

CARBON ABATEMENT – RENEWABLE NATURAL GAS ENABLING
AND GEOTHERMAL ENERGY SERVICE

Introduction

1. Based on the *Climate Change Mitigation and Low-carbon Economy Act, 2016* (“Climate Change Act”), the Natural Gas Utilities are under a legal obligation to account for their emissions (including the emissions of most of their customers) through the Cap and Trade program. The Natural Gas Utilities are statutorily mandated to procure allowances and offsets and abate emissions as part of regular business operations.
2. The Ontario Energy Board’s (“OEB” or the “Board”) Regulatory Framework for the Assessment of Costs of Natural Gas Utilities’ Cap and Trade Activities (the “Framework”) indicates that natural gas utilities have a number of compliance options available to meet their obligations under Ontario’s Cap and Trade program. In addition to purchasing allowances and offset credits, natural gas utilities can and are expected to undertake Greenhouse Gas (“GHG”) abatement measures to meet their compliance obligations.
3. The Framework states:

The Utilities are required by the Climate Change Act to be responsible for the GHG emissions related to all natural gas delivered on their distribution systems to customers other than LFEs or voluntary participants. In order to comply with this obligation the Utilities will incur costs. While these costs are not specifically tied to the operation of the gas distribution system, they are an on-going business obligation of a natural gas distributor under the Climate Change Act.¹
4. This mandate is further articulated by the Framework which outlines several ways in which the Utilities may propose to meet their Cap and Trade obligations which

¹ Ontario Energy Board, Regulatory Framework for the Assessment of Costs of Natural Gas Utilities’ Cap and Trade Activities (EB-2015-0363), September 26, 2016, page 33.

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include: financial instruments (e.g., allowances, offsets), customer abatement (e.g., renewable natural gas (“RNG”), energy efficiency, fuel switching such as geothermal, new technologies), and facilities abatement (e.g., distribution system upgrades).

5. The Company understands customer abatement to include reducing GHG emissions from current customers and potential future customers through installation of energy systems other than those which utilize natural gas.
6. The Framework makes it clear that the utility’s Cap and Trade related activities and investments are utility functions; however, the Framework states that these investments will not be approved in conjunction with the OEB’s review of a utility’s Cap and trade Compliance Plans.

The OEB will not approve the Utilities’ Compliance Plans. Utilities are responsible for deciding on the exact makeup of activities to be included in their Plans, how best to prioritize and pace investments in Cap and Trade compliance options and abatement activities, and how and when to participate in the market.²

Further;

The OEB expects a Utility’s Compliance Plans to include a description of the longer term strategy. The actual forecasts of planned capital expenditures related to any investments will, however, be dealt with in a Utility’s regular rate application and/or any leave to construct cases. This means that although the Compliance Plans will highlight a Utility’s thinking around long-term investments, the actual approval of costs and cost recovery will be dealt with like any other type of investment.³

7. In addition, the Board recently issued a Decision in relation to Enbridge’s Cap and Trade Compliance plan for 2017.⁴ In that Decision the Board

² Ontario Energy Board, Regulatory Framework for the Assessment of Costs of Natural Gas Utilities’ Cap and Trade Activities, September 26, 2016, page 7.

³ Ontario Energy Board, Regulatory Framework for the Assessment of Costs of Natural Gas Utilities’ Cap and Trade Activities, September 26, 2016, page 27.

⁴ EB-2016-0296/EB-2016-0300/EB-2016-0330 Decision and Order.

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confirmed that it expects the gas utilities to bring forward plans for customer abatement activities (which may include new business activities) as part of its future applications.⁵

8. In 2006 and 2009, the Undertakings between the Province and Enbridge were amended to enable, *inter alia*, Enbridge to provide services that would assist the Government of Ontario in achieving its goals in energy conservation. This included the promotion of cleaner energy sources, alternative energy sources and renewable energy sources. Copies of Enbridge's current Undertakings (including the 2006 and 2009 Minister's Directives) are attached as Appendix 1.
9. Over the past two years, the Province has provided direction and guidance about GHG abatement and adoption of lower or zero carbon technologies. The Company's move toward the implementation of carbon abatement strategies is consistent with the Province's energy and GHG abatement related goals.
10. The Company's 2017 Cap and Trade Compliance Plan (EB-2017-0300) submission made reference to several potential carbon abatement initiatives that the Company had under investigation at the time. Enbridge's 2018 Cap and Trade Compliance Plan submission to the Board (EB-2017-0224) has now been filed. The Company's evidence in that case describes the Abatement Construct framework being utilized to evaluate potential multi-year abatement programs and how Enbridge proposes to integrate these initiatives into its overall Cap and Trade compliance planning to assist in meeting the Company's Cap and Trade obligations.⁶

⁵ Ibid, page 27.

⁶ EB-2017-0224, Exhibit C, Tab 5, Schedule 1.

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11. The 2018 Compliance Plan proceeding evidence includes a full list and description of the abatement opportunities the Company is currently exploring and summarizes the Company's Renewable Natural Gas ("RNG") Enabling Program and Geothermal Energy Service proposals detailed in this submission.⁷ The RNG Enabling Program is intended to allow Enbridge to provide upgrading and injection services for RNG producers, in an effort to increase the supply and availability of low-carbon RNG in Ontario. The Geothermal Energy Service Program is intended to allow Enbridge to own and maintain geothermal loops to encourage homeowners to choose and use geothermal energy systems for their home heating and cooling requirements as an alternative to natural gas and other fossil fuels.

12. Enbridge is of the view that the combined effect of the Framework and the Undertakings support the inclusion of carbon abatement activities such as the RNG Enabling Program and Geothermal Energy Service Program described in this submission in the regulated utility. The purpose of this evidence is to present these programs to the Board and obtain the Board's approval to enable the Company to implement these programs within the regulated utility in 2018.

Context and Background

13. In June 2016 the Ontario Ministry of Environment and Climate Change (the "MOECC") published its Climate Change Action Plan (the "CCAP"). The CCAP consolidated the Province's plans to bring together effective initiatives designed to enable Ontario to achieve its GHG reduction targets. The plan outlines how the Province intends to direct the Cap and Trade proceeds towards projects that will create good jobs, help families and businesses become more energy-efficient, and accelerate Ontario's transition to a low-carbon economy.

⁷ EB-2017-0224, Exhibit C, Tab 5, Schedule 2.

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14. Further to the CCAP, the Province recently released its 2017 Long Term Energy Plan (the “2017 LTEP”). One of the significant inputs to the LTEP is a report prepared by Navigant Consulting Inc. on behalf of the Ministry of Energy (the “MOE”) called the Fuels Technical Report (the “FTR”). The FTR complemented the IESO’s Ontario Planning Outlook the purpose of which was to help the MOE advise as to how the Province’s electricity energy demand could be met over the coming twenty years while also enabling the achievement of the Province’s GHG emission targets and CCAP strategies. A copy of the FTR is attached as Appendix 2 to this evidence.
15. The 2017 LTEP includes a number of plans and initiatives to encourage innovation and new technologies, and assist in meeting climate change goals. Several of these are directly relevant to this Application, including:
- A direction to build a “*culture of innovation*” in the energy sector and look for ways to allow utilities to make non-traditional and “non-wires” investments and work with customers in scenarios where each party owns part of an energy system.⁸
 - A plan to have RNG become part of the Ontario supply mix: “*Ontario is looking at using renewable natural gas to lower the carbon intensity of the natural gas that people burn. As an added benefit, it can use the existing natural gas distribution system and replace the use of conventional natural gas in today’s stoves and furnaces.*”⁹

⁸ Ontario’s Long-Term Energy Plan 2017: Delivering Fairness and Choice (“2017 LTEP”), at pages 69-70.

⁹ 2017 LTEP, at page 114.

- A goal to increase the number of geothermal energy systems used for low carbon space and water heating in homes and buildings across Ontario. The 2017 LTEP indicates that *“Natural gas will continue to play a critical role in space and water heating, but we must use it as efficiently as possible and supplement it with the next generation of clean energy technologies, such as ground-source and air-source heat pumps. Proceeds from cap and trade auctions will help fund the further application of these technologies.”*¹⁰
16. The 2017 LTEP indicates that the government is investing proceeds from the auctions in the carbon market to help introduce RNG and ground source heat pumps in the province. Enbridge’s proposed RNG Enabling program and Geothermal Energy Service program will complement and expedite the Government’s plans as outlined in the 2017 LTEP. A copy of the 2017 LTEP is included as Appendix 3.
17. In this application, the Company is bringing forward a Renewable Natural Gas Enabling program and Geothermal Energy Service program proposal. These new programs have been developed so as to be consistent and compliant with the Framework, existing regulatory principles and OEB guidelines, such as the EBO 188 feasibility test.
18. The OEB’s Cap and Trade Framework recognizes that gas distribution utilities will need to meet their Climate Change Act obligations, which suggests an expanded view as to what will constitute core utility business activities. Enbridge’s proposed new business activities are provided for under the Undertakings between the Enbridge and the Province and are in support of and will assist the Government of Ontario in the achievement of its goals in regard to carbon emissions reduction and

¹⁰ 2017 LTEP, at pages 109 and 115.

the promotion of clean alternative energy sources and renewable energy. The activities are consistent with the goals and initiatives set out in the 2017 LTEP.

19. With respect to the advancement of RNG production in Ontario, Enbridge sees its role as that of a facilitator that can assist RNG producers in the process of upgrading raw untreated biogas into pipeline quality RNG and the injection and transportation of this gas to market. Over the course of the past eighteen months, the Company has conducted discussions with several municipalities and other potential RNG producers with respect to the services Enbridge could provide to accelerate the development of RNG production capacity in its service area. Enbridge believes this will support the growth of RNG production which will facilitate lower cost RNG to supply market demand. This dialogue has led the Company to develop the RNG enabling program described in this submission which is based on utility investment in RNG upgrading and injection equipment.
20. The Company proposes to offer RNG upgrading services on an optional basis. As such RNG producers will have the choice of upgrading biogas to pipeline quality themselves or having Enbridge perform this function for them. All RNG producers who wish to use Enbridge's distribution system to transport RNG will have to contract with Enbridge for RNG injection services. This will enable the Company to meet its responsibilities as a distributor of natural gas and ensure the safe and reliable distribution of RNG to market.
21. Ground source heat pump heating and cooling systems ("geothermal systems") have been readily available in Ontario for a number of years. However, the adoption of this technology has been hampered by barriers such as high initial costs compared to other building heating / cooling technologies and inconsistent deployment and installation practices. These factors have resulted in low market

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penetration of geothermal systems and less than desirable levels of customer satisfaction with this technology.

22. Enbridge has been working with the Ontario Geothermal Association (“OGA”), the MOECC, and the MOE to find solutions that will overcome these barriers faced by the geothermal industry which will lead to further the adoption of ground source heating and cooling systems. The solution that Enbridge has developed is a utility service that combined with financial support from the MOECC’s Greenhouse Gas Reduction Account (“GGRA”) administered by the Green Ontario (“GreenON”) Fund will make this technology cost competitive compared to more traditional building heating and cooling alternatives. Enbridge will own and maintain the geothermal loops while customers will own and maintain the heat pump system.
23. On December 13, 2017, the Ontario Government announced new rebates from the GreenON fund for ground source heat pumps (home geothermal).¹¹ Homeowners will be eligible for rebates of up to \$20,000 for ENERGY STAR certified ground source heat pumps. This will offset the customer’s costs under Enbridge’s proposed Geothermal Energy Service program.
24. The Company’s RNG enabling program and Geothermal Energy Service program both form part of the Company’s long term carbon abatement strategy and relate to the Company’s contributions towards the Province’s *Climate Change Mitigation and Low-carbon Economy Act, 2016* and the OEB’s Framework. The Company has used the Board’s EBO 188 Guidelines as a guide in the determination of the charges for these services. This approach aims to ensure that existing ratepayers will not subsidize these new programs.

¹¹ The GreenON announcement can be found at the follow link:
<https://www.greenon.ca/programs/greenon-rebates-ground-source-heat-pumps>.

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Regulatory Treatment of RNG Enabling Program and Geothermal Energy Service Program

25. Given Ontario's current carbon reduction objectives, supporting legislation and regulatory framework, the RNG Enabling program and Geothermal Energy Service program are appropriate utility activities. Both programs over their respective lifetimes will reduce the number of Cap and Trade allowances that the Company will need to procure and hence lower the compliance costs for its existing and forecasted customers. Both programs are captured within the scope of the Undertakings between the Company and the Province. These utility investments will significantly contribute towards the attainment of Ontario's CO₂ emission target reductions by abating and displacing the consumption of (non renewable) natural gas in the Company's service area.
26. Through this application Enbridge is seeking approval for and establishment of charges (service fees) for both programs which are contingent on projects within each program attaining a Profitability Index ("PI") equal to or greater than 1.0 (applying the principles set out in the EBO 188 Guidelines). In applying the EBO 188 Guidelines, Enbridge has or will determine the capital, operating and financing cost requirements for these programs over the forecast horizon. These costs are then utilized to derive overall revenue requirements. Enbridge has calculated monthly service fees to recover the revenue requirement over the life of the assets relevant to each program such that the resultant PI for each program is equal to or greater than 1.0.
27. This approach will ensure that the recipients of the RNG and Geothermal services will pay the full cost of these programs. Existing customers are not harmed and will

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benefit over the life cycle of these programs. Additionally, there will be broader benefit from increased RNG production and reduced GHG emissions.

28. Enbridge recognizes that in applying the EBO 188 principles there will be a deficiency in terms of the revenues versus the costs of these programs in their early years. However, in later years there will be a sufficiency in terms of the revenues versus the costs of these programs. As time goes on and the assets' net book value decreases, these assets will deliver annual revenues in excess of their revenue requirements thereby returning and to some extent exceeding the revenue deficiency underwritten by ratepayers in the early years.
29. While these programs will be part of the Company's regulated business activities and constitute carbon abatement activities, the best methodology to address their utility revenue requirement implications over their asset lives will be to treat the annual utility revenue sufficiencies and deficiencies associated with these programs as credits or debits to the cost of carbon or costs of carbon abatement.
30. Enbridge proposes that these differences (deficiencies in early years and sufficiencies in later years) be captured within the Greenhouse Gas Emissions Compliance Obligation-Customer-Related Variance Account ("GHG-Customer VA") and be periodically cleared to ratepayers. The recovery of these amounts through the GHG-Customer VA is appropriate because the objective of these initiatives is to reduce GHG emissions associated with natural gas deliveries and customers' consumption of natural gas.¹²

¹² Under this approach, the costs and revenues associated with these programs would be excluded from the 2018 ESM calculation.

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Renewable Natural Gas Enabling Program

31. Enbridge's proposed RNG enabling program is focused on providing services to RNG producers that will expand and facilitate lower cost RNG supply for the Company and other consumers.

The RNG Market in Canada and Ontario

32. RNG is a potential natural gas supply source that offers environmental, economic and waste management benefits. RNG (also referred to as "bio-methane") is refined from biogas produced from organic waste, such as that found on farms, at waste water treatment plants, food processing facilities and in landfills. The process that creates biogas from this waste is called anaerobic digestion.

33. Anaerobic digestion takes place when organic material decomposes in an oxygen-free environment, either controlled within an anaerobic digester, or naturally in a landfill. The main products of anaerobic digestion are methane (CH₄) and carbon dioxide (CO₂), the combination of which is commonly referred to as biogas when produced in digesters, and landfills.

34. RNG has similar physical properties to conventional natural gas, and with respect to GHG emissions provides benefits in two forms; 1) emission reduction; and 2) fuel substitution. Emission reduction is achieved by capturing emissions of methane that would otherwise enter the atmosphere from landfills, the decomposition of organic waste and waste water. The fuel substitution benefit results from the displacement of a more traditional fossil fuel. The origin of RNG therefore has a significant impact on its carbon abatement potential and carbon offset value.

35. In its CCAP, the Ontario Government indicated that it would provide support to encourage the use of cleaner, renewable natural gas in industrial, transportation and buildings sectors. This intent is also echoed in the 2017 LTEP, where the

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government has indicated that it will “continue to work with industry partners to introduce renewable natural gas into the province’s natural gas supply and expand the use of lower-carbon fuels for transportation.”¹³

36. In the near term, most if not all biogas supplies are expected to be produced through anaerobic digestion processes. In the longer term, RNG is expected to also be produced through a process known as gasification. Gasification is a process that converts carbonaceous materials, such as coal, petroleum, or biomass, into carbon monoxide, hydrogen and methane by the reaction of the raw organic feedstock at elevated temperatures with a controlled amount of oxygen (less than stoichiometric). The resulting gas mixture is called synthesis gas or syngas and is itself a fuel. Syngas may be burned directly in internal combustion engines, used to produce methanol and hydrogen, converted via the Fischer-Tropsch process into synthetic fuel, or converted to methane through catalytic methanation.
37. On July 20, 2017, the OEB issued a report developed by ICF Consulting Canada Inc. (“ICF”) which provides a Marginal Abatement Cost Curve (“MACC”) for natural gas abatement activities in Ontario. The MACC report includes a summary for RNG potential in Canada and Ontario. ICF outlines five feedstocks for RNG and their 10-year potential. The report made the simplifying assumption that RNG production from Landfill Gas (“LFG”), wastewater treatment plants, animal manure, and SSO (source separated organics) would occur via anaerobic digestion. It also assumed that agricultural residue would be converted to RNG via thermal gasification.
38. The ICF report includes an estimate of future RNG production potential in Ontario, based upon a 2013 report from the Canadian Biogas Association. The relevant table from the ICF report is reproduced in Table 1 below.¹⁴

¹³ 2017 LTEP, at page 15.

Table 1: RNG Production Potential in Ontario

Feedstock for RNG	Canada Resource Potential Estimate (million m³/y)	Ontario Resource Potential Estimate (million m³/y)
LFG	290	113
WWT gas	180	71
Animal manure	874	191
SSO (Residential and Commercial)	300	110
Agricultural residue	774	142
Total	2,418	627

39. The figures above assume that nearly 100% of the RNG production potential estimated in the Canadian Biogas Study is achievable by 2028 for each feedstock. However, in order for that to be achieved, there will have to be significant new infrastructure to condition the biogas (converting it to pipeline quality) and to enable the injection of the RNG into gas distribution systems.
40. Both the CCAP and the FTR and now the 2017 LTEP identify RNG as a significant contributor to the achievement of the Province's CO₂ emission reduction objectives. These sentiments were expressed to the OEB by Glenn Thibeault, Ontario's Minister of Energy. In his letter of December 10, 2016, Minister Thibeault communicated the Government's interest in the OEB taking steps to examine the prospect of RNG becoming a component of Ontario's natural gas supply. The Minister also encouraged the OEB to move forward in a timely manner to include RNG as a means of helping to reduce GHG emissions by becoming part of the gas utilities' gas supply portfolios. A copy of Minister Thibeault's letter is included as Appendix 4 to this evidence.

¹⁴ Final Report , Marginal Abatement Cost Curve for Assessment of Natural Gas Utilities' Cap and Trade Activities (EB-2016-0359), released July 20, 2017: Figure 1: RNG feedstock in Ontario and Canada.

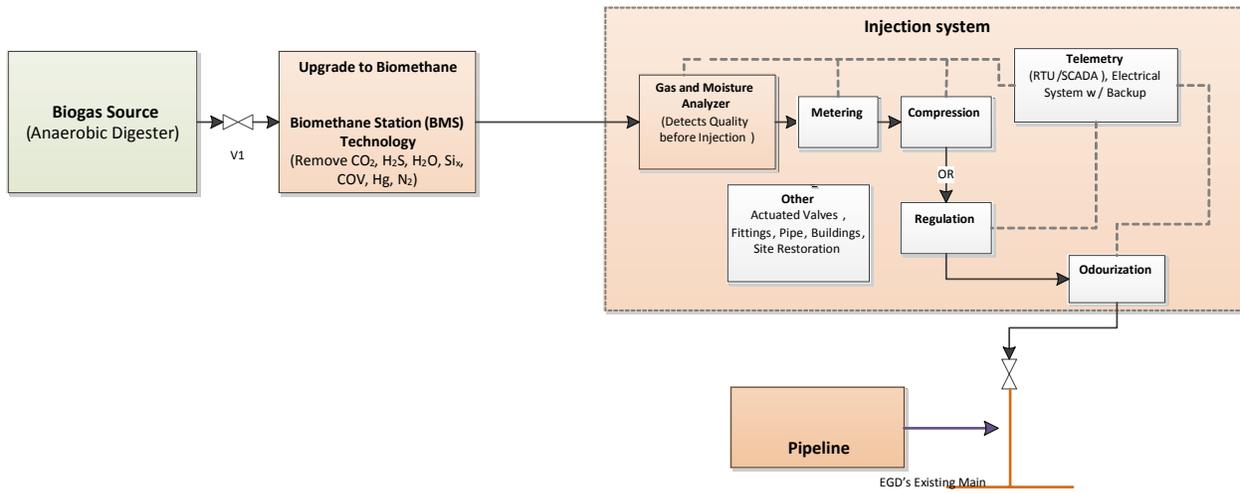
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41. The Board followed through on the Minister's request by identifying RNG as a key point of interest in formulation its upcoming Framework for the Assessment of Distributor Gas Supply Plans (the "Gas Supply Framework").¹⁵ The Gas Supply Framework working group initially focused on the issues related to RNG as a component of utility gas supply plans and has made an effort to understand the state of the current RNG marketplace and the potential for Ontario sourced RNG to become part of the OEB's system gas supply plan.
42. On May 2, 2017 and May 23, 2017, the Gas Supply Framework working group held meetings focused on communicating issues concerning the RNG sector and how these issues could be overcome in Ontario.
43. Over the past year, Enbridge has been in discussions with a number of RNG producers to better understand the market and needs of the producers. The Company's primary focus has been on municipalities that are required to deal with large waste streams as part of their day to day operations. Below is a list of potential RNG producers and municipalities that have expressed interest in working with Enbridge on RNG opportunities.
1. City of Toronto
 2. Region of Peel
 3. Durham Region
 4. Niagara Region
 5. Private Industrial Waste Management Company
 6. City of Peterborough

¹⁵ EB-2017-0129.

44. As already noted, in order to encourage RNG production in Ontario, Enbridge sees that it can play an important role as a facilitator that can assist RNG producers in the process of upgrading raw untreated biogas into pipeline quality RNG and then injecting and transporting that gas to market. These roles require new facilities. The new facilities will provide producers with conditioning and upgrading service, and will enable the RNG (the upgraded biogas) to be injected into the Company's distribution system to be transported to market.
45. Figure 1 provides a schematic of the RNG production process and the RNG services Enbridge proposes to offer producers.

Figure 1: RNG Production Process and Enbridge Service Offerings



46. At a high level, the production of RNG is comprised of the three major steps depicted in Figure 1.
- a. The first step is the production of raw untreated biogas. Typical sources of biogas are landfills and anaerobic digesters that capture the gases released from source sorted organic waste, waste water or agricultural waste.

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- b. The second major step in the process is the upgrading of the biogas to pipeline quality. Raw biogas is usually mainly comprised of methane and carbon dioxide. However, it also contains a number of impurities that need to be removed from it to achieve pipeline quality. Impurities such as sulfur compounds, nitrogen, oxygen, volatile organics, ammonia, siloxanes, and other trace elements need to be removed from biogas before it can be safely comingled with traditional natural gas supplies.
- c. The third step in the process of bringing RNG to market is the injection of this gas into a gas distribution system. This step entails measurement of the energy content of the gas, ensuring that it meets pipeline quality standards, control of flow and pressure through regulation or compression, odourization and delivery into the gas distribution system.

Enbridge's Proposed RNG Enabling Program

- 47. The Company's RNG Enabling Program has been designed such that Enbridge can support and help facilitate Ontario RNG production and the injection of RNG into the natural gas distribution system separate and apart from the rate setting implications of including RNG into the Company's gas supply portfolio.
- 48. Enbridge proposes to offer two services to RNG producers. These services will enable producers to inject pipeline quality RNG (bio-methane) into the gas distribution system. The two services that Enbridge is proposing are: 1) a Biogas Conditioning and Upgrading Service ("Upgrading Service"), and 2) RNG Injection Service ("Injection Service"). The Upgrading Service is complementary to the Injection Service whereas the Injection Service can be stand alone. As set out

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below, Enbridge is requesting Board approval of the manner in which service fees will be determined for each of these Services.

49. The Upgrading Service will be offered to potential RNG producers as an optional service. Producers choosing this option will contract with Enbridge to plan, design, procure, construct, own, operate and maintain biogas conditioning and upgrading equipment on the producer's premises. The Upgrading Service, where provided by the Company, will ensure the biogas is treated for safe injection into the distribution network. This is the process of converting the raw biogas to RNG (bio-methane), and encompasses the removal of the impurities such as carbon dioxide, hydrogen sulfide, nitrogen, and other impurities. Once the conditioning is complete, the upgraded gas has the same physical properties as traditional pipeline gas.
50. Under the Injection Service, Enbridge will build the pipeline attaching the producer to the distribution system, odourize the bio-methane, measure the gas volumes and energy content of the gas, manage pressures and ensure that the gas meets required specifications. Enbridge will inject the RNG into the distribution network and transport the RNG to delivery points designated by the RNG producer. Once the RNG is in the Company's gas distribution system, Enbridge will enable the movement of that gas to a terminal location of the producer's choice through the various service offerings Enbridge provides its customers today. All RNG producers requesting to inject RNG into Enbridge's distribution system will be required to contract for the Injection Service, including RNG producers who do not require Upgrading Service.
51. Enbridge will provide these services subject to the Company entering into contracts with the RNG producers for the provision of these service(s). Items to be addressed in the contracts will include but not be limited to: the design, location,

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construction, operation, timing and costs of the required upgrading and injection facilities and related services. While the specific contents of each contract will be different (to reflect the details of the relevant facilities), the form of the contracts will be common or similar for all producers receiving Upgrading and / or Injection Service.

52. Enbridge will recover the cost of these facilities (and the associated operating and other costs) through service fees charged to the RNG producer for the Upgrading Service (if applicable) and the Injection Service. Gas distribution charges will apply to the transportation of RNG through Enbridge's distribution system.
53. Through the provision of these services, Enbridge will ensure that the RNG injected into the gas distribution system, at minimum, meets the requirements of CSA Z662 and other applicable codes and standards as specified in the Company's policies. As well, the Company will ensure the natural gas in the distribution network continues to meet the current gas quality requirements for its customers.

Calculation of Service Fees

54. The RNG producer will be charged separate service fees for each of the two services offered by the Company. Each service fee will be derived from a discounted cash flow ("DCF") analysis. The DCF analysis will be based on the principles and parameters set out in the OEB's EBO 188 feasibility guideline. The fee for each service (Upgrading or Injection) will be site specific and set so as to recover operating and maintenance costs, depreciation, utility's return on investment, and taxes while achieving a PI equal to or greater than 1.0 over the service life of the plant. Enbridge will charge a levelized (constant) service fee for each month of the term of the contract.

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55. The term of the contract for each service will be negotiated with the producer. It is assumed that the contract term will be equal to the service life of the assets, or (if shorter) the expected lifespan of the feedstock.
56. The determination of the service fees for Upgrading and Injection Services will be site specific and based on the fully allocated costs associated with the services in each particular instance.
57. Tables 2 and 3 set out a hypothetical example for a single RNG production facility to illustrate how the service charges for the Company's Biogas Upgrading and RNG Injection Services are to be determined. The appropriate service charge would be included in the contract with the RNG producer. Details of the calculations and assumptions contained in Table 2 are set out in Appendix 5 to this Exhibit. A revenue requirement calculation is contained in Appendix 6. Details of the calculations and assumptions contained in Table 3 are set out in Appendix 7 and Appendix 8 contains a revenue requirement calculation.

Table 2: Upgrading Service Rate Example

Station Equipment and Construction (includes OH)	\$7,420,000
Estimated construction period	12 months
Plant life	20 years
Total O&M	\$449,000/year
Monthly Rate	\$110,750

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Table 3: Injection Service Rate Example

Injection Station Cost	\$3,600,000
Pipeline Cost	\$1,440,000
Land	\$400,000
Total Injection Service Capital	\$5,440,000
Estimated construction period	4 months
Plant life	20 years
Operating and Maintenance	\$107,000/year
Monthly Rate	\$ 63,083

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58. Enbridge is requesting approval of a new Rate 400 for Upgrading Service and Rate 401 for Injection Service. The service fees charged under Rates 400 and/or Rate 401 to each RNG producer will be as set out in the relevant contract. The proposed Rate Schedules for Rate 400 and Rate 401 are attached as Appendix 9 and Appendix 10 respectively.

59. As detailed in the “Regulatory Treatment of RNG Enabling Service and Geothermal Energy Service Program” section of this evidence, Enbridge is also requesting approval of its proposal to record the annual revenue deficiency or sufficiency associated with the RNG enabling service program in the GHG-Customer VA to be periodically cleared to ratepayers. Examples showing relevant amounts can be seen in Appendix 6 and Appendix 8 at Line 18.

Market options for RNG Producers

60. Once the RNG has been injected into Enbridge’s gas distribution system, the producer will have the following four options to sell the RNG, or to use it for their own purposes:

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- a) The RNG producer can use the RNG to provide all or part of their gas supply requirements at another of their locations served by Enbridge (this will require a Direct Purchase arrangement).
- b) The RNG producer can sell the RNG to another Enbridge customer to fulfill all or a portion of their gas supply requirement (this will require a Direct Purchase arrangement).
- c) If the RNG producer wishes to move and sell the RNG outside of the Enbridge service area, Enbridge will facilitate the transportation of RNG produced to a trading hub, typically Dawn.
- d) In the event that Enbridge is purchasing RNG as part of the Company's gas supply mix, the RNG producer will be able to respond to tenders for the sale of RNG to the Company.

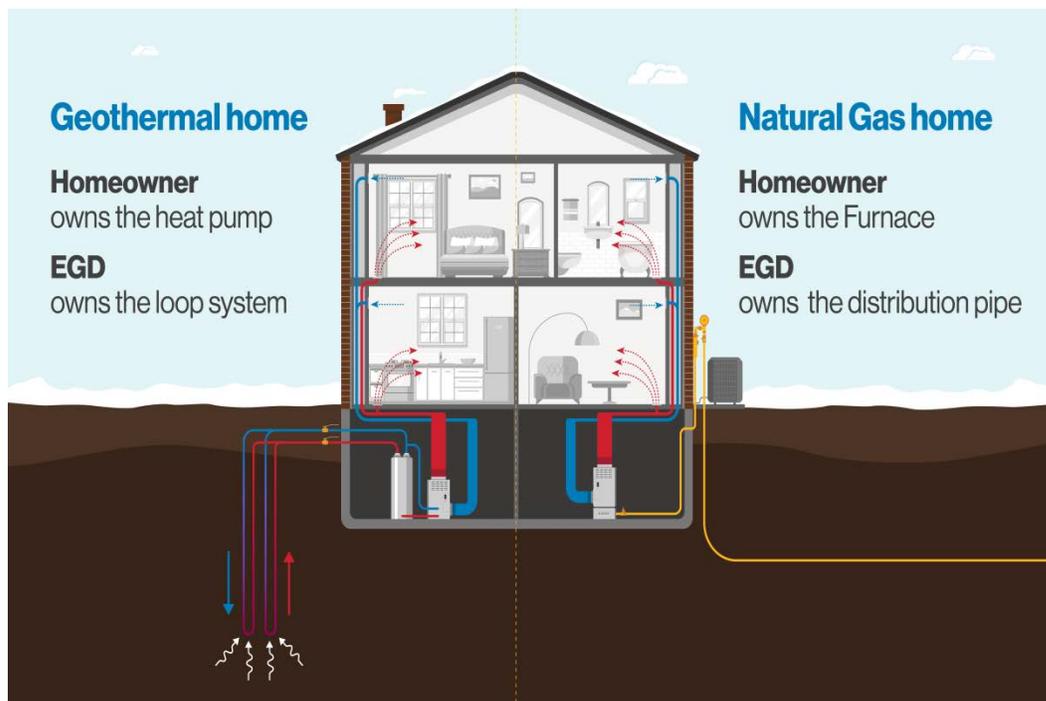
Geothermal Energy Service Program

61. The purpose of this portion of the Company's evidence is to describe the utility based Geothermal Energy Service program that Enbridge plans to implement in 2018 as a GHG emission abatement program to offset natural gas usage. Enbridge's proposed Geothermal Energy Service program is focused on making geothermal systems more broadly available and implemented for customers who would otherwise be using natural gas or other fossil fuels for space and water heating.
62. Enbridge's proposed Geothermal Energy Service program will see complementary investments between customers, Enbridge and GreenON funding. Enbridge will

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own and maintain the geothermal loops while customers will own and maintain the heat pump system and will receive GreenON funding to offset some of that cost. This is similar to the current gas distribution system approach, where the utility owns the supply infrastructure and the customer owns the in-home appliances – see Figure 2 below.

Figure 2: Geothermal and Natural Gas Home



Background

63. Geothermal systems provide space heating, water heating and cooling and are typically electrically powered, highly efficient and release no direct GHG emissions. A geothermal system consists of ground source loops (“geothermal loops”) which are pipes in the ground; and a heat pump system (“heat pump”) that is functionally

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similar to a furnace air conditioner combination and is installed above ground in the home and connects to the geothermal loops through pipes that go into the house.

64. Geothermal systems can be used with forced-air and hydronic heating systems. They work by transferring heat from and into the earth by circulating a liquid, such as ground water or an antifreeze solution, via a heat pump system. During the heating season, the heat pump system extracts heat from this liquid. This heat is used to heat indoor air. This process is reversed during summer months when heat is removed from indoor air and transferred to the earth by the ground water or antifreeze solution.
65. Geothermal systems have been available in Ontario for a number of years. However, the adoption of this technology has been hampered by high initial cost compared to other building heating / cooling technologies and inconsistent approaches by different contractors. These factors have resulted in low market penetration and less than desirable levels of customer satisfaction with this technology.
66. Geothermal systems have been identified as an important means of achieving the Province's GHG emission reduction targets. In June 2016, the MOECC issued its Climate Change Action Plan (the CCAP). The CCAP includes a section discussing plans to reduce GHG emissions within the "Buildings and Homes, and indicates that:

Ontario will help homeowners purchase and install low-carbon energy technologies such as geothermal heat pumps and air-source heat pumps, solar thermal and solar energy generation systems that reduce reliance on fossil fuels for space and water heating.

67. The CCAP promises \$500 to \$600 million in future funding to promote the adoption of geothermal heating, air source heat pumps, solar thermal and solar electricity generation in the Province's residential buildings sector.¹⁶
68. On December 13, 2017, the Ontario Government announced new rebates from the GreenON fund for ground source heat pumps (home geothermal).¹⁷ As noted above, homeowners will be eligible for rebates of up to \$20,000 for ground source heat pumps, which will offset the customer's portion of costs under Enbridge's proposed Geothermal Energy Service program.
69. Enbridge is in a unique position to use its safe, consistent, repeatable and standardized business processes along with its presence in Ontario to enable adoption of geothermal systems as a safe and reliable low-carbon solution for future household heating requirements. The utility can provide this service through its ownership and maintenance of geothermal loops for the residential market.
70. To this end, the Company has been consulting and meeting with the MOECC, the MOE and the OGA to discuss Enbridge's role in facilitating the expansion of geothermal systems to more Ontario homes.
71. The Company will ensure uniform standards are applied to the safety, design, sizing and installation of geothermal systems to achieve a high level of quality assurance and consistent operating and economic performance. For the new construction market, Enbridge can utilize its strong relationship with the home builder community and apply similar business processes to the installation of ground source loops and

¹⁶ CCAP, at page 67 (http://www.applications.ene.gov.on.ca/ccap/products/CCAP_ENGLISH.pdf)

¹⁷ The GreenON announcement can be found at the follow link:
<https://www.greenon.ca/programs/greenon-rebates-ground-source-heat-pumps>.

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heat pump systems as those used to install gas distribution piping and services today. It is anticipated that over time, significant cost reductions can be achieved for the heat pump systems through achievement of scale making geothermal systems more cost effective and less dependent on government support.

72. Enbridge can also bring brand name and recognition to the Ontario geothermal market. This can provide visibility and credibility to the technology as a viable option for home or building owner.
73. As described below, Enbridge is proposing a Geothermal Energy Service program where the utility owns and maintains geothermal loops at customers' homes. The customers will own the heat pump and other geothermal system equipment. This approach will make geothermal technology cost competitive compared to more traditional building heating and cooling alternatives (natural gas space and water heating combined with electric air conditioning) because customers will be able to receive financial support from the GreenON Fund for the ground source heat pump, and will pay for the use of the geothermal loops over time.
74. Enbridge sees geothermal systems as a key way to abate carbon. Deploying geothermal systems where natural gas would otherwise be consumed will offset natural gas usage. Over a 10 year geothermal customer additions forecast (discussed below), the Geothermal Energy Service program is expected to reduce over 2.4 mega tonnes of CO₂ over the asset life. This contributes towards the Company's plan and obligation to abate carbon emissions. As such, the Company's position is that all such geothermal loop assets and operating costs and revenues associated with this program that displace current or future natural gas consumption will be considered as part of the Company's regulated utility activities as abatement assets.

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The Enbridge Geothermal Energy Service Program

75. Under Enbridge's Geothermal Energy Service program, the Company will install, own and maintain the geothermal loop component of new geothermal systems. Enbridge will charge the home or building owner a monthly service fee specific to the heating capacity of the ground source loop. The Program is initially targeted to single family homes (both new and retrofit). In the future, the Program may be expanded to multi-residential and commercial markets.
76. Enbridge will supply and install separate geothermal loops for each home or building owner who participates in the Geothermal Energy Service program. The owner will enter into a contract with Enbridge under which the Company will supply and install the geothermal loops, and the owner will provide Enbridge with necessary access to the property over the life of the geothermal loops. Enbridge will own, and maintain the geothermal loops over the term of the contract and the owner will pay a monthly service fee to Enbridge.
77. The home or building owner will arrange for the installation of the ground source heat pump and other equipment necessary to complete the geothermal energy system. Enbridge will provide support to the customer to ensure that the appropriate equipment is procured and installed. The relationship between Enbridge and the customer, where Enbridge owns, and maintains the pipes that supply the home with energy and the home or building owner owns and operates the parts of the geothermal energy system within the home is similar to the current gas distribution business (See Figure 2 above).
78. The required geothermal loop and heat pump size to provide sufficient heating and cooling functions is dependent on the size, amount of insulation and design of the

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home. The geothermal systems are sized in tonnes of heating capacity. Typical homes in Ontario will require between 3 and 5 tonnes of heating capacity.

Calculation of Service Fees

79. To calculate the Geothermal Energy Service program service fees, Enbridge has built a DCF model using a 10 year customer forecast, estimates of capital, operating costs and taxes, applying the principles set out in EBO 188.

80. The Company's 10 year customer forecast is based on several factors including expected demand for geothermal systems (which will be driven in part by a GreenON Fund Geothermal Rebate program), current capacity in the market, and ramp-up capability of the market to meet future demand. The Company expects about 170 customers in Year 1 and over a period of 10 years a total of about 18,000 customers.

81. The estimated capital costs for the installation of the geothermal loops are based on unit costs for drilling and trenching based on market information and the Company's experience. The estimated capital costs also include construction management, commissioning and quality assurance with contingencies based on geographical and geological construction uncertainties.

82. The operating and maintenance expenses for the Geothermal Energy Service program includes periodic inspection and maintenance of the geothermal loops, customer care and billing cost, overhead and management costs and costs of other typical utility functions for an ongoing business operation. In addition, Enbridge's DCF model includes one-time system setup and development costs for the Geothermal Energy Service program. For all operating and maintenance expenses

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and development costs, Enbridge has applied fully allocated costs in the DCF model.

83. Using the customer forecasts, capital costs and operating costs as described above and using Enbridge's 2018 capital structure and cost rates, Enbridge has calculated the monthly loop service fees that would be required to provide for the 10 year customer addition portfolio to achieve a PI of 1.1. The DCF model is set out at Appendix 11 and the revenue requirement calculation is provided in Appendix 12. Using this methodology the required monthly Geothermal Service Program fee(the "Loop Service Fee") will be \$25.07 per tonne for 2018. Terms and conditions will be set out in the customer service agreements supporting this Program. /u
84. Under the proposed Geothermal Energy Service program model there will be little or no impact to existing ratepayers, as the geothermal customers will pay cost based fees over the life of the geothermal loops, with the fees based on the fully allocated cost of providing the proposed Geothermal Energy Services program.
85. Given that this will be a new program and to protect existing ratepayers from any downside risk, Enbridge is proposing Geothermal Energy Service program service fees that would provide a PI greater than 1.0 as per the principles set out in EBO 188.
86. Appendix 12 shows that the geothermal program is expected to generate a net revenue deficiency until 2021 and again from 2029 to 2038. From 2022 through 2028 and again from 2039 through 2057 (the end of the DCF analysis period), the program returns a net revenue sufficiency. Overall, these cash flows return a PI of 1.1 or a net present value of \$16.7 million over the DCF analysis period. /u

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Additionally, there is a cumulative revenue sufficiency of \$76.2 million over the DCF /u
analysis period which represents an overall net benefit to ratepayers.

87. As detailed in the “Regulatory Treatment of RNG Enabling Service and Geothermal Energy Service Program” section of this evidence, Enbridge plans to record the annual revenue deficiency or sufficiency associated with the Geothermal Energy Services program in the GHG-Customer VA to be periodically cleared to ratepayers. Relevant amounts can be seen in Appendix 12 at Line 23.

Implementation

88. Enbridge expects that approximately 170 geothermal systems can be put in place under its Geothermal Energy Services program in 2018. Under Enbridge’s 10 year customer additions forecast, the program is expected to reduce over 2.4 mega tonnes of CO₂ over the asset life and provides a net sufficiency of \$76.2 million to /u
the GHG-Customer VA. The analysis supports this longer term investment as a beneficial and cost-effective abatement program for Enbridge to undertake to manage its Cap and Trade obligations.
89. The Company expects that the December 13, 2017 GreenON announcement will prompt increased customer interest in geothermal installations. It is with that in mind that Enbridge is moving quickly so that the Geothermal Energy Services program can be launched as soon as possible. To this end, the Company has been working with the OGA to insure that adequate training, inspection and certification processes are in place to accommodate the increased demand for geothermal Systems that the launch of the rebate program is expected to bring about.

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Approvals Requested

90. Based on the foregoing, Enbridge requests that the Board provide the following approvals in this proceeding.

- a) Approval of Rate 400 and Rate 401 which will support the utility offering RNG Upgrading and RNG Injection Services respectively, using site specific service fees based on the methodology described in this evidence.
- b) Approval of the 2018 Geothermal Energy Service program service fee.
- c) Approval to record the annual revenue deficiency / sufficiency associated with the RNG Enabling Program and Geothermal Energy Service program in the GHG-Customer VA. The amounts recorded will be cleared through the annual process of settling the GHG-Customer VA.

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