-to-pay-more-for-renewable-energy/

[228] Morning Consult Stevens Institute of Technology, "Green Energy Perceptions and Usage," June 2022, https://assets.stevens.edu/mviowpldu823/5A5SnXSK3xveWHaPnYdbO6/a46b811adcdaea70c52c00ea73875f1b/TechPulse_Green_Energy.pdf

[229] Barbara C. Farhar, "Willingness to Pay for Electricity from Renewable Resources: A Review of Utility Market Research," NREL, July 1999, https://www.nrel.gov/docs/fy99osti/26148.pdf

greener electricity resources.[230] (We note that commercial and industrial customers' willingness to pay has likely increased since this study was conducted in 1999 due to recent trends in corporate climate commitments and Environmental, Social, Governance investors.[231])

Applying the above study results to the average household natural gas bill in British Columbia, customers would have an implied willingness to pay a premium for non-fossil gas of approximately $4/month to $22/month (see Figure 22 below). This figure is based on an assumed household natural gas consumption of 87 GJ/year[232] and an average natural gas price of $7.72/GJ.[233] This premium is lower on a per-GJ basis than $7/GJ that FEI charges to Voluntary RNG Customers. However, the implied monthly bill increase is consistent with the bill impact forecasted by FEI for a 10% to 50% RNG blend under the Voluntary Renewable Gas program.[234]

FIGURE 22: IMPLIED WILLINGNESS TO PAY FOR NON-FOSSIL GAS

STUDY	PREMIUM	IMPLIED NON-FOSSIL GAS PREMIUM ($/MONTH)
CERE / OECD-10	6.8% (CANADA)	$3.74/MONTH
YALE	US$16.25/MONTH	$22/MONTH
STEVENS INSTITUTE OF TECHNOLOGY	10%	$5.51/MONTH
NREL (C&I CUSTOMERS)	US$5/MONTH[235]	$7/MONTH

[230] *Ibid.*

[231] RMI, "What we're learning about corporate climate ambition," November 29, 2021, https://rmi.org/what-were-learning-about-corporate-climate-ambition/ and S&P Global, "Key trends that will drive the ESG agenda in 2022," January 31, 2022, https://www.spglobal.com/esg/insights/featured/special-editorial/key-esg-trends-in-2022

[232] Statistics Canada, "Household energy consumption, Canada and provinces," Table 25-10-0060-01, May 2, 2022, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510006001.

[233] Fortis Energy Inc., "Cost of Gas Report for Q4 2022," https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

[234] FEI, "How much does Renewable Natural Gas cost?" https://www.fortisbc.com/services/sustainable-energy-options/renewable-natural-gas/how-much-does-renewable-natural-gas-cost

[235] This premium reflects Commercial and Industrial customers' willingness to pay for renewable electricity.

C. Consideration for Differences between Customers in a Voluntary vs Non-Voluntary Opt-in Program for RNG

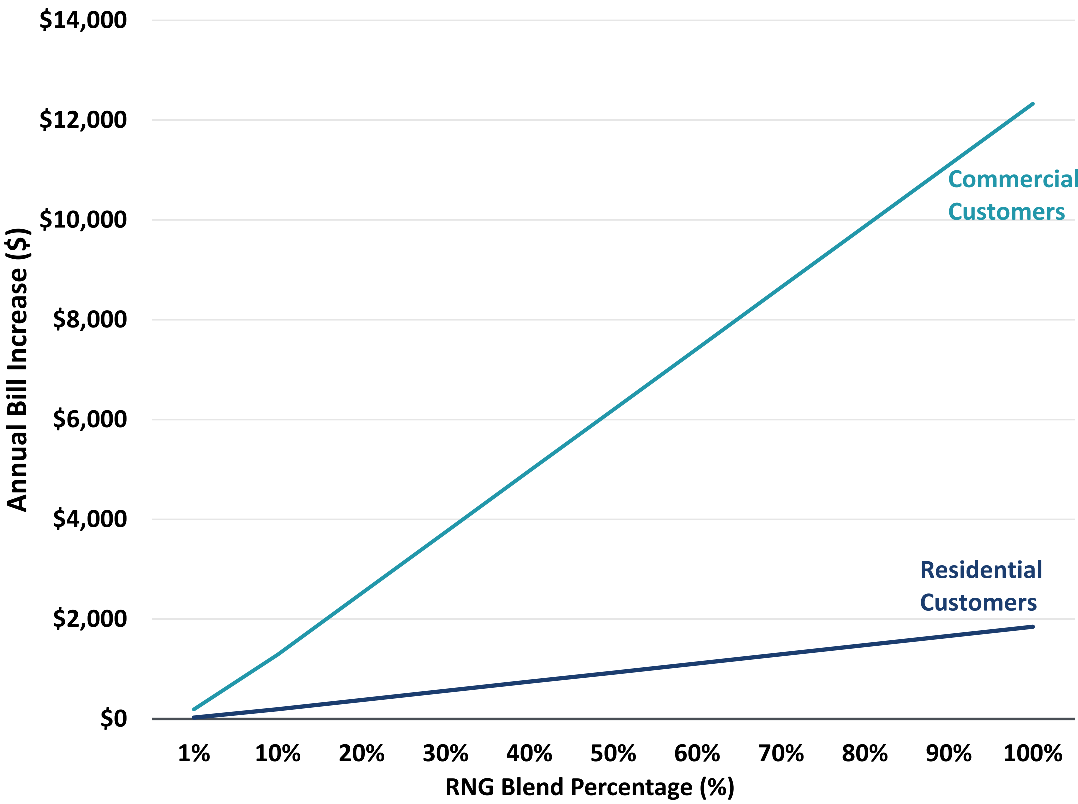
The above research has important implications for customer enrollment in FEI's programs and their willingness to pay for RNG. Customers enrolled in FEI's Voluntary Renewable Gas program are apparently willing to pay a $7-$8 premium (for at least a share of their gas use), based on FEI's customer survey data and prior enrollment patterns. This premium is broadly consistent with the finding of empirical studies outside of British Columbia (though of course this level of price sensitivity will not necessarily remain constant over time).

The cost of contracted RNG supplies indicates that the RNG cost premium is generally much greater than $7/GJ. The RNG acquisition cost cap ($31/GJ) is approximately four times higher than FEI's cost of gas ($5.159/GJ plus $2.559/GJ carbon tax). The average cost of FEI's existing RNG supplies (approximately $22/GJ)[236] reflects a premium of $14/GJ above the cost of gas. At this level, the FEI survey results indicate that most customers would not be willing to pay for any level of RNG blending under the Voluntary RNG program, if the full RNG cost was reflected in the customer rate. The RNG premium has been fixed at $7/GJ to encourage customer participation in the voluntary program, with the remaining additional RNG costs being spread amongst all FEI sales customers. In addition, all sales customers will receive a 1% RNG blend in 2024 through the RNG Blend Program. The blend amount will increase over time reflecting the difference between the RNG supply volumes and the demand from the Voluntary Renewable Gas and Renewable Gas Connections programs. Consequently, the supply cost for all sales customers will increase as increasing amounts of higher priced RNG are blended in with lower priced natural gas.

Figure 23 below demonstrates the expected annual bill increase for one average residential and one average commercial customer under increasing RNG blend scenarios. A 1% RNG blend increases the annual bill for a residential customer by about $18 and about $123 for a commercial customer (due to a higher per-customer natural gas consumption assumption for commercial customers).

[236] FEI, "Fourth Quarter 2022 Gas Cost Report," November 23, 2022, Tab 4 Page 4, https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/221123-fei-2022-q4-gas-cost-report-ff.pdf?sfvrsn=7d32aea4_1

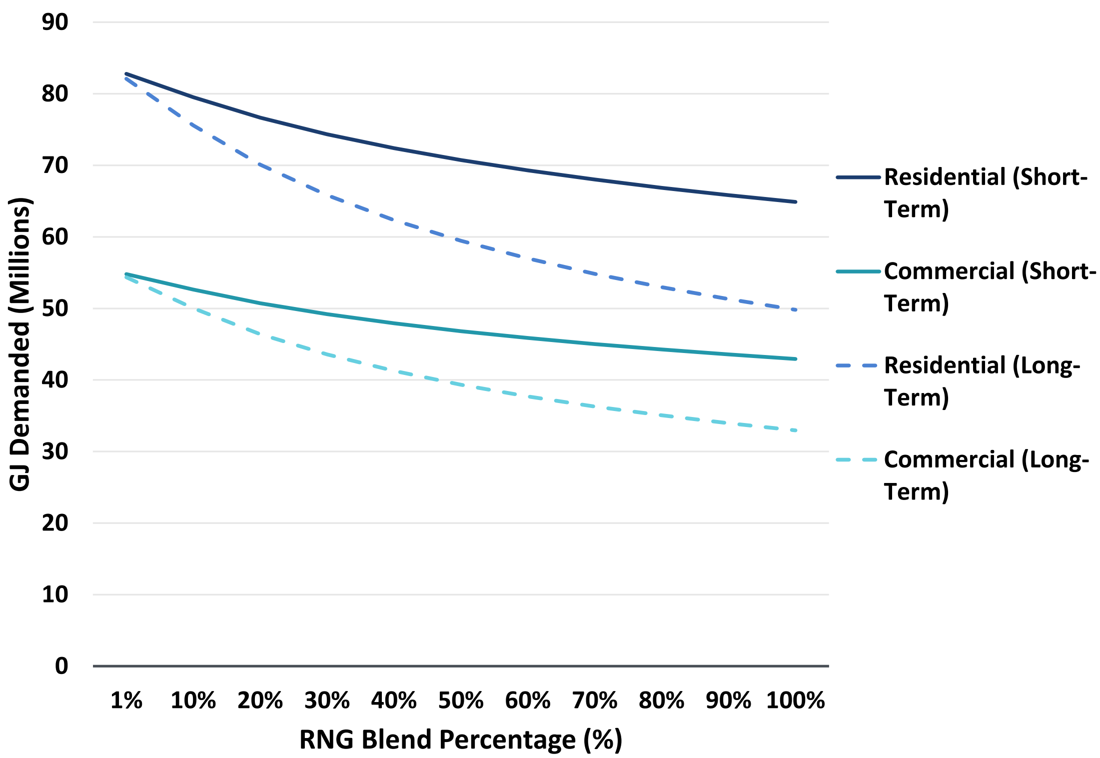
FIGURE 23: ANNUAL BILL IMPACT VERSUS RNG BLEND PERCENTAGE[237]
(Renewable Gas Blend Program)



Total natural gas demand might decrease at the rates described above at increasing levels of RNG blend, due to these bill impacts. Figure 24 illustrates how both residential and commercial natural gas demand might decrease in both the short-term and the long-term at increasing levels of RNG blend. At a 100% RNG blend, residential and commercial demand could decrease by 22% in the short term. Longer term, demand would decrease by 40%.

[237] We note that this figure assumes that the average household consumption of natural gas for residential customers is about 87 GJ per year and 579 GJ per year for commercial customers, per Statistics Canada. The commodity price of RNG is $14.718/GJ.

FIGURE 24: CUSTOMER DEMAND VERSUS RNG BLEND PERCENTAGE[238]
(Renewable Gas Blend Program)



Since most of the cost of RNG is not borne by the voluntary customers (through either the Connections or Voluntary programs), a significant portion of the price elasticity effect will occur via the overall cost of gas. That cost will increase in part due to RNG blending, but also because sales customers will shoulder most of the costs of the Connections and Voluntary programs. The demand behavior of these customers may be similar to the natural gas price elasticity study results discussed above. In the near-term, customer demand is relatively inelastic, limited largely to behavioral changes. Over the longer term, demand becomes more elastic as customers can improve building efficiency or switch to more efficient appliances or switch to those running on other forms of energy (e.g. electric heat pumps).

[238] Figure assumes that the average household consumption of natural gas for residential customers is about 87 GJ per year and 579 GJ per year for commercial customers, per Statistics Canada. Short-term residential price elasticity of demand for natural gas is 0.19% (an average of results from the Auffhammer and Labandeira studies). Long-term residential price elasticity of demand is 0.39% (an average of results from the Labandeira study and the AEO). Short-term commercial price elasticity is 0.16% (both averages of commercial results from Labandeira and AEO).

Under the Renewable Gas Connections program, new residential building owners will choose between 100% RNG and alternative energy sources. The structure of the program insulates these new customers from the full costs of RNG by charging them the LCG Charge (equivalent to the rate paid by other gas customers) and then spreading the cost of their RNG across all customers, minimizing the elasticity effect. If the full cost of RNG were imposed on new gas customers, the high customer cost impact might result in very little additional RNG demand through this program. For these customers, since the choice opportunity arises only at the time of construction, this effect will be observed only as a long-term effect.

The limited amount of RNG cost that must be covered by opt-in customers under the Voluntary program raises questions about what it means to be voluntary – these customers voluntarily choose RNG but the program structure pushes most of the supply cost onto other customers. Therefore, it is likely that more customers will volunteer for RNG than if those customers were charged the full cost of the RNG supply.

V. Conclusion

FEI is proposing modifications to its existing Renewable Gas Program that will expand RNG service offerings to customers. Specifically, FEI's proposal includes programs that 1) allow all customers to opt-in to various levels of RNG blending; (2) provide 100% RNG to all customers in new residential dwellings; and (3) provide a 1% blend to all sales customers starting in 2024, increasing thereafter. The proposal will assist FEI in achieving the climate and energy policy goals established in the CleanBC Roadmap to 2030—a 15% blend of RNG in the gas distribution system and a GHG emission cap of 6 million tCO_2e for all gas utilities in British Columbia. To achieve this, FEI will need to increase its RNG supply portfolio to between 30 PJ and 65 PJ by 2030.

Recent studies find that the RNG supply potential in British Columbia, Canada, and the United States are insufficient to displace a significant amount of current natural gas demand. Even longer-term projections with optimistic assumptions of feedstock availability and production costs lead to similar conclusions. Given the constraints on physical RNG supplies in the province, gas utilities in British Columbia are permitted to procure notional RNG supplies elsewhere in Canada and the United States and count these volumes towards achieving the CleanBC Roadmap to 2030 targets. Currently, FEI procures over 70% of its current RNG supplies outside of British Columbia. We find that this strategy will likely provide FEI with access to sufficient notional supplies to achieve its goal of procuring an additional 26 PJ to 61 PJ by 2030. However, FEI will need to compete for these RNG volumes with other North American natural gas utilities with similar RNG ambitions. Alternatively, FEI can meet its climate commitments by procuring carbon offsets, an inexpensive but sometimes dubious way to achieve climate benefits.

RNG is significantly more expensive than natural gas. Reported RNG prices range from $10/GJ to $50/GJ, depending on the production methodology and location of the supply. FEI is permitted to purchase RNG supplies up to a price cap of $31/GJ under the Renewable Gas program – its current weighted average cost of RNG is approximately $22/GJ. Utilities elsewhere have regulated price caps as high as $36/GJ. We find that RNG prices will likely remain elevated going forward. Price caps will likely reinforce elevated RNG prices because utilities are reasonably assured cost recovery as long as the cost is below the cap. RNG prices will be further buoyed by demand from renewable fuel standard markets in Canada and the United States that permit RNG to be used as a low-carbon fuel. Compliance credits in these markets currently trade for up to $50/GJ.

As the proportion of RNG in FEI's supply portfolio increases, FEI will need to enroll additional customers in the Renewable Gas Program to recover the higher RNG supply costs. FEI currently purchases 4 PJ of RNG but only sells approximately 1.3 PJ to customers through a Voluntary Renewable Gas program. These customers pay a $7/GJ premium over the rate charged to natural gas customers (yielding an RNG rate of $14.718/GJ in 2023). This premium was established based on studies and FEI's experience with customers' willingness to pay more for a low-carbon alternative fuel.

FEI is now proposing to expand its Renewable Gas Program to provide a blend of RNG to all its sales customers, as well as 100% RNG for new residential connections, in addition to the incremental RNG sales that occur through the continuation of its voluntary program. This will increase the overall volumes of RNG that FEI sells to its customers, spreading most of the higher RNG costs across all of its sales customers. Voluntary RNG customers (those who choose a greater share of RNG than the share blended for all customers) would continue to pay $7/GJ for their chosen, incremental, RNG volume, with the remaining RNG costs being spread across all sales customers. Renewable Gas Connections customers will pay a similar amount as all Renewable Gas Blend customers, despite nominally receiving 100% RNG; the additional costs for this would also be spread across all sales customers.[239] This structure artificially encourages RNG use by allowing some customers (those participating in the Voluntary and Connections programs) to voluntarily choose RNG and pay only a small portion of its actual costs, skewing their incentives toward choosing RNG. The remaining RNG costs are recovered from all sales customers generally, who can avoid some of the increased costs only by reducing their overall gas consumption.

Customers' willingness to enroll voluntarily in the Renewable Gas Program (i.e., through the Voluntary or Connections programs) will largely depend on the RNG cost premium which the program incurs. The remaining customers in the Blending program will not choose their RNG consumption, but will have it automatically blended into their gas supply (along with some of the RNG cost for Voluntary and Connections customers). Economic studies find that customers' natural gas demand is inelastic in the near-term as they are captive to their existing energy supplies. Longer-term, customers are more sensitive to changes in natural gas prices because they can pursue energy efficiency investments or switch to a lower-cost energy source, though even in the long-term, gas usage is relatively insensitive to price.

[239] FEI Application, p. 120.

We are not aware of any price elasticity studies that focus on the cost-gap between RNG and natural gas in order to analyze customer reception of cost versus environmental benefits. However, FEI's experience suggests that customers have limited appetite for a price premium beyond about $7/GJ, even though the cost premium for RNG is considerably higher than this. In the short-run, Renewable Gas Blend customers' commodity costs will increase as their RNG blend increases above 1%. These customers will likely respond by reducing their gas consumption slightly, consistent with the price elasticity study findings. In the long run, some may further reduce their gas consumption by implementing efficiency measures, or switching to an alternative energy form (e.g., electrification), though long-run price elasticity is also relatively low. Still, because of the magnitude of the RNG price premium, as blending quantities increase (and also to the extent costs from the Connections and Voluntary programs further increase costs for Blending customers), the cost impact could become meaningful, potentially causing a material decrease in overall gas demand. FEI and the BCUC will need to carefully balance procuring sufficient RNG supplies to meet the CleanBC climate and energy policy goals against the cost implications for Blending customers (those sales customers not involved in the Connections or Voluntary programs). This will include developing an understanding of whether in the longer term, the higher RNG supply costs may challenge the ability of the Renewable Gas Program to recover the higher RNG supply costs without unduly suppressing overall gas demand.