STAFF INTERROGATORY #12

INTERROGATORY

Ref: Exhibit D / Tab 1 / Schedule 1 / p. 1, #1
Exhibit C / Tab 5 / Schedule 2 / p. 3
Exhibit C / Tab 5 / Schedule 1 / p. 11, #28
Exhibit D / Tab 1 / Schedule 1 / p. 2, Table 1

Preamble:
Enbridge Gas states that it forecasts its 2018 Administrative Costs to be captured in the 2018 GGEIDA to be a total of $5.2 million; of that amount, $2.0 million is related to the Low Carbon Innovation Fund. Enbridge Gas also states that it is requesting approval of two new FTEs to support investigation, planning and project management activities, to be funded through the GGEIDA.

Enbridge Gas estimates that the 2018 cost associated with the two additional FTEs will be approximately $350,000.

Enbridge Gas has provided the following Table 1 as a summary of its 2018 Forecasted Administrative Costs:

Table 1: 2018 Forecasted Administrative Costs

Cost Element	**Forecasted Amount**
Revenue requirement implications of IT billing system upgrades	$191,000
Staffing Resources	$1,500,000
Low Carbon Initiative Fund ("LCIF")	$2,000,000
Consulting Support and Market Intelligence	$400,000
OEB Cap and Trade related Consultation	$100,000
Incremental Cap and Trade related GHG Reporting and Verification Audit	$40,000
Bad Debt Provision	$960,000
Other Miscellaneous Costs	$60,000
Applicable Compliance Plan Proceeding Costs	TBD
Total 2018 Forecast Administrative Costs for GGEIDA	**$5,251,000**

Witnesses: T. Bruckmueller
A. Langstaff
D. McIlwraith
F. Oliver-Glasford

a) Please complete the table below. For the 2017 Actual column, please provide year-to-date actuals and the remainder of the 2017 year as a forecast.

Administrative Cost Item	**2017 Forecast**	**2017 Actual**	**2018 Forecast**
Staffing Resources (Salaries and Wages)	$1,120,000		$1,500,000
Consulting	$561,000		$400,000
Bad debt related to cap and trade	$900,000		$960,000
IT Billing System Updates	$76,100		$191,000
Customer Education and Outreach	$115,000		
External Legal Counsel	$125,000		
OEB Costs			$100,000
C+T GHG reporting and verification costs	$20,000		$40,000
Other (travel expenses, market research and communications)			$60,000
SUB-TOTAL	**$2,917,100**		**$3,251,000**
Low Carbon Initiative Fund	n/a		$2,000,000
TOTAL			**$5,251,000**

b) Please explain why Enbridge Gas' customer education and outreach costs went from $115,000 in 2017 to $0 in 2018.

c) Please discuss the rationale and appropriateness of the difference in bad debt related to cap and trade costs proposed by Enbridge Gas ($960,000 in 2018) and Union Gas ($425,000 in 2018).

d) Please explain why Enbridge Gas' forecast bad debt related to cap and trade for 2018 is $60,000 more than its forecast bad debt for 2017, while Union Gas' forecast

Witnesses: T. Bruckmueller
A. Langstaff
D. McIlwraith
F. Oliver-Glasford

bad debt related to cap and trade for 2018 is $175,000 less than its forecast bad debt for 2017.

e) Please explain whether the 2018 cost associated with the two additional FTEs that Enbridge Gas has requested is included in Exhibit D / Tab 1 / Schedule 1 / p. 2, Table 1.

f) Enbridge Gas and Union Gas filed a MAAD application[1] with the OEB. Please explain whether, and if so how, Enbridge Gas will realize any economies of scale in relation to FTEs that are working on cap and trade.

g) For the table in a), please provide an explanation for any line item where:
   i. The cost difference between 2017 Forecast and 2017 Actual is greater than 10 percent.
   ii. The cost difference between 2017 Actual and 2018 Forecast is greater than 10 percent.

RESPONSE

a) Enbridge notes that Table 1 shown above, and in the evidence at Exhibit D, Tab 1, Schedule 1 did not include forecast costs for external legal counsel. As external counsel costs associated with Cap and Trade are an incremental cost, it is appropriate to include in the 2018 administrative cost forecast. External counsel costs have been included in the table below.

[1] EB-2017-0306

Witnesses: T. Bruckmueller
A. Langstaff
D. McIlwraith
F. Oliver-Glasford

Administrative Cost Item	2017 Forecast	2017 Actual	2018 Forecast
Staffing Resources (Salaries and Wages)*	$1,120,000	$694,590	$1,500,000
Consulting	$561,000	$156,772	$400,000
Bad debt related to cap and trade	$900,000	$600,007	$960,000
IT Billing System Updates	$76,100	$97,600	$191,000
Customer Education and Outreach	$115,000	$12,881	$0
External Legal Counsel	$125,000	$363,648	$400,000
OEB Costs		$317,968	$100,000
C+T GHG reporting and verification costs	$20,000	$9,500	$40,000
Other (travel expenses, market research and communications)		$20,736	$60,000
SUB-TOTAL	**$2,917,100**	**$2,273,702**	**$3,651,000**
Low Carbon Initiative Fund	n/a	0	$2,000,000
TOTAL		**$2,273,702**	**$5,651,000**

b) In 2018, Enbridge intends to use existing communication methods as ensure that customers remain informed on the aspects of Cap and Trade, at no additional cost.

Enbridge has been leveraging existing customer communication methods (i.e., no or low incremental cost communication methods) since the inception of the program. A summary has been provided below.

In January 2017, the Company used an on-bill envelope message to direct customers to Enbridge's Cap and Trade website to obtain additional information about the Cap and Trade program. A sample of this on-bill envelop message was filed at EB-2016-0300, Exhibit E, Tab 1, Schedule 1, Appendix D. For detailed information on Enbridge's Cap and Trade website, please refer to Board Staff interrogatory 29 a) filed at Exhibit I.3.EGDI.STAFF.29. Enbridge did not incur any incremental costs for the inclusion of this on-bill envelope message.

Witnesses: T. Bruckmueller
A. Langstaff
D. McIlwraith
F. Oliver-Glasford

Throughout 2017, upon request, Enbridge continued to communicate with customers about Cap and Trade through various non-cost platforms such as Twitter, the call centre and the Ombudsman's office. For additional information, please refer to Board Staff interrogatory #29 filed at Exhibit I.3.EGDI.STAFF.29.

c) As identified at Exhibit D, Tab 1, Schedule 1, paragraphs 27 through 30, Enbridge utilized the Company's total revenue requirement, total forecasted cost of compliance and corporate bad debt forecast to calculate a forecasted cost of bad debt associated with Enbridge's Cap and Trade program. Enbridge is not aware of the specific details of Union Gas Limited's methodology for forecasting bad debt associated with Cap and Trade.

d) Enbridge is maintaining the same methodology of attributing a fixed share of bad debt to Cap and Trade based on the percentage of billed revenue. The increase in Enbridge's Cap and Trade bad debt forecast in 2018 is a result of an increase in the forecast total cost of compliance between 2017 and 2018.

e) The costs associated with the two new FTEs for the implementation and sustainment of the abatement construct are included in the staffing resources costs in Table 1 filed at Exhibit D, Tab 1, Schedule 1.

f) Please refer to Board Staff interrogatory #16a, filed at Exhibit I.1.EGDI.STAFF.16.

g)

i) Enbridge's external legal counsel costs exceeded the Company's budget by greater than 10%. At the time the 2017 Compliance Plan was filed, the Company did not have a complete understanding of the intricacies and effort involved in the preparation and defense of the Company's first Cap and Trade Compliance Plan.

In Enbridge's 2017 Compliance Plan, the Company did not forecast any 'Other' expenses or OEB costs. As noted in the Board's table, 'Other' would include such expenses as travel, market research and communication. Such costs have been forecasted in Enbridge's 2018 Compliance Plan.

In regards to the IT billing system updates, the actual 2017 revenue requirement was greater than the 2017 forecast revenue requirement provided in EB-2016-0300, primarily as a result of higher than forecast actual billing system update costs ($564K versus $516K) and a slightly earlier than forecast in-service date

Witnesses: T. Bruckmueller
A. Langstaff
D. McIlwraith
F. Oliver-Glasford

(December 2016 versus January 2017), which resulted in higher than forecast depreciation and cost of capital revenue requirement amounts.

ii) The difference in staffing costs are attributed to the continued development of Enbridge's Cap and Trade team, recognizing the increased complexity of the market and evolution of the Company's abatement processes. Enbridge's anticipated 2018 staffing requirements are set out in Table 2 of EB-2017-0224, Exhibit D, Tab 1, Schedule 1.

The higher forecast consulting costs for 2018 (over Enbridge's 2017 actual costs) are also a result of the increased complexity of the Cap and Trade market. Enbridge anticipates that it will require support towards the development of the 2019 / 2020 Compliance Plan and continuing support in reviewing and responding to various regulatory updates and/or offset protocols.

It should be noted that Enbridge's bad debt forecast from 2017 to 2018 increased by approximately 7%. The actuals recorded in 2017 were lower than forecasted due to the Company's actual overall bad debt being lowered than forecasted. As discussed in response to CME Interrogatory #5, filed at Exhibit I.1.EGDI.CME.5, Enbridge continues to use the same methodology to forecast bad debt. The 2018 forecast bad debt related to Cap and Trade is only a forecast. Enbridge will only seek clearance of the actual bad debt incurred.

The forecast 2018 revenue requirement related to the Cap and Trade billing system updates is greater than the 2017 actual revenue requirement primarily due to higher forecast income taxes. The increase in 2018 income taxes is a result of lower Capital Cost Allowance tax deductions attributable to the billing system updates capital cost, which were utilized within the determination of 2016 and 2017 actual revenue requirements.

An increase in Cap and Trade GHG reporting and verification is noted as it is mandatory that the Company undergo a complete audit and verification on its customer-related emissions. This is a new requirement based on the implementation of the Cap and Trade program. In 2017, the costs of this incremental audit and verification were less as the Company completed only a pre-verification audit to ensure readiness for 2017.

The increase in 'Other' is primarily due to the growth in the Cap and Trade team. For example, this will result in higher costs for conferences and forums. As detailed in paragraph 31 of EB-2017-0224, Exhibit D, Tab 1, Schedule 1,

Witnesses: T. Bruckmueller
A. Langstaff
D. McIlwraith
F. Oliver-Glasford

Enbridge recognizes that these conferences and forums provide invaluable learning and networking opportunities. Additionally, it is noted that Enbridge included Communication in the 'Other' cost components. Enbridge may consider alternate forms of Cap and Trade communication or research, should they be considered necessary.

Witnesses: T. Bruckmueller
A. Langstaff
D. McIlwraith
F. Oliver-Glasford

STAFF INTERROGATORY #13

INTERROGATORY

Ref: Exhibit D / Tab 1 / Schedule 1 / p. 6-7

Preamble:
Enbridge Gas notes that it receives support from experts and consultants for development and execution of its Cap and Trade activity. It also notes that consulting and market intelligence costs are forecasted to be approximately $400,000, which includes expert insights and support related to Enbridge Gas' development and implementation of its Compliance Plan; Specific offset market insight to build an effective offset strategy as well as help support development of an active offset market; Carbon market and related climate policy insight and analysis; and Legal and/or technical review of regulation amendments and commercial contract support where required.

a) Please explain how many consultants Enbridge Gas is using or intends to use to fulfill all of the support activities described.

b) Please complete the table below:

Consultant	**2018 Costs**
Total	**$400,000**

c) Please describe whether Enbridge Gas undertook or will undertake a competitive procurement process when selecting each of its consultants.

d) Enbridge Gas and Union Gas filed a MAAD application[1] with the OEB. Please explain whether, and if so how, Enbridge Gas will realize any economies of scale in relation to external consultants working on issues related to cap and trade.

[1] EB-2017-0306

Witnesses: A. Langstaff
F. Oliver-Glasford

RESPONSE

a) For 2018, Enbridge has not finalized the totality of its consultant requirements or selection but recognizes that the Company will need third party support. Enbridge anticipates that it will require support towards the development of the 2019/2020 Compliance Plan and continuing support in reviewing and responding to various regulatory updates and/or offset protocols.

b) The table referenced below was generated for forecasting purposes. As identified in part a) of this question, Enbridge has not finalized its full complement of consultants for 2018.

Component	**Consultant**	**2018 Forecast**
Compliance Plan Consulting and Implementation Support	TBD	$150,000
Offset Market Consulting Support	TBD	$100,000
Carbon Market and Related Climate Policy Support	Associations	$20,000
Carbon Market and Related Climate Policy Support	Market Intelligence	$30,000
Carbon Market and Related Climate Policy Support	Offset protocol response	$50,000
Compliance Enabling Legal Support	McCarthy Tetrault and Aird & Berlis	$50,000

c) To the extent possible, Enbridge will undertake a competitive bid process. It must be recognized that the pool of carbon market consultants and experts is small; however, Enbridge will evaluate the cost of any proposal against costs quoted by other consultants, or through historical experience where possible.

d) Please refer to Board Staff Interrogatory #16a, filed at Exhibit I.1.EGDI.STAFF.16.

Witnesses: A. Langstaff
F. Oliver-Glasford

STAFF INTERROGATORY #14

INTERROGATORY

Ref: Exhibit B / Tab 2 / Schedule 1 / p. 2 and p. 6, Table 1
Exhibit C / Tab 5 / Schedule 2 / p. 26, Table 3

Preamble:
Enbridge Gas provides a 2018 volume forecast that remove 31,139,000m^3 due to demand side management (DSM) volumes. Enbridge Gas indicates that this is a partially effective volumetric reduction.

In Exhibit C, Tab 5, Schedule 2, on Existing Customer Abatement Programs, Enbridge Gas indicates that the savings from its DSM Plan in 2020 (including recurring annual savings achieved as a result of DSM efforts in 2018, 2019, and 2020 respectively) is 225,560,390m^3.

Questions:

a) Please explain what Enbridge Gas means by "partially effective" volumetric reduction.

b) Please explain whether and how the DSM volume reduction included in the 2018 volume forecast in Exhibit B is consistent with the 2020 DSM Plan savings analysis in Exhibit C, since the DSM analysis includes annual savings that result from DSM efforts in 2018, 2019, and 2020.
    i. If it is not consistent, please explain why not.

RESPONSE

a) In recognition that volumes associated with energy efficiency within a given year do not all initiate January 1st, partially effective volumetric savings are the DSM annual saving forecasts adjusted for the timing of when participants begin to realize saving in their first year of participation (i.e., not all participants are added in the first months of the year). Fully effective DSM savings would only apply if all programs and participants were delivered and fully subscribed on January 1st of the program year. The Company follows an approach which has been developed and used within DSM since the late 1990's to forecast partially effective volumes in a given year for the purposes of calculating a Lost Revenue Adjustment Mechanism ("LRAM"). For LRAM purposes partially effective DSM savings are calculated by dividing 75% of the annual savings equally by month, assuming savings accumulate at the same

Witnesses: D. Johnson
M. Suarez

rate monthly. For specificity, partially effective volumes in January represent 1/12 of the savings; for February, year-to-date DSM savings represent 2/12 of the savings from January, plus 1/12 of the savings in February, and so on.

b) There are differences between the 2018 volume forecast in Exhibit B and the analysis in Exhibit C. Exhibit B, provided the partially effective volumes as is explained in part a) of this question, while the analysis in Exhibit C uses the fully effective annual volume. The volumetric savings for Exhibit B as described above used the 2018 forecast that aligned with the LRAM calculation, while the analysis in Exhibit C used the numbers as filed in the DSM plan EB-2015-0049.

Witnesses: D. Johnson
M. Suarez

STAFF INTERROGATORY #15

INTERROGATORY

Ref: Exhibit C / Tab 1 / Schedule 1 / p. 11, #40

Preamble:
Enbridge Gas states that it has created a Carbon Strategy Working Group to monitor the implementation of the Compliance Plan and underpin the function of the Carbon Procurement Governance Group (CPGG). The Working Group will include members from the Carbon Strategy, Contract and Legal departments.

Questions:

a) Please explain the roles and responsibilities of the Carbon Strategy Working Group and how it differs from the CPGG.

RESPONSE

a) Enbridge developed the Carbon Procurement Governance Group ("CPGG") in 2016 to oversee the development and implementation of the Compliance Plan. Voting members of the CPGG consist of senior management at the Company. As noted in EB-2016-0300, Exhibit C, Tab 1, Schedule 1, paragraph 21, "The group's primary responsibility will be to ensure the successful and cost-effective implementation of Enbridge's Cap and Trade program, inclusive of its Compliance Plan". The Company notes that this governance structure worked well in 2017, and is continuing in 2018.

   In the vein of continuous improvement, one of the Board's Guiding Principles, Enbridge has implemented a Carbon Strategy Working Group ("CSWG"), which is comprised of employees that are accountable in the day-to-day operation and implementation of the Company's Cap and Trade procurement activities. This group was formed to enhance connectivity between the various group and individuals involved in procurement.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

STAFF INTERROGATORY #16

INTERROGATORY

Ref: Exhibit C / Tab 3 / Schedule 1 / p. 8-9

Preamble:
In the WCI linked market, Enbridge Gas states that it is considered a related person with two entities: Union Gas and Gazifère Inc.

Enbridge Gas and Union Gas also filed a MAAD application[1] with the OEB.

Questions:

a) For 2018, please explain whether, and if so how, Enbridge Gas will realize any economies of scale in relation to the following cap and trade activities:
   i. Research and development, including RNG research and development
   ii. Back office functions
   iii. FTEs related to cap and trade
   iv. Cap and trade consultants
   v. Abatement activities

b) Do Enbridge Gas and Union Gas intend to file individual and separate compliance plans for 2019-2020? Please explain.

RESPONSE

a) Enbridge and Union Gas will continue to operate as separate utilities until they have received all necessary OEB approvals to amalgamate. Only after the decision is made to proceed with the amalgamation will an integration plan be developed. If there is a decision on amalgamation within a reasonable timeframe before the year ends, the Utilities will work together to determine if and how economies of scale can be realized.

b) Enbridge recognizes the confluence of timelines between the MAAD application and related process and the current August 1, 2018 filing date of the 2019/2020 Compliance Plan. Although Enbridge notes that submitting a joint 2019/2020 Compliance Plan with Union Gas is an option, the Company must still determine if it is practically feasible to do so particularly given the above noted filing deadline.

[1] EB-2017-0306

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

STAFF INTERROGATORY #17

INTERROGATORY

Ref: Exhibit C / Tab 1 / Schedule 1 / p.2

Preamble:
Enbridge Gas states that it will have to share and allocate the purchase and holding limits between three entities (Enbridge Gas, Union Gas and Gazifère Inc.).

Union Gas, in its 2018 Compliance Plan[1], states that it intends to apply to the MOECC for a holding limit exemption in the fall of 2017 under Section 41 of the Cap and Trade Regulation.

Questions:

a) Does Enbridge Gas intend to apply to the MOECC for a holding limit exemption? Please explain.

RESPONSE

a) Yes, Enbridge also applied for a holding limit exemption in November 2017 and was granted approval by the MOECC.

All capped participants are allowed to hold a certain amount of allowances in their compliance account that are exempt from the holding limit. The exemption amount is calculated based on the table in Section 41.(1) of the Cap and Trade Regulation. For 2017 and 2018 the formula in the table is based on emissions in 2015, however since Enbridge did not report customer emissions in 2015 the Company was required to apply to the Director under Section 41.(3) to assign a value.

For 2019 and future years, the exemption is calculated using emissions reported in 2016 onwards; therefore, Enbridge will no longer be required to apply for exemptions and will receive exemptions based on the formula in the table.

[1] EB-2017-0255, Ex 3/T2/p.11

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

STAFF INTERROGATORY #18

INTERROGATORY

Ref: Exhibit C / Tab 1 / Schedule 1 / p. 12
Exhibit C / Tab 3 / Schedule 1 / p. 8

Preamble:
Enbridge Gas notes that it can continue to use its existing Compliance Instrument Tracking System Service (CITSS) account upon linkage of Ontario with the WCI market.

Enbridge Gas states that under Ontario Regulation 144/16, The Cap and Trade Program, related capped participants must share the purchase limit of 25%. In the WCI linked market Enbridge Gas is a related person with two entities – Union Gas and Gazifère Inc.

Questions:

a) How may CITSS accounts does Enbridge Gas have?
   i. Please describe each of Enbridge Gas' CITSS accounts

b) Do Union Gas, Enbridge Gas and Gazifere share a CITSS account? Please explain.

c) Please explain how Union Gas, Enbridge Gas and Gazifere will coordinate and report their accumulated compliance instruments to demonstrate compliance.

RESPONSE

a) Enbridge has one CITSS account. As a capped participant, within Enbridge's CITSS account there are two accounts for holding allowances and credits. The "General Account", also referred to as a holding account, is used to hold emissions allowances and credits, and to conduct transactions. The "Compliance Account" is used to surrender allowances and credits to the MOECC at the end of the compliance period.

b) Enbridge, Union Gas, and Gazifère are required to have their own CITSS accounts pursuant to the Ontario and Quebec Cap and Trade program.

c) At this time, each of Union Gas, Enbridge and Gazifère manage their compliance instruments independently. Each entity will surrender instruments as required to their respective jurisdiction and will provide notice of compliance to their respective regulator separately.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

STAFF INTERROGATORY #19

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 1 / pp. 2-3

Preamble:
Enbridge Gas states that "With the increasing cost of carbon and the increasing recognition of the value of avoiding GHG emissions, attractiveness of GHG abatement will evolve."

Questions:

a) Please discuss why Enbridge Gas has prioritized RNG as an abatement activity in its 2018 Compliance Plan. Please provide all supporting documentation including analysis.

b) Please explain why, as the cost of carbon increases, Enbridge Gas is not looking to undertake any of the abatement opportunities outlined in the OEB's Marginal Abatement Cost Curve[1] (OEB MACC). Please provide all supporting documentation, including data and analysis.

RESPONSE

a) Given that California, Quebec and British Columbia are all actively pursuing RNG as a means of GHG abatement and it is anticipated that the government of Ontario will provide funding to equate the cost of RNG to that of traditional natural gas supplies inclusive of its applicable carbon cost, Enbridge believes that it is important to prioritize RNG as a carbon abatement initiative at this time. Information supporting the Company's RNG procurement proposal can be found 1 at Exhibits I.C.EGDI.STAFF.1 and I.C.EGDI.CCC.10.

   Enbridge has prioritized RNG procurement in its 2018 Compliance Plan because the Company believes that RNG presents a cost-effective abatement option, which meets the Board's Guiding Principles. As discussed in response to Board Staff Interrogatory #1 filed at Exhibit I.C.EGDI.STAFF.1,and CCC Interrogatory #10 filed at Exhibit I.C.EGDI.CCC.10, government funding is anticipated, which will allow RNG to be provided to natural gas customers with no incremental cost over the cost of traditional natural gas, including the

[1] EB-2016-0359

Witnesses: D. Johnson
S. McGill
F. Oliver-Glasford

applicable cost of carbon. Given that California, Quebec and British Columbia are all actively pursuing RNG as a means of GHG abatement, and a federal Low Carbon Fuel Standard is currently under development, Enbridge believes it is to the natural gas ratepayers' advantage to leverage funds from Cap and Trade, which were partially collected from them, to initiate an RNG market in Ontario.

b) Please see the Company's response to Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24.

Witnesses: D. Johnson
S. McGill
F. Oliver-Glasford

STAFF INTERROGATORY #20

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 1 / p. 3, #8
Exhibit C / Tab 5 / Schedule 2 / p. 3, Table 1

Preamble:
Enbridge Gas states that it worked collaboratively with Union Gas to outline an Abatement Construct to guide abatement initiatives which is expected to be subject of continuous improvement.

Enbridge Gas provides the following Table 1, which is a summary of its proposed abatement initiatives and required approvals:

Table 1: Abatement Initiatives Summary

Initiative Development Stage	Initiative	2018 OEB Approvals Required
Stage 3: Propose	Renewable Natural Gas Procurement	Approval to procure RNG in 2018 as per the model identified in this exhibit.
	Natural Gas Renewable Enabling Program	Approval of new rates for RNG processing and injection, and approval to record deficiency and sufficiency in the applicable variance account. This program will be addressed in EB-2017-0319.
	Geothermal Energy Services Program	Approval of geothermal energy service fees and approval to record deficiency and sufficiency in the applicable variance account. This program will be addressed in EB-2017-0319.
Stage 2: Formulate	Hydrogen (Power to Gas)	Approval for 2 FTEs to support investigation, planning and project management activities, to be funded through the GGEIDA. Approval of funding of up to $2M starting in 2018 in the Low Carbon Innovation Fund ("LCIF") to advance pilot projects and research throughout stages one to three of the Initiative Funnel that would enable a more complete assessment of promising technologies and opportunities for eventual implementation. The LCIF would be tracked through the GGEIDA.
	Net-Zero Homes/ Micro-Generation	
	Expanded NGV Program	
	Natural Gas Air-Source Heat Pumps	
Stage 1: Conceptual	Smart Metering	
	RNG – Gasification	
	Carbon Capture	
Implementation / Existing Activity	Demand Side Management	Enbridge's 2015 to 2020 DSM Plan has already been approved in EB-2015-0029/49. The DSM mid-term review which as one component is assessing the interconnection between DSM and Cap and Trade is in progress (EB-2017-0127 and EB-2017-0129).
	Green Investment Fund Program	Enbridge's incremental residential energy efficiency abatement through the Green Investment Fund has been in place since 2016 and does not require an approval through this 2018 Compliance Plan.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

a) Please provide Table 1 (above) with the following columns added on:
   i. The cost per tonne of CO_2e ($/tonne CO_2e) for each abatement initiative.
   ii. A description of the funding that Enbridge Gas has requested or will request, if any, from the provincial government for each abatement initiative.
      1. An explanation of why these abatement initiatives require government funding.

b) Please provide all supporting documentation, including data, analysis and assumptions, used to calculate the $/tonne CO_2e for each abatement activity in a).

c) For any abatement activity in Table 1 that is more expensive per tonne of CO_2e than the abatement activities on the OEB MACC, please explain why Enbridge Gas selected these activities instead of the less expensive abatement activities on the OEB MACC. In Enbridge Gas' response, please provide all supporting documentation, including data, assumptions and analysis.

RESPONSE

a) and b) One output of the Initiative Funnel is to determine and/or refine the cost per tonne of CO_2e of an abatement initiative. Where they could be estimated, Enbridge included in its evidence at Exhibit C, Tab 5, Schedule 2 the possible GHG savings for Stage 2 initiatives. The final cost per tCO_2e is most relevant at which time Enbridge is at the Stage 3 or the "Propose" stage of the funnel.

All three of the carbon abatement initiatives that Enbridge has advanced to the "Approve" stage of the Initiative Funnel (RNG Enabling, RNG Procurement and Geothermal Energy Services) will be supported by CCAP funds. Details of the information available at this time about the anticipated CCAP funding is set out in the EB-2017-0319 filing, and in response to the RNG procurement proposal interrogatories already answered in this proceeding. For more discussion on this topic please see Board Staff Interrogatory 24, filed at Exhibit I.1.EGDI.STAFF.24.

c) Details of the Company's RNG procurement proposal can be found at Exhibit C, Tab 5, Schedule 2, paragraphs 10 to 32. Details of the Company's RNG Enabling and Geothermal Energy Service are set out in the Company's evidence in EB-2017-0319. A discussion on the MACC is outlined in the response to Board Staff IR #24 b) filed at Exhibit I.1.EGDI. 24.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

STAFF INTERROGATORY #21

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 1 / pp. 4-6

Preamble:
Enbridge Gas states that "abatement investments require complementary criteria to be applied in the assessment and selection of abatement programs that would be put forward as part of a Compliance Plan." Enbridge Gas then outlines its selection and screening criteria for the Abatement Construct, including:

- Funding
- Timely advancement of technology
- Support for government targets
- Efficient and rational development
- Respect for appropriately modified regulatory constructs

a) In the OEB's Cap and Trade Framework[1], the OEB indicates that its assessment of the gas utility's Compliance Plan will be guided by six principles, the first of which is cost-effectiveness. Please explain why cost-effectiveness is not one of Enbridge Gas' guiding principles for abatement.
   i. Please explain how each of Enbridge Gas' abatement guiding principles upholds the Cap and Trade Framework's guiding principles of rate predictability, cost recovery, transparency, flexibility and continuous improvement.

b) Please explain how Enbridge Gas used its abatement guiding principles in its decision to pursue RNG Procurement, RNG Enabling, and Geothermal Energy Services Program for its 2018 proposed customer abatement activities.
   i. Please explain whether Enbridge Gas considered the cost-effectiveness of RNG Procurement, RNG Enabling, and Geothermal Energy Services.

c) In regards to the second principle, "timely advancement of technology", please explain what Enbridge Gas believes its role is in advancing the adoption of new technology in Ontario.

d) In relation to the third principle, "support for government targets", please explain what Enbridge Gas believes its role is in supporting government abatement targets.

[1] EB-2015-0363, pp. 7-8

Witnesses: S. McGill
F. Oliver-Glasford

RESPONSE

a) Enbridge has acknowledged the importance of adherence to the Board's Cap and Trade Regulatory Framework in the Company's stated "complementary criteria" for assessment and selection of abatement programs under the "Respect appropriately modified regulatory constructs" subheading, which states:

> *Respect appropriately modified regulatory constructs: Abatement programs should manage customer cost impacts; adhere to cost causality (no undue cross subsidization); use applicable valuations and appropriate costing (including marginal cost allocation where appropriate); and align with procurement and compliance guiding principles.*

In addition, to further enhance the importance of cost-effectiveness to Enbridge, it is cited as an additional consideration on top of the screening criteria and Board's guiding principles (found in Exhibit C, Tab 5, Schedule 1, page 6, paragraph 12).

i) The following explains how each of Enbridge Gas' "complementary" abatement screening criteria upholds the Cap and Trade Framework's guiding principles of cost-effectiveness, rate predictability, cost recovery, transparency, flexibility and continuous improvement:

- Funding: By soliciting funding in support of initiatives that will facilitate the cost effective reduction of GHG emissions associated with the consumption of gas delivered on the Company's gas distribution system.
- Timely advancement of technology: The timely adoption of higher efficiency gas using equipment and other low or no carbon energy systems will reduce GHG emissions associated with the consumption of gas delivered on the Company's gas distribution system. Further, the initiatives put forward in this Compliance Plan demonstrate creativity and flexibility and a drive for continuous improvement in terms of the use of non-traditional solutions to address the goal of reduced GHG emissions.
- Support for government targets: See the Company's response to part d of this question below.
- Efficient and rational development: Enbridge seeks and pursues GHG emission reducing initiatives that can be efficiently and rationally developed and implemented in recognition of the Board's principles of cost-effectiveness and rate predictability.
- Respect for appropriately modified regulatory constructs: The Company respects the role of the OEB both in terms of its traditional rate setting responsibility and the broader scope required to assess new initiatives brought before it that have the goal of abating GHG emissions.

Witnesses: S. McGill
F. Oliver-Glasford

Enbridge has been open and transparent in its presentation of its proposals designed to achieve this goal.

b) Enbridge has held to its "complementary" abatement principles in its decision to pursue RNG Procurement, RNG Enabling, and Geothermal Energy Services Programs. Both RNG production and geothermal energy technologies have been commercially available but mostly economically unviable for a number of years. The Company's proposals with respect to these three initiatives are;
   - in support of the provincial governments stated goal to reduce Ontario's greenhouse gas ("GHG") emissions,
   - to be supported by provincial government Cap and Trade derived funding,
   - supportive of the adoption of low carbon energy technologies,
   - a means of efficiently and rationally promoting the development of markets for related products and services that will ultimately enhance the cost effectiveness of RNG and geothermal energy systems, and
   - respectful of traditional regulatory constructs that will need to evolve in order to enable the province's gas utilities to meet their obligations with respect to the province's Cap and Trade legislation and anticipated renewable fuel standards.

   Enbridge considered the cost effectiveness of its RNG Procurement, RNG Enabling, and Geothermal Energy Services. All three of these initiatives are cost effective once one considers the impact of government support in the form of direct subsidy or legislation. The Company's RNG and Enabling programs will help develop a competitive market for Ontario produced RNG supplies in advance of the introduction of renewable fuel standards that could have the potential to force the Company to acquire RNG at any cost. The Company's Geothermal Energy Service proposal will work in conjunction with already announced provincial grant funding to make the geothermal option cost competitive with traditional building heating and water heating systems. All three of these initiatives are cost effective from the standpoint of the consumer and have been developed in cooperation with the provincial government as a means of helping to achieve the government's GHG emission reduction objectives.

c) Enbridge believes it has a critical role in the timely advancement of the adoption of new technologies in Ontario with respect to the reduction of GHG emissions related to natural gas that is or would otherwise be delivered on its distribution system based in part on the following statement from the Board's Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities:

> *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 provisions of the Climate Change Act.*[2]

It is the Company's view that if it is to be held responsible for GHG emissions related to the use of gas delivered on its system, then it should be enabled to take steps to advance the use of technologies that will reduce those emissions.

d) Please see the quote referenced in the Company's response to part c of this question above. Section 6(1) of the province's *Climate Change Mitigation and Low-carbon Economy Act* sets out targets for the reduction of Ontario's GHG emissions from the Act's inception to the end of 2050. Given that the Board recognizes that the Utilities are responsible for GHG emissions associated with the gas delivered on their systems it follows that the Utilities should be enabled to undertake initiatives that reduce current and future emissions through energy efficiency initiatives for facility and customer related emissions and/or or the use of renewable and alternative energy sources

[2] Ontario Energy Board. Report of the Board: Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities; EB-2015-0363, September 26, 2016, page 33 – 34.

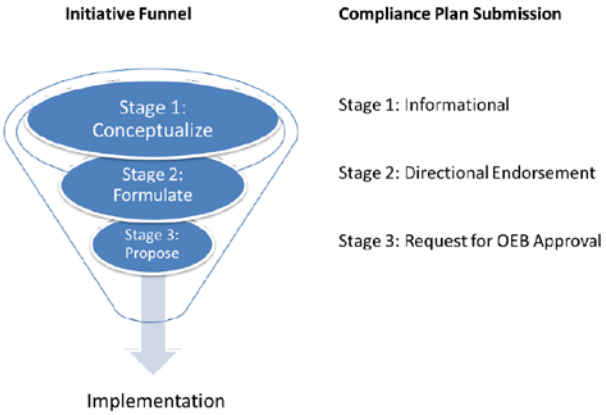
Witnesses: S. McGill
F. Oliver-Glasford

STAFF INTERROGATORY #22

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 1 / pp. 6-9

Preamble:
Enbridge Gas proposes the following Initiative Funnel for its approach to investigating, planning and implementing abatement activities through its Compliance Plan.



Questions:

a) Are all the screening criteria equally important or are some of the criteria more important than others? Please explain.

b) Please explain how Enbridge Gas' screening criteria will be incorporated into its decision regarding which abatement activity moves through the Funnel stages. Please explain whether the screening criteria are different depending on the stage?

c) Will Enbridge Gas consider the cost-effectiveness of different abatement initiatives as it moves projects through the Initiative Funnel?
   i. If yes, please describe how Enbridge Gas will consider and compare the cost-effectiveness of all potential abatement initiatives.
   ii. If no, please explain why not.

d) Please explain whether, and if so how, stakeholder input will be used by Enbridge Gas to made decisions regarding which abatement initiatives to pursue.

Witnesses: S. McGill
F. Oliver-Glasford

RESPONSE

a) and b) In Enbridge's evidence at Exhibit C, Tab 2, Schedule 1 on page 5 it is noted that:

> *The Framework identifies "Guiding Principles" for the Compliance Plan. It also recognizes, as noted above, that longer term investments should be aligned with broader priorities. Therefore, Enbridge observes that abatement investments require complementary criteria to be applied in the assessment and selection of abatement programs that would be put forward as part of the Compliance Plan.*

Subsequently, Enbridge's evidence outlines the criteria and additional considerations about which initiatives should be pursued. Enbridge believes all screening criteria are important and should be broadly considered using judgement and market insight noting that priority will be given to cost effective carbon abatement potential and timely advancement to market. Nevertheless, Enbridge does not intend to apply a formulaic or rigid approach to prioritization. And, while all screening criteria and considerations will be considered in each Initiative Funnel stage, importance of each criterion may vary just as decision making may not be linear. There may be new information or insights that come into play at various times which provoke a review and perhaps a rethink or update of the analysis and ultimately the prioritization of the initiative. For example, if funding was believed to available towards an initiative and therefore made it more cost effective relative to other options, the initiative may be prioritized in the Initiative Funnel. However, if subsequently the funding was no longer available, and the cost of the initiative no longer was deemed cost effective relative to other options, then the initiative may be demoted in the prioritization exercise.

c) Yes, Enbridge will consider cost effectiveness as a guiding principle for its entire compliance planning process, not just in the procurement of allowances. Also, Enbridge recognizes cost effectiveness to be one of the Board's guiding principles and as such, the Company will ensure it is considered.

d) Enbridge has a history of undertaking considerable stakeholdering in its energy efficiency portfolio and through formal and informal discussions with a variety of customer groups including small and large businesses, residential customers and low income customers/support associations. Enbridge is also regularly in touch with the market, and various groups involved in the low carbon economy, to understand opportunities in abatement development. For example, Enbridge co-hosted a renewable natural gas session to gain a full understanding of the issues and dialogue around RNG. Enbridge also continues to collaborate with the Ontario Geothermal Association and other similar groups. Further Enbridge recognizes and

appreciates the stakeholdering that the Board has done in taking on the task of developing a Long Term Carbon Price Forecast ("LTCPF") and a Marginal Abatement Cost Curve. Input gained through the development of those planning inputs as well as the Compliance Plan proceeding itself are valued inputs from stakeholders. To ensure ongoing pursuit of the Board's guiding principles including transparency, flexibility and continuous improvement, other means of gathering stakeholder input may be identified.

Witnesses: S. McGill
F. Oliver-Glasford

STAFF INTERROGATORY #23

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 1 / pp. 9-10
Exhibit C / Tab 5 / Schedule 1 / p. 11

Preamble:
Enbridge Gas proposes a $2 million annual "Low Carbon Initiative Fund" (LCIF) to enable the identification and development of GHG reducing technologies to progress into future abatement opportunities.

Enbridge Gas indicates that "the LCIF will initially provide funding for Enbridge Gas to better define each opportunity in order to successfully qualify for government grants." It will also provide the means to accelerate innovative technologies necessary for the Province to meet its renewable energy and emissions reduction targets."

Enbridge Gas also indicates that it will require two additional full time equivalent ("FTE") employees to support its efforts to identify, formulate and begin to implement on new or expanded abatement activities within the Initiative Funnel.

Questions:

a) How does Enbridge Gas currently identify abatement activities to pursue? What would change if the LCIF is approved? Please explain.
    i. In 2017, did Enbridge Gas undertake any activities that would, in 2018, fall within the ambit of the LCIF?
        1. If yes, please provide: a description of each activity; amounts spent on each activity in 2017; and whether those amounts are included in Enbridge Gas' 2017 admin costs.

b) Please explain what work Enbridge Gas intends to undertake in 2018 with the LCIF, if approved.
    i. Please explain how this work is related to the abatement activities proposed in the Initiative Funnel.

c) Please provide details of expected resourcing requirements and costs associated with each stage of the Funnel, including implementation, for 2018.
    i. Please explain whether these costs are incremental to Enbridge Gas' forecast 2018 administration costs.
    ii. Please explain whether these costs are included in the proposed $2M LCIF.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

d) Please explain why it is appropriate for Enbridge Gas to receive additional ratepayer funding so that it can qualify for government grants.

e) Please explain why it is appropriate for Enbridge Gas to obtain ratepayer funding to accelerate technologies to help the Province meet its renewable energy and emissions reduction targets.

f) Please explain what will happen if the OEB does not approve the proposed $2M LCIF.

g) Enbridge Gas and Union Gas filed a MAAD application[1] with the OEB. Please explain whether, and if so how, Enbridge Gas will realize any economies of scale in relation to activities being undertaken in relation to GHG abatement.

h) Please provide details of the activities and work that Enbridge Gas' proposed two new FTEs would undertake in 2018.
   i. Given the Enbridge Gas and Union Gas MAAD application[2] with the OEB, please explain whether, and if so how, Enbridge Gas has considered any economies of scale in relation to resourcing requirements.

i) Please provide references to specific cases and/or policy from the OEB and from any other authorities where research and development activities such as consulting, pilot programs, testing, market research, and data analysis is funded by ratepayers.

j) In the event where Enbridge Gas' research undertaken through the LCIF leads to new technologies that could be marketed resulting in a financial value, would that financial value be shared with the ratepayers?
   i. If yes, please explain how.
   ii. If no, please explain why not

RESPONSE

a) Enbridge has put into place an Abatement Construct and Initiative Funnel as described in Exhibit C, Tab 5, Schedule 1. The Company uses the outlined abatement principles (please see the response to Board Staff Interrogatory #21, filed at Exhibit I.1.EGDI.STAFF.21) as a supplement, or complementary to the Board's Guiding Principles and considers a range of factors (please see the response to

[1] EB-2017-0306
[2] Ibid

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

BOMA Interrogatory #1, filed at I.C.EGDI.BOMA.1) when identifying abatement activities to pursue. If the LCIF is approved, Enbridge will be in a position to rely on a reliable and steady flow of funding to support its abatement planning.

i. Yes, Enbridge did engage in some activities during 2017 that would be expanded with the benefit of the incremental LCIF funding. Please see the table below for the requested information:

Activity	Description of 2017 Work	Approximate 2017 Spend	Included in EGD 2017 GGEIDA Costs
Net Zero/micro generation	Development of equipment integration strategies between electricity and gas systems, including acquisition of equipment for integration testing before larger-scale field deployments in customer homes.	$70,000	No
Natural gas heat pumps	Two pilot projects – 1. Heat pump field demonstration: Quantify the energy savings of an air source natural gas absorption heat pump (GHP) in a domestic hot water application. The heat pump has been providing domestic hot water to two TCHC buildings served by a common boiler plant. 2. Monitoring the space heating performance of a NGASHP and estimate its GHG reduction in a controlled setting at the Kortright Center.	$30,000	No
Hydrogen	Participation in European and Canadian technical task forces that are evaluating the requirements for gas utility blending of hydrogen in the networks. Information to be used by Enbridge to finalize detailed work plans for the implementation of a hydrogen blending initiative and to confirm budget requirements	$30,000	No

Further to the table above, work that Enbridge has supported through the Canadian Gas Association may also be considered to be in the scope of the LCIF.

b) Please see table below for the customer-related abatement initiatives. For a list of facility-related abatement initiatives and associated costs, please refer to the response to Board Staff Interrogatory #27c, filed at Exhibit I.1.EGDI.STAFF.27.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

Breakdown of proposed $2M 2018 LCIF Budget - Customer-Related Abatement Initiatives

Stage	Initiative	Targeted / Applicable Sectors	Description of work under consideration	2018 Estimate
Stage 1: Conceptualize	Smart Metering	Residential/ Small Commercial	Pilots to demonstrate the integration of hybrid heating (dual-fuel) appliance control that leverages new meter functionality to minimize carbon emissions	$ 100,000
	RNG - Gasification	Residential/ Commercial/ Industrial	Research Projects to investigate biomass conversion to RNG through gasification	$ 200,000
	Carbon Capture	Residential/ Commercial/ Industrial	Pilots in Ontario demonstrating potential for 2 carbon capture technologies. Market scan of existing technologies/limitations, development/leveraging of strategic partnerships as well as financial support for vendors to develop new technologies that can achieve up to 100% carbon capture.	$ 250,000
Stage 2: Formulate	Hydrogen (Power to Gas)	Residential/ Commercial/ Industrial	Technical due diligence and planning, specific to Enbridge's gas distribution system, to establish the initial guidance and capabilities for blending hydrogen into the natural gas pipeline network as means of diversifying how Ontario can meet provincial and federal renewable content requirements. This work is required as a prerequisite before proceeding with an a actual field trial of hydrogen blending in a segment of Enbridge's pipeline network.	$ 500,000
	Net-Zero Homes/ Micro-Generation	Residential/ Small Commercial	Implementation of Net Zero Energy Emissions pilot project for residential homes to build on the earlier 2017 technology integration assessments and planning. The pilot will be implemented in partnership with electric LDC(s) and Municipalities. The objective is testing, optimization and monitoring of variations in the hybrid heating solutions, as well as distributed power generation platforms like solar PV and mCHP. The objective is to fully assess the GHG reduction potential, costs and potential for cost reductions. This results of the multi-home pilot would help inform energy planners and the HVAC industry on the development priorities to accelerate measures that advance higher-value GHG abatement.	$ 449,000
	Expanded NGV Program	Commercial	Demonstration projects with small fleets. Focus on developing the large transport truck market within Ontario.	$ 300,000
	Natural Gas Air-Source Heat Pumps	Residential/ Commercial	Conduct field tests to quantify actual savings and provide performance data vs. energy efficient furnaces as well as electric heat pumps. Aim to develop competitively priced natural gas heat pumps specifically for the residential market.	$ 150,000
Total Estimated 2018 Cost				**$ 1,949,000**

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

c) Enbridge requires two incremental FTEs to support activities related to the Initiative Funnel.

   i. The two incremental FTEs are included in the 2018 Administrative Costs outlined in Table 1 in Exhibit D, Tab 1, Schedule 1. This is further illustrated through the detailing of the Staffing Resources found in Exhibit D, Tab 1, Schedule 1 in Table 2.

   ii. The costs associated with the two incremental FTEs are in addition to the $2 million LCIF.

d) The proposed LCIF is to help ensure the Company has the ability to work through the implications and data related to abatement opportunities. In completing research or a pilot, it may be determined that a next step is to seek government funding where available noting this isn't the principal purpose for LCIF. Where government funding is available and can be obtained that would be to the benefit of ratepayers.

e) The ratepayers will benefit from the LCIF where it promotes the development and ultimately implementation of cost effective abatement technologies.

f) Should the $2 million LCIF fund not be approved, Enbridge's ability to adequately review, assess and develop low carbon abatement opportunities is lessened. To develop abatement opportunities Enbridge needs access to certain and steady funding.

g) Please refer to the response to Board Staff Interrogatory #16a, filed at Exhibit I.1.EGDI.STAFF.16.

h) The two incremental resources would be responsible to support the Company's efforts in identifying, formulating and implementing initiatives related to the LCIF. Please see Exhibit C, Tab 5, Schedule 1, page 11 of 15 for areas of responsibilities.

   i. Please refer to the response to Board Staff Interrogatory #16a, filed at Exhibit I.1.EGDI.STAFF.16.

i) In the DSM multi-year filing, the Collaboration and Innovation Fund was approved to promote innovative or collaborative research and pilots within the realm of customer related energy efficiency.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

j) As stated in Exhibit C, Tab 5, Schedule 1, page 9, paragraph 23 “The Low Carbon Initiative Fund (“LCIF”) is proposed to enable the identification and development of GHG reducing technologies to progress into future abatement opportunities”. It is premature to consider how unknown future benefits from proposed LCIF technology projects would be treated.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

STAFF INTERROGATORY #24

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 1 / p. 15
Exhibit C / Tab 5 / Schedule 2 / p. 1, #4

Preamble:
Enbridge Gas states that it considered the guidance and information provided in the OEB MACC study to assess whether it should be expanding DSM programs, and Enbridge Gas "concluded that additional DSM programs would not be cost-effective; in some cases the marginal costs of new programs may be higher than the cost of compliance instruments."

Enbridge Gas also states that it remains in the best position to deliver reliable energy efficiency programs in the Province. Further, Enbridge Gas indicates that since the Government announced its Climate Change Action Plan ("CCAP"), it has been responsive to evolving Government objectives and has made several proposals to advance energy efficiency in the province.

Questions:

a) Please explain how Enbridge Gas determined that additional DSM programs would not be cost-effective, and in some cases, the marginal costs of new programs may be higher than the cost of compliance instruments. Please provide all supporting documentation including data, assumptions and analysis.

b) Does Enbridge Gas plan to undertake any customer abatement without provincial funding? Please explain.

RESPONSE

a) Enbridge took the analysis as provided by the ICF MACC study and compared the anticipated results filed for DSM with what the MACC study indicated was cost effective. At a high level the results show that all energy efficiency customer abatement deemed cost effective in the MACC is being undertaken by Enbridge's existing DSM offerings. This analysis is shown in Exhibit C, Tab 5, Schedule 2 Page 25-26, with the assumptions provided. Further details are included in the attached document, Attachment 1.

Witnesses: D. Johnson
A. Langstaff
S. McGill
J. Murphy
F. Oliver-Glasford

In addition, Enbridge also performed a separate analysis using the ICF Natural Gas Potential Study. In this analysis Enbridge compared the marginal cost in $/tonne of moving from the Constrained (budgets at the Company's current level of DSM spending) to Semi-Constrained (budgets were gradually doubled) and Unconstrained (assumes no budget constraints or policy restrictions) scenarios as defined in the Natural Gas Conservation Potential Study. This analysis showed that the marginal cost of increasing to the Semi-Constrained scenario was $60/tonne, which exceeded the LTCPF through 2028. Further details are included in the attached document, Attachment 2.

b) Given the number of interrogatories received on the topic of incremental customer abatement, and more specifically incremental energy efficiency, Enbridge believes it is appropriate to articulate its concerns and to outline current realities which impact how and whether the Company could proceed with abatement programs.

It is important to first recognize that there are billions of dollars entering the market for low carbon abatement initiatives. This dramatically changes the landscape in which the Utilities are developing and implementing their Compliance Plans. It is also important to note that the gas utilities are already actively collaborating with GreenOn and other entities in the design and roll out of new and significantly expanded programs that are being funded by GreenOn at least in part. In other words, there already is a substantial expansion of abatement, including incremental energy efficiency activities.

Enbridge acknowledges that the MACC is useful in helping to identify potential abatement activities, however the Company notes that a MACC is relevant for a given point in time, and is based on externalities such as technology and the availability of external funding at that point in time. The MACC developed by ICF for the Board did not contemplate the dramatic change in low carbon investment in Ontario through the Government's GreenOn program, which materially impacts the marginal cost effectiveness of abatement programs. The MACC therefore cannot be relied on at this time in the context of non-transparent and significant funding entering the market.

The availability of GreenON funding can play a material role in the cost effectiveness of an abatement activity. For example, if the Government directs funding to an activity that is not currently cost effective from a ratepayer DSM or MACC perspective, such programs may, with the Government's subsidy,

Witnesses: D. Johnson
A. Langstaff
S. McGill
J. Murphy
F. Oliver-Glasford

become cost effective. As an example, RNG which is shown as not being cost effective on the MACC at a range of $77 to $1,990 per tCO_2e, has now become cost effective with the addition of Government funding. Conversely, existing DSM programing may become ineffective or less relevant where Government subsidies are funneled to similar programs not driven by the Utility. As an example, Enbridge's DSM Adaptive Thermostat Program has been impacted by GreenOn's program of the same nature, which provides a greater incentive to participants. The potential of Enbridge's program, and its related costs, are materially changed by the presence of Government funding, regardless of what the MACC or Conservation Potential Study might suggest. To have proposed in either 2017 or in 2018 a material increase in this program is a clear example of the risk and problem of proceeding without knowledge of the Government's intentions. If Enbridge was able to gain transparency with GreenOn funding, the MACC may be modified to reflect the new information.

Once the amount of Government funding is known, the Utilities are in a better position to determine how best these funds can be leveraged and considered in the design and implementation of incremental abatement programs, which complement the Governments initiatives instead of competing with them. Until such time, Enbridge believes that development of any incremental DSM or abatement activities is not a prudent course of action as true cost effectiveness cannot be determined.

Enbridge believes that, in addition to first understanding the Government's intentions and priorities, some indication is required from the Board as to whether additional ratepayer funding should be directed at DSM. Clear rules are required around the treatment of results, determination of targets, and appropriateness of budgets.

In the interim, Enbridge is always looking for ways to improve DSM programs within the existing framework to drive improved results though changes to incentive levels, more effective marketing, etc. Outside of the DSM framework, Enbridge is in discussion with GreenON to look at additional funds for new or enhanced programs. This includes proposing new programs that may not be cost effective in the DSM framework, and bidding on RFPs issued by the government to deliver incremental energy efficiency programs.

Witnesses: D. Johnson
A. Langstaff
S. McGill
J. Murphy
F. Oliver-Glasford

MACC Potential vs. DSM Plan

Customer Segment	Province-Wide Gross Savings in MACC Study (Mid-Range LTCPF)	Net Savings	% of Potential in EGD Franchise	Net Potential in EGD Franchise as per MACC	DSM Plan as originally filed in EB-2015-0049
Residential	97,000,000	82,450,000	62%	51,119,000	56,224,675
Commercial	99,000,000	83,160,000	58%	48,232,800	169,335,715
Industrial	96,000,000	48,000,000	44%	21,120,000	
Total	**292,000,000**	**213,610,000**	**-**	**120,471,800**	**225,560,390**

Ref: EB-2017-0224 Exhibit C Tab 5 Sch 2 p26

From 2015-2020 Plan	2018	2019	2020	
Large C/I	40,943,260	41,047,949	41,206,955	
Small C/I	10,402,236	10,610,277	10,822,487	
LI Multi-Res	4,646,475	4,766,646	4,889,430	
Total	55,991,971	56,424,872	56,918,872	169,335,715
HEC	11,249,383	11,798,048	12,281,470	
Adaptive	4,765,500	4,989,858	5,135,099	
LI Part 9	2,021,333	2,001,709	1,982,275	
Total	18,036,216	18,789,615	19,398,844	56,224,675

Note: exludes O-Power as this program was not approved and Small Commerial New Construction as this program was not pursued

NTG Rates

HEC	85%	85%	Residential
Industrial	50%	50%	Industrial
Commerical	88%	84%	Commercial
Multi-Residential	80%		

EB-2014-0354, Exhibit B, Tab 1 Schedule 2, Page 9

Total DSM program - All of Ontario
Achievable Potential - 2020

Description	Constrained	Semi-constrained	Unconstrained
Annual Savings (million m3/yr)	1,187	1,338	1,869
Measure Lifecycle Savings CCM (million m3)	14,115	18,909	28,582
Program Spending to milestone year (million $)	$666	$893	$3,298

Source: Natural Gas Conservation Potential Study - July 7, 2016; Exhibit ES 4, page v

Industrial Large Volume program - All of Ontario
Achievable Potential - 2020

Description	Constrained	Semi-constrained	Unconstrained
Annual Savings - m3/yr	183	241	350
Measure Lifecycle Savings CCM (million m3)	1,174	3,999	5,726
Program Spending to milestone year (million $)	$26	$33	$442

Source: Natural Gas Conservation Potential Study - July 7, 2016; Exhibit ES 17, page xv

Province-Wide Gas DSM

Achievable Potential by 2020 (excl. Large Vol)

Description	Constrained	Semi-Constrained	Unconstrained
Annual Savings (million m3/yr)	1,004	1,097	1,519
Measure Lifecycle Savings CCM (million m3)	12,941	14,910	22,856
Program Spending 2015-2020 (million $)	640	860	2,856
GHG Savings (million tonnes)	24	28	43
$/tonne	$26	$31	$67
Marginal Cost ($/tonne)	-	$60	$134

STAFF INTERROGATORY #25

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 2 / pp.19 – 22

Preamble:
Enbridge Gas states it is expected that by 2019 or 2020 hydrogen blending could contribute to its renewable content requirements as part of future cap and trade Compliance Plans. Enbridge Gas also states that it will research and develop hydrogen pipeline standards for transportation of pure hydrogen to blending sites within its gas network, and that the additional staffing resources requested will coordinate this work and continue the research into hydrogen gas blending and other opportunities for hydrogen within the low carbon economy, and that "LCIF money will be expended on working with consultant research around the remaining steps required for advancing the introduction of hydrogen into the energy market."

With regards to natural gas heat pumps, Enbridge Gas indicates that it will expand its work with interested parties in the pursuit of developing natural gas heat pumps and will also support the integrated approach which includes electric heat pumps in the Net Zero program.

Questions:

a) Please explain why Enbridge Gas is proposing to undertake research on heat pumps and hydrogen technologies using ratepayer funding given that both of these technologies are shown (on the OEB MACC) are high cost compared to other energy efficiency options for space heating, and that hydrogen is more expensive than RNG abatement opportunities.

RESPONSE

Enbridge believes it has an important role in enabling the timely advancement of GHG abating technologies to reduce emissions. For further details please refer to the responses to Board Staff Interrogatory #20 and #21, filed at Exhibit I.1.EGDI.STAFF.20 and Exhibit I.1.EGDI.STAFF.21. It is also noted that one of the objectives of the Initiative Funnel is to research and better understand costs, opportunities and barriers of alternate abatement opportunities for ultimate proposal via stage three once projects are seen as cost effective and viable for broader adoption.

Witnesses: S. McGill
R. Sigurdson

STAFF INTERROGATORY #26

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 2 / pp. 23-24

Preamble:
Enbridge Gas states that its stage 1 (conceptualize) projects include Smart Metering, Gasification, and Carbon Capture.

Questions:

a) Please explain what activities (such as research and development, pilot projects, market research, etc.) Enbridge Gas intends to do with regards to the stage 1 projects in 2018.
    i. Please indicate how much Enbridge Gas expects these activities to cost in 2018.

RESPONSE

Please refer to the response to Board Staff Interrogatory #23b, filed at Exhibit I.1.EGDI.STAFF.23.

STAFF INTERROGATORY #27

INTERROGATORY

Ref: Exhibit C / Tab 5 / Schedule 3 / pp. 1-6

Preamble:
Enbridge Gas identifies the following stage 1 (conceptual) initiatives for facility abatement: Portable Booster Compressor, High Bleed Pneumatic Devices, Building Efficiency Improvements, and Natural Gas Air Source Heat Pump.

Enbridge Gas states that it has undertaken a study in 2017 to review the electricity and natural gas use and resulting emissions from the operations of six of its office buildings. Enbridge Gas also states that this study identified potential abatement opportunities and suggested several initiatives that can be explored over the next five years.

Enbridge Gas indicates that the initiatives identified above will be reviewed in 2018 to determine if they can be advanced to either Stage 2 (Formulate) for pilot scale testing or Stage 3 (Proposal) for full scale implementation. The results of these initiatives will be reviewed in future Compliance Plans submissions as appropriate.

Questions:

a) Has Enbridge Gas undertaken a study on facility abatement? If yes, please provide the study.

b) Has Enbridge Gas undertaken a cost analysis of any of the facility abatement initiatives in its 2018 Compliance Plan?
   i. If yes, what is the cost in $/tonne of CO_2e for each of these initiatives? Please provide all analysis and supporting documentation.

c) Please explain what activities (such as research and development, pilot projects, market research, etc.) Enbridge Gas intends to do with regards to these stage 1 facility abatement projects in 2018. Please indicate how much of the $2M Enbridge Gas intends to use to further develop the stage 1 projects indicated in the exhibit above.

d) Please explain how Enbridge Gas will undertake the following: “the initiatives identified above will be reviewed in 2018 to determine if they can be advanced to either stage 2 (Formulate) for pilot scale testing or stage 3 (Proposal) for full scale implementation.”

Witnesses: J. Murphy
S. Dinopolous

RESPONSE

a) As discussed in Exhibit C, Tab 5, Schedule 3, paragraphs 5, Enbridge has reviewed opportunities to reduce operational emissions, however, the Company did not complete a formal study. As discussed in Exhibit C, Tab 5, Schedule 3, paragraph 6, the Company did hire an external consultant to conduct a study that specifically examined emission reductions from the Company's office buildings. This included reviewing both electricity and natural gas use, and providing suggested improvements to reduce consumption. The study is attached to this interrogatory response.

b) Enbridge has not undertaken cost analysis of the facility abatement initiatives in the 2018 Compliance Plan.

c) Enbridge identified several initiatives to be undertaken as Stage 1 projects, which are listed in Table 1 of Exhibit C, Tab 5, Schedule 3 and further discussed in paragraph 7. In addition Enbridge has identified one additional initiative to be included in 2018. Additional details on the scope of work for 2018 are provided below.

Stage	**Initiative**	**Description of Work Under Consideration**	**2018 Estimate**
Stage 1: Conceptualize	Portable Booster Compressor	Review current use and limitations of existing equipment, identify potential improvements to existing equipment, and complete a market scan of other potential technologies/equipment. This will include review of studies that have been undertaken by industry associations and/or other utilities, where available. As part of this project, the costs for completing improvements to the existing equipment or purchasing new equipment will be reviewed, including the $/t$CO_2$e.	$40,000

Witnesses: J. Murphy
S. Dinopolous

	High Bleed Pneumatic Devices	Conduct an inventory of existing pneumatic devices at distribution stations. For any high bleed pneumatics currently in use, review potential abatement strategies (i.e. replace with low/no-bleed alternative, reconfigure to vent into low pressure system) and determine the costs for completing these improvements, including the $/t$CO_2$e. It is currently assumed that this initiative will be completed by internal staffing resources.	$0
	Building Efficiency Improvements	Enbridge will review the recommendations provided in the study on office building energy efficiency and will determine which recommendations to pursue for natural gas and GHG reductions. It is currently assumed that this initiative will be completed by internal staffing resources. (Note: The Company will be undertaking VPC and TOC recommissioning in 2018 under Real Estate and Workplace Services budget, and this work is excluded from the Initiative Funnel.)	$0
	Natural Gas Air Source Heat Pump	Review the outcomes of the field tests for customer use of heat pumps and determine applicability to Enbridge facilities. This will include identifying costs, including the $/t$CO_2$e. It is currently assumed that this initiative will be completed by internal staffing resources.	$0
	Assessment of Leak Detection Methodologies	Participation in a study through the Canadian Energy Partnership for Environmental Innovation ("CEPEI") to examine different approaches to leak detection and repair, including emerging technologies.	$3,000
	Engine Venting Best Management Practices	Participation in a study through the CEPEI to review abatement opportunities and best management practices for engines at Gas Storage.	$8,000
Total estimated 2018 Cost			$51,000

Witnesses: J. Murphy
S. Dinopolous

d) The outcome of the work discussed above in response to part c above will be to identify the next steps to be taken for each initiative. This could include moving the projects along the Initiatives Funnel, or it could be determined that the costs of the projects are prohibitive.

Witnesses: J. Murphy
S. Dinopolous

ENBRIDGE ONTARIO PORTFOLIO

GHG REDUCTION PLANNING

Project No: 171-04219-00
Date: August 24, 2017

–

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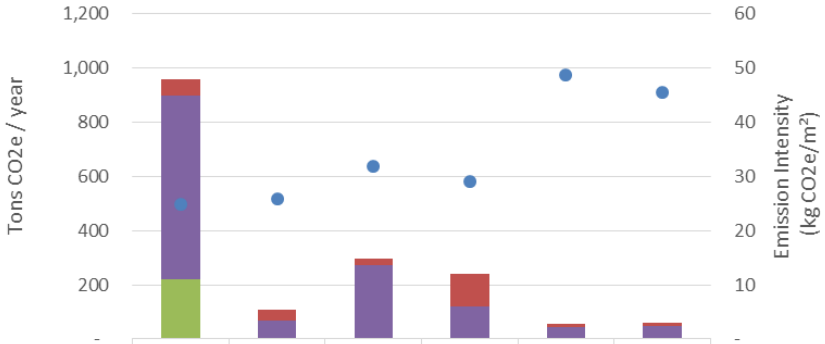
TABLE OF CONTENTS

APPENDICES

EXECUTIVE SUMMARY

This report presents the results of a Carbon Reduction Study of 6 buildings in Enbridge's Ontario portfolio, located across the GTA: Toronto (VPC), Tecumseh, Markham (TOC), Thorold, Oshawa and Brampton facilities. The scope of the study includes electricity and natural gas use carbon emissions related to facility uses, but excludes process loads, such as the turbo-expander reheating at VPC (790 tons) and natural gas vehicle re-fuelling at all buildings.

These facilities use about 764 million m³ of natural gas, spend about $940,000 each year, and emit about 1,700 tons of GHGs each year. The majority of greenhouse gas emissions are related to natural gas consumption, primarily for space and ventilation air heating. Fugitive emissions are omitted from the scope of this exercise.



	Toronto (VPC)	Tecumseh Ops	Markham TOC	Thorold	Oshawa	Brampton
Electricity Grid Emissions	60	38	23	119	13	12
Natural Gas Emissions	679	69	272	122	42	48
Generation Emissions	219	-	-	-	-	-
GHG Emission Intensity (kg CO2e/m²)	25	26	32	29	49	45

The current GHG emissions intensity for all 6 buildings averages 27 $kgCO_2e/m^2$, about double the 2050 target (per the Sectoral Decarbonisation Approach presented by the Science-Based Targets Initiative). If the 5 year plan of conservation measures recommended in this report were implemented, the GHG emissions would drop to 16 $kgCO_2e/m^2$, only 20% above the 2050 target.

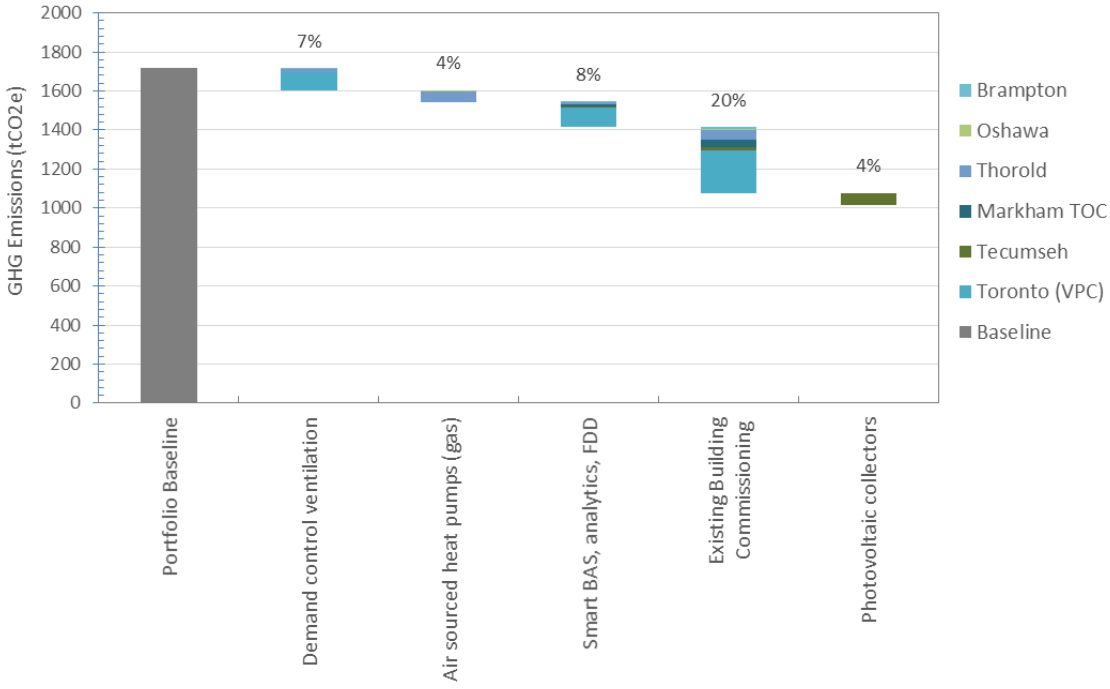
Starting from about 30 opportunities for carbon conservation we selected 9 and further refined and evaluated five measures which presented the greatest opportunity to Enbridge's portfolio based on cost per tonne of CO_2 reduction. The proposed implementation plan presents one possible path forward to reduce emissions, with the following estimated costs and carbon savings per year:

Measure	2017-2018	2018-2019	2019-2020	2020-2021	Total
Existing Building Commissioning	$110,000	$250,000			$360,000
Smart BAS, analytics, FDD	$140,900	$55,250			$196,150
Air sourced heat pump pilot project (gas)	$35,000	$35,000	$132,500		$202,500
Demand control ventilation	$16,200		$138,800		$155,000
Photovoltaic collectors			$30,000	$350,000	$380,000

Measure	2017-2018	2018-2019	2019-2020	2020-2021	Total
Total Budget Per Year	**$302,100**	**$340,250**	**$301,300**	**$350,000**	**$1,293,650**
Annual Carbon Reductions:	**175 Tons/yr**	**223 Tons/yr**	**123 Tons/yr**	**32 Tons/yr**	**553 Tons/yr**
Annual Carbon Reductions:	**10%**	**13%**	**7%**	**2%**	**32%**

Due to the interactive nature of building systems, it is difficult to determine the total savings with precision. However we estimate that the results of implementing the 5-year carbon conservation plan would be as follows.

- You will save about 550 tons/year of carbon (32% of the portfolio's total carbon emissions);
- You will save about 4,000,000 ekWh of annual energy consumption (21%);
- You will save about $260,000 in annual energy cost (22%);
- It will cost you about $1,300,000 (HST/GST not included) to implement the measures, assuming cost efficiencies available by implementing measures portfolio-wide where practical.
- The simple payback will be about 8 years overall.



To realize the benefits outlined in this report, the measures identified must be implemented. We have recommended a next step for each measure. These will be refined in year 2 with data collected during re-commissioning activities. WSP can provide the expertise and services that will lead to successful completion of conservation measures.

1 INTRODUCTION

1.1 AUTHORIZATION

This report was prepared at the request of Steve Dinopoulos, At Enbridge Gas Distribution in accordance with our proposal dated February 27, 2017.

1.2 BACKGROUND

Enbridge has made capital available over the next 5 years dedicated to reducing GHG emissions within Enbridge's Ontario property holdings. As part of the first phase of work, WSP has developed this strategic investment plan, to prioritize identified GHG reduction opportunities and suggest strategies to uncover new opportunities.

While Enbridge's Ontario holdings includes 15 locations, we have limit our focus to the following six (6) sites for this Strategy:

Property Name	Address
Toronto (VPC)	500 Consumers Rd, Toronto
Tecumseh Engineering/ Tecumseh Gas	3595 Tecumseh Rd, Mooretown
Markham (TOC)	101 Honda Blvd, Markham
Thorold	3401 Schmon Pkwy, Thorold
Oshawa	1350 Thornton Rd S, Oshawa
Brampton	6 Colony Ct, Brampton

Refer to Appendix A for a description of the methodology followed to complete this assessment.

1.3 OPINIONS OF COST

The opinions of probable costs presented in this report should be considered preliminary budgets. We have used our experience with evaluating the energy savings for similar retrofits in other buildings, as well as industry resources, to estimate energy savings for projects, on the basis of key building parameters (weather-dependant gas consumption, estimated fresh air requirements, or building area.)

They are intended to provide an indication of cost and allow for ranking of the options being considered. Each project will require further investigation and design to accurately determine construction budgets and timing. Costs are intended to exclude HST.

2 CURRENT ENERGY & GHG EMISSIONS

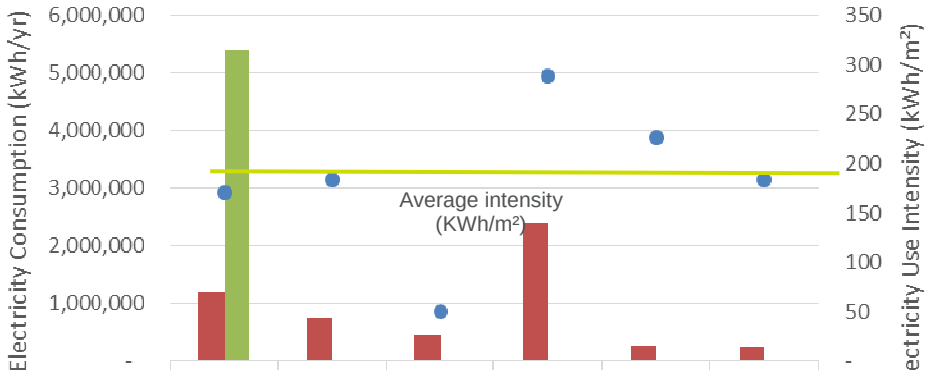
Enbridge uses about 764 million m³ natural gas, and spends about $940,000 each year to serve the 6 buildings studied, and emits about 1,700 tons of GHGs each year (excluding VPC gas vehicle fuelling and turbo-expander reheating, which represent an additional 240 tons and 790 tons respectively).

More detail on each building's historic energy and water consumption can be found in Appendix D – Utility Data.

2.1 ANNUAL ELECTRICTY USE

The buildings studied are supplied with electricity from local electricity utilities, and through on-site generation. The figure below shows grid-supplied electricity, on-site generation, and energy use intensity for each of the 6 sites. Our database of over 400 commercial buildings shows an average energy use intensity of 200 ekWh/m², making most of these buildings average electricity users, except:

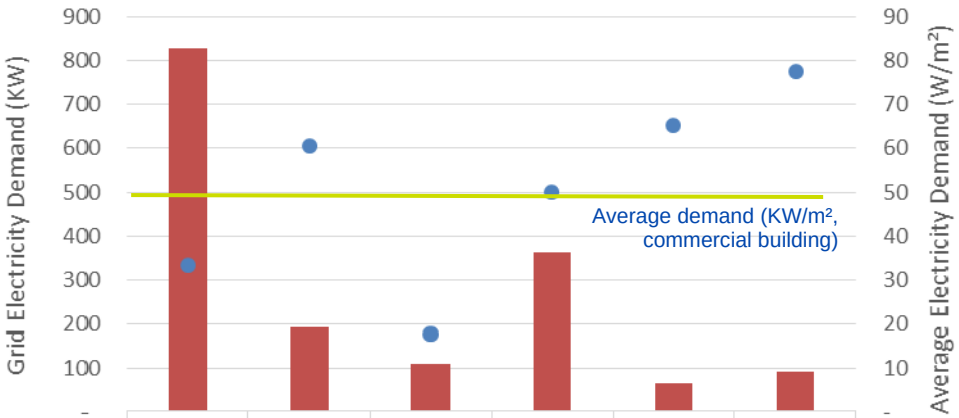
- → Thorold's high electricity use intensity is understood to relate to the on-site Data Centre.
- → Markham TOC has low use, and is a brand new state-of-the-art facility opened in 2012.



	Toronto (VPC)	Tecumseh Ops	Markham TOC	Thorold	Oshawa	Brampton
Net Grid Electiricty Use (kWh/yr)	1,203,470	757,440	466,372	2,383,008	254,991	243,584
On-Site Generation (kWh/yr)	5,388,742					
Electricity Use Intensity (kWh/m²)	170	183	50	288	227	184

On-site electrical generation at Toronto VPC contributes to an average carbon intensity of about 42g CO2e / kWh for that site, versus 50g CO2e/kWh for the other entirely grid-supplied sites.

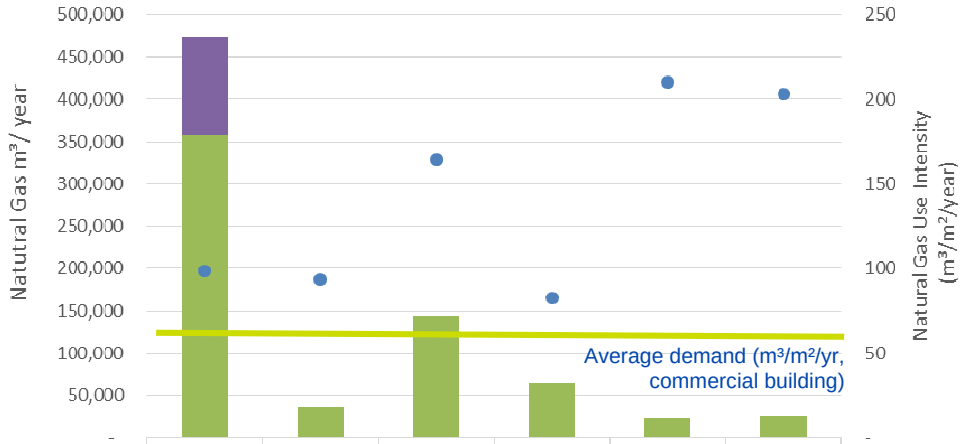
The following graph shows the average billed grid peak monthly electrical demand for each site. Toronto VPC had the highest electrical demand peak of the 6 buildings, however, per square foot, it had the second lowest peak demand, due to on-site generation. Tecumseh, Oshawa and Brampton peak above 50 W/m², the median electricity demand for a commercial office space. This may indicate opportunities for conservation at these sites.



	Toronto (VPC)	Tecumseh Ops	Markham TOC	Thorold	Oshawa	Brampton
KW (average monthly)	829	191	111	362	64	92
KW/m²	33	60	18	50	65	78

2.2 NATURAL GAS USE

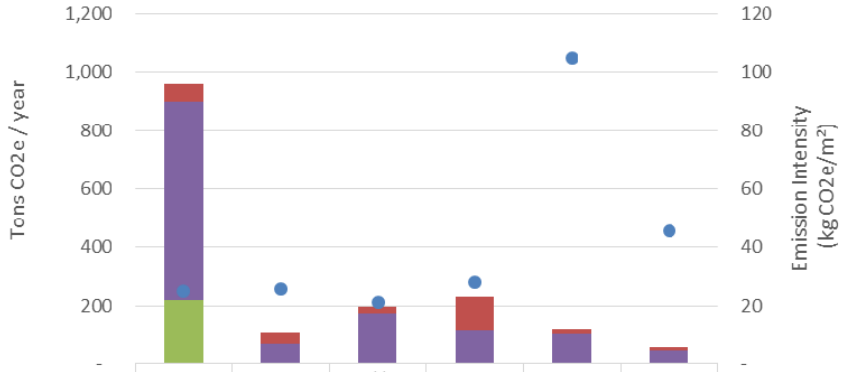
The buildings studied are supplied with natural gas from Enbridge. The figure below shows metered natural gas consumption and the equivalent energy use intensity for each of the 6 sites. (Note: we have excluded gas serving the natural gas vehicle re-fueling and associated compressor station from the Toronto VPC data.) Enbridge's Load Estimator indicates that the average small office, warehouse or industrial building using natural gas for heating, ventilation & makeup air and domestic hot water would have a natural gas energy end-use intensity of about 60-65 m³/m²/year. All buildings are higher than this, with Oshawa, Brampton and Markham TOC in particular higher than normal from an intensity perspective.



	Toronto (VPC)	Tecumseh Ops	Markham TOC	Thorold	Oshawa	Brampton
Generator Natural Gas Use	115,408					
Natural Gas Use	357,546	36,148	143,128	64,093	22,194	25,260
Natural Gas Energy Use Intensity (ekWh/m²/yr)	98	93	165	83	210	203

2.3 ANNUAL GHG EMISSIONS

The annual GHG emissions from the six sites evaluated were calculated using annual average grid emissions factors for 2016 from the IESO of 50g CO2e/kWh electricity consumed from the grid, 1900g CO2e/m³ of natural gas, and, assuming 85% efficiency for the turbo-expander, which is used to supply the majority of on-site generation at VPC, the following figure shows the greenhouse gas emissions attributable to utilities for each of the 6 sites, for a total of 1700 tons CO_{2e}/year and 26 kg CO_{2e}/m^2.



	Toronto (VPC)	Tecumseh Ops	Markham TOC	Thorold	Oshawa	Brampton
Electricity Grid Emissions	60	38	23	119	13	12
Natural Gas Emissions	679	69	172	113	105	48
Generation Emissions	219	-	-	-	-	-
GHG Emission Intensity (kg CO2e/m²)	25	26	21	28	105	45

The data from Toronto VPC we received initially included process heating and compressor use, resulting in an extremely high natural gas use. This use has been removed from the total shown above.

Data for fugitive emissions from refrigerants can form a non-trivial portion of overall GHG emissions from buildings (between 5% - 15% in portfolios we have reviewed) however, data for annual refrigerant recharge was not provided for these sites, and therefore is not included in the baseline. In the GTA, GHG contributions from water use for commercial buildings are usually in the range of 1% of total impact, and therefore not a focus for this report.

2.4 GREENHOUSE GAS BENCHMARKING AND TARGET SETTING

Greenhouse gas (GHG) emissions reduction targets for buildings are an emerging sector. The buildings sector will play an important role in reducing emissions to limit a global temperature increase to 1.5°C.The Science-Based Targets Initiative promote methods for organizations to identify their fair share of the emissions reductions necessary to limit global temperature increases. A leading methodology, the Sectoral Decarbonisation Approach, has identified an emissions intensity target for the global buildings sector of 13.2 $kgCO_{2e}/m^2$ by 2050.

The Canadian market is advancing towards this goal more quickly. The new construction office building Tier 1 and 2 targets proposed for the 2018 Toronto Green Building Standard are, respectively, 20 $kgCO_{2e}/m^2$ and 15 $kgCO_{2e}/m^2$.

The current GHG emissions intensity for all 6 buildings averages 26 kgCO2e/m2, about double the 2050 target. If the 5 year plan of conservation measures in this report were implemented, the GHG emissions would drop to 16 $kgCO_2e/m^2$, only 20% above the 2050 target.

When greenhouse gas reductions are prioritized, then conservation should focus on natural gas reduction which has a greater impact on greenhouse gas than electricity in Ontario.

2.5 FUTURE READINESS

Although we have based our estimates of likely costs and savings on today's weather patterns, making modifications to building heating and cooling systems can involve capital cost and long-time horizons. The Greater Toronto Area has already moved from Climate Zone 6 to Climate Zone 5 (become warmer over the year) in the last 30 years, and this trend is expected to continue.

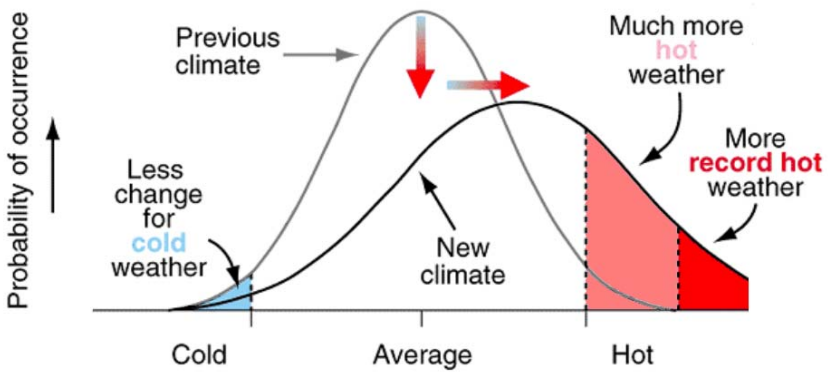


FIGURE 2-1*: Anticipated impact of climate change (Source: IPCC 2001)*

Toronto's Future Weather and Climate Driver Study, produced in 2011, predicts increases in hot weather; heat waves, daily rainfall, mild winters; freeze-thaw cycles; warm nights; severe storms and year-to-year variability.

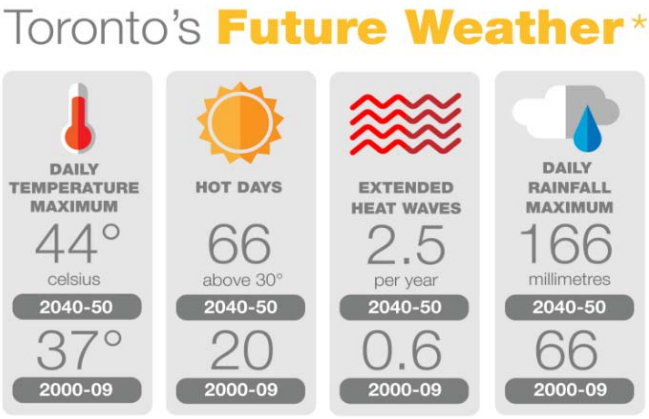


FIGURE 2-2: Toronto's Future Weather (source: City of Toronto website and "Toronto's Future Weather and Climate Driver Study, 2011")

As Enbridge contemplates improving its assets, consideration of how designs will perform in the future, and how to plan for expansion of capacity are encouraged.

3 KEY FINDINGS

Our findings generally relate to opportunities which reliably reduce natural gas consumption, providing significant greenhouse gas emissions reductions.

1. **Operational improvements offer quick wins.** Enbridge's carbon reduction efforts have not yet included concerted building re-commissioning and continuous commissioning efforts. Research shows that commissioning and improved measurement & monitoring can reliably reduce consumption and provide paybacks between 1-4 years.
2. **Energy recovery from process loads could be large opportunities, but require more investigation.** Enbridge's unique facilities, mixing high process loads with standard office and operations & maintenance facilities, often have systems which handle enough energy to heat or cool the remaining facility. Two examples include:
   - → Toronto VPC could be partially cooled by an upgraded turbocharger reheat system, while simultaneously decreasing process natural gas use, and
   - → Thorold's data centre heat rejection may be able to make a significant contribution to building heating.

A review of these opportunities can be included in a building re-commissioning scope.

4 GHG MEASURE SELECTION

This study sets out to examine up to 10 highly applicable measures which would reduce portfolio greenhouse gas emissions. The following criteria were used to assess the effectiveness of potential measures with respect to meeting Enbridge's goals for this study:

- → **Applicable for Buildings in the Study:** Opportunities which are lower cost to implement, or, where there is an opportunity to tie-in with needed facility renewal, have been prioritized in the ranking system.
- → **Reduced Carbon Solutions**: Opportunities which have the potential to result in building reduced greenhouse gas emissions during operation by avoiding natural gas use.
- → **Saves Operating Costs Effectively:** Existing building systems have been selected for low operating cost, including operation, maintenance and utilities. Opportunities which have the potential to further reduce costs have been prioritized.
- → **Financial Viability**: Expected financial impact on long-term net present value of the property.

The following high performance building strategies were considered, to identify how they might achieve the evaluation criteria noted. A summary of this viability is provided below. High-scoring measures are highlighted and were explored further at Enbridge's portfolio.

TABLE 4-1: Opportunity Table

Measure	IMPACT				
	Applicable/ Innovative (0-3)	Reduces Carbon Emissions (0-3)	Saves Operating Costs Effectively (0-2)	Financial Viability Likely (0-2)	Total Measure Score (0-10)
Building Form					
High performance windows	2	2		1	5
Transpired solar thermal collectors	1	2		0.5	3.5
Insulate / reclad walls	2	2			4
Insulate Roof	2	2			4
Solar thermal water heating	2	2			4
Daylighting	2				2
Controls					
Smart BAS, analytics, FDD	3	3	2	2	10
Existing Building Commissioning	3	3	2	2	10
Generation & Storage					
VPC Plant Reheat Via Building A/C System or ambient exchange system	3	3	1	1	8
Battery storage	3	1	1	1	6
Photovoltaic collectors	3	2		1	6
Wind turbines	2	1			3
Hydrogen fuel cell		1			1
Thermal energy storage	2	2		1	5
HVAC					
Air sourced heat pumps (electric or gas)	3	3		1	7
De-stratification fans	3	2	2	1	8
Demand control ventilation	3	3		1	7
Air-side heat reclaim	3	3		1	7
Heat pump DHW	3	2		1	6
Variable refrigerant flow (VRF/VRV)	1	1	1		3
Biomass heating		1			1
Biogas -heating		1			1
Geo-exchange system	1	3		1	5
Variable speed motors	2	1	1		4
On-site waste heat recovery		1			1
Air Curtains	1	1	1	1	4

Lighting						
	LED	3		2	1	6
	Occupancy control	3		1	1	5
	Addressable lighting	3		1	1	5
Occupant						
	Data center efficiency	3	1	2	2	8
	Plug/process load management	2		1		3
	Space consolidation	2	1	1		4

From the potential strategies considered, the following were selected for deeper analysis. These are considered to have potential to influence a low/no-carbon development strategy at the Subject Property, or, are of interest to Enbridge to understand relative impact. These are:

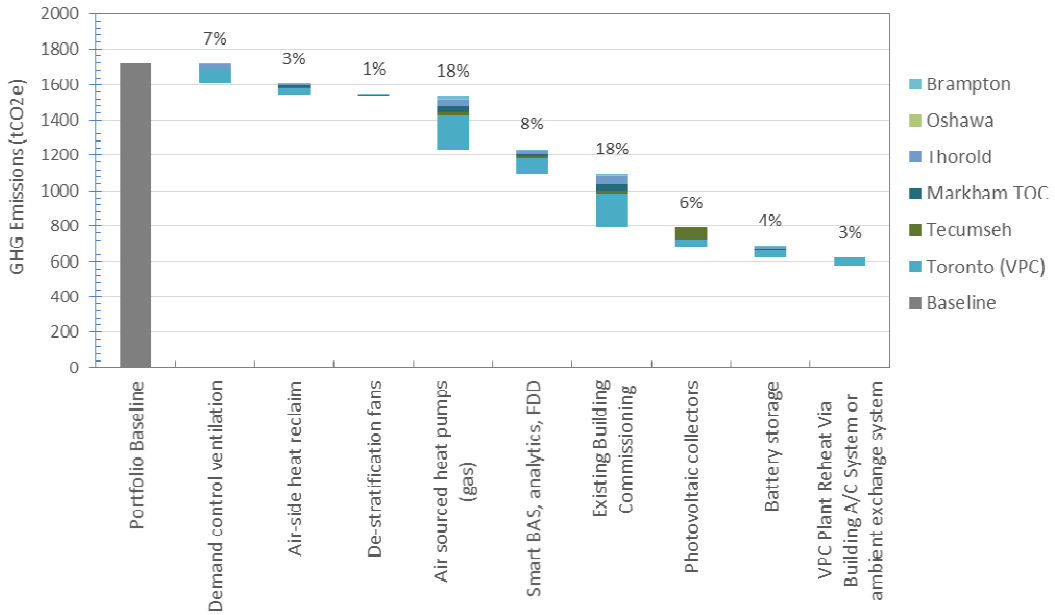
- Demand control ventilation
- Air-side heat reclaim
- De-stratification fans
- Smart BAS, analytics, FDD
- Existing Building Commissioning
- Air sourced heat pumps (electric or gas)
- Battery storage
- Photovoltaic collectors
- VPC Plant Reheat via Building A/C System or ambient exchange system

We analyzed the potential for each activity, reporting energy, carbon, and cost benefit of each. To quantify the savings available for each building in terms of energy and carbon we have:

- Used our experience with costing similar retrofits in other buildings to estimate per square foot costs for projects, with minimums. Exceptions to this methodology are noted below.
- Estimated the potential impact for carbon, both per year, as a lifetime total, and, in $ capital investment per lifetime carbon saved. We have not applied a discount rate to the value of future carbon reductions. (Measure lifespans vary from 6 to 25 years.)

4.1 SUMMARY OF FINDINGS

The following figure shows the evaluation of carbon savings potentials for each measure:



We also evaluated the likely payback ranges for each measure. Our findings are shown below.

Measure Type	Average Payback
Existing Building Commissioning	1-2
Smart BAS, analytics, FDD	2-5
Demand control ventilation	7-9
Battery storage	5-20+
De-stratification fans	6-20+
Photovoltaic collectors	16
Air-side heat reclaim*	20+
VPC Plant Reheat Via Building A/C System or ambient exchange system*	20+
Air sourced heat pumps (gas)*	20+

Measures marked with * will show better paybacks when equipment reaches end of life and requires renewal or replacement, but will not easily justify retrofit when existing equipment has useful life left. Based on these findings, the team decided to focus energy on measures with high potential for savings. Based on these findings, we focussed our investigation on measures which have the highest impacts.

- → demand control ventilation,
- → air sourced heat pumps,
- → Smart BAS systems,
- → existing building commissioning, and
- → photovoltaics.

4.2 DEMAND CONTROL VENTILATION

Each building uses air handling units or rooftop packaged units to provide fresh air to occupants whenever the building is scheduled to be occupied. Based on the building performance, age, and design objectives when constructed, we believe that Tecumseh and Markham TOC would already use demand control ventilation, so they have been excluded from the predicted savings calculation.

We assume the air handlers already turn off overnight, and we assume all air handling units are already equipped outdoor air dampers and airflow monitoring devices. By retrofitting carbon dioxide monitoring sensors to the office floor areas and warehouse floor areas (one sensor per return air duct) the volume of outside air supplied to the space can be reduced when the space isn't fully occupied. We observe approximately significant savings from this kind of measure on buildings with longer operating hours and significant partial occupancy hours, such as operations and maintenance facilities. We have assumed a 40% reduction in fresh air delivered could be achieved, corresponding to a 42% reduction in ventilation heating energy.

If the building air handlers are equipped with variable speed drives which can reduce speed when less fresh air is needed, there can be further (2%+) electricity saving associated with this measure. The table below describes our overall assumptions and findings for this measure as it applies to your buildings:

TABLE 4-2: Demand Control Ventilation Measure Summary

Cost ($/ft2)	Minimum Project Cost	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)		
			Natural Gas	Electricity	Carbon
$0.27	$8,500	17	5-14%	0.3%+	4-9%

* This metric is the simple total of energy savings and capital costs, divided by the total of carbon saved, over the equipment lifetime. Positive numbers indicate net cost savings. Negative numbers indicate net cost.

The table below shows applicability to each facility, and, estimated impact on carbon.

TABLE 4-3: Demand Control Ventilation Building-by-Building Savings and Costs

Building	Natural Gas (m3)	Electricity (kWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	Lifetime Capital Cost Per Ton ($/tCO2)
Toronto (VPC)	45,400	21,334	$14,695	$113,500	7.7	89	$90
Thorold	8,700	4,129	$3,242	$24,500	7.6	17	$105
Oshawa	1,500	688	$571	$8,500	14.9	3	$25
Brampton	1,500	688	$568	$8,500	15.0	3	-$24
Total	**57,100**	**26,839**	**$19,076**	**$155,000**	**45.1**	**112**	**$89**

To implement this retrofit measure, we would propose to identify the appropriate systems (as part of a re-commissioning exercise), followed by design activities in consultation with your air conditioning service provider for a price to install these controls.

4.3 AIR SOURCED HEAT PUMPS (GAS)

Each building has gas-fired heating systems (boilers or air handler-based) and electric cooling (provided by rooftop units which have standard efficiency air conditioning or by a chilled water plants on site.), and gas-fired heating.

New gas-driven compressor technology can use direct expansion air conditioning systems to generate hot water for building heating and domestic hot water. Although these systems are available in reversible models, using gas to provide cooling would increase carbon emissions and is therefore not recommended. The units can be installed in a well ventilated space or outdoors, and piped to replace existing boiler systems (60%-70% of all office space -is served by boiler loops.)

However, to replace existing indirect or direct-fired roof top units, overhead radiant heaters, and unit heaters in industrial areas, a new glycol hydronic system would need to be installed, supplied by a new heat pump. These heat pumps have efficiencies of between 130%-180%.

To implement this end-of-life equipment replacement measure, consult with a building services mechanical engineer to conduct a detailed assessment of the costs and paybacks. The table below shows applicability to each facility, and, estimated impact on carbon.

As this is an emerging technology in Toronto, the installed cost may be prohibitive from a payback perspective. However, the benefits of piloting a technology that uses gas more efficiently, reducing carbon emissions, and reducing operating costs may be compelling. The table below describes our overall assumptions and findings for this measure as it applies to your buildings:

TABLE 4-4: Air Sourced Heat Pump Measure Summary

Cost ($/ft2)	Minimum Project Cost	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)		
			Natural Gas	Electricity	Carbon
$9-$11	$20,000	20	11%-35%	2%	10%-21%

The table below shows building by building calculations. Savings at Brampton are due to the very high gas use at that facility. If not all the gas used there is for heating, the paybacks presented here would need to be revised.

TABLE 4-5: Air Sourced Heat Pump Building-by-Building Savings and Costs

Building	Natural Gas (m3)	Electricity (kWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	Lifetime Capital Cost Per Ton ($/tCO2)
Toronto (VPC)	109,600	-98,772	$27,903	$3,418,875	122.5	194	-$738
Tecumseh	9,600	-11,389	$1,095	$623,500	569.2	17	-$1,809
Markham TOC	16,600	-7,043	$3,665	$818,250	223.2	30	-$1,223
Thorold	23,200	-35,724	$1,488	$350,000	235.2	39	-$323
Oshawa	5,900	-3,821	$1,099	$132,500	120.6	11	-$520

Building	Natural Gas (m3)	Electricity (kWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	Lifetime Capital Cost Per Ton ($/tCO2)
Brampton	6,500	-3,650	$1,324	$156,000	117.8	12	$551
Total	**171,400**	**-160,398**	**$36,575**	**$5,499,125**	**1,388.6**	**302**	**-$789**

To implement this retrofit measure, WSP or your preferred mechanical consultant can do an in depth review of operating records to verify heating loads, prepare a schematic design for a proposed facility, select preliminary equipment and verifying the estimated budgets.

There are number of funds in Ontario's Climate Change Action Plan intended to fund innovation to improve the carbon footprint of natural gas, which also may support this retrofit as a pilot or trial.

4.4 SMART BAS, ANALYTICS, FDD

We understand that the portfolio operates using a mix of stand-alone controls, pneumatic control systems, and building automation systems. While these systems are expected to have basic scheduling and alarm capability, further savings can be achieved if building analytics are implemented.

Smart BAS, analytics and fault diagnostics and detection systems can save energy by:

- Using weather forecasts to pre-cool or pre-heat the building as needed. Since the air conditioning systems at this building run more efficiently at part-load, this type of forecasting reduces energy costs while increasing comfort.
- Providing high-level analysis of alarms and faults, alerting the building operator to unusual patterns which may indicate equipment failure, forgotten system overrides or other issues;
- Optimize sequences of operation and operating settings over time.

For smaller buildings, new networked smart thermostats and fault detection and diagnostics designed for rooftop units can add controls and supervision to a building without the cost of upgrading to a full BAS.

The table below describes our overall assumptions and findings for this measure as it applies to your buildings:

TABLE 4-6: Smart Bas, Analytics, FDD Measure Summary

Cost ($/ft2)	Minimum Project Cost	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)		
			Natural Gas	Electricity	Carbon
$0.25-$0.50	$2,000	8	10%	10%	6%-9%

The table below shows applicability to each facility, and, estimated impact on carbon.

TABLE 4-7: Smart BAS, Analytics, FDD Building-by-Building Savings and Costs

Building	Natural Gas (m3)	Electricity (kWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	Lifetime Capital Cost Per Ton ($/tCO2)
Toronto (VPC)	20,600	334,178	$23,017	$116,550	5.1	88	$96
Tecumseh	1,300	38,531	$6,428	$25,000	3.9	8	$413
Markham TOC	5,900	23,828	$6,218	$40,000	6.4	15	$83
Thorold	1,400	120,865	$18,933	$35,500	1.9	20	$714
Oshawa	700	12,929	$2,480	$25,000	10.1	3	-$201
Brampton	800	12,350	$2,358	$25,000	10.6	3	$227
Total	**30,700**	**542,681**	**$59,435**	**$267,050**	**37.9**	**138**	**$189**

To implement this retrofit measure, consult with an engineer to assist you in preparing a request for proposals for smart building automation vendors for your building. These contracts will have both an up-front fee, and then an ongoing cost for monitoring and management. Smart building software can be incorporated into an existing building commissioning exercise, as this software helps commissioning agents identify measures in greater depth.

4.5 EXISTING BUILDING COMMISSIONING

Retro-commissioning (ReCx) is a systematic process applied to existing buildings to ensure continued efficiency over time. ReCx is the tune-up for your existing building that looks beyond the efficiency of individual pieces of equipment to address system-wide functionality. While ReCx may include recommendations for capital improvements, the primary focus is on using diagnostic testing and tune-up activities to optimize building performance given the current needs of occupants. The Building Automation System (BAS), controls, sensors, actuators and programming are fundamental areas of ReCx.

Because the focus is on operational performance improvements, recommendations can often be implemented at a lower cost than traditional capital upgrades. As an example, a survey of ReCx at 640 existing buildings in the United States identified nearly 7,000 individual building performance problems, which, when corrected, led to an average energy savings of 16%. The average payback for these improvements was 13 months, giving an annual return on investment of 90%.

Our estimate of savings takes the total energy use for building and then estimates assume a further reduction of 10% is identified after the implementation of all other EE measures identified in this report.

The table below shows applicability to each facility, and, estimated impact on carbon.

TABLE 4-8: Existing Building Commissioning Measure Summary

Cost ($/ft2)	Minimum Project Cost	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)		
			Natural Gas	Electricity	Carbon
$0.25-$0.50	$2,000	8	10%	10%	%10

TABLE 4-9: Existing Building Commissioning Building-by-Building Savings and Costs

Building	Natural Gas (m3)	Electricity (kWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	Lifetime Capital Cost Per Ton ($/tCO2)
Toronto (VPC)	38,600	634,938	$48,370	$208,500	4.3	194	$70
Tecumseh	2,400	73,210	$13,913	$35,000	2.5	18	$440
Markham TOC	11,200	45,274	$13,079	$50,000	3.8	30	$159
Thorold	2,700	229,643	$41,261	$44,500	1.1	49	$698
Oshawa	1,300	24,564	$5,351	$35,000	6.5	7	-$67
Brampton	1,600	23,465	$5,109	$35,000	6.9	7	$98
Total	**57,800**	**1,031,094**	**$127,083**	**$408,000**	**25.1**	**305**	**$194**

To implement this measure, your first step is to engage a commissioning agent to conduct an investigation to review operational practices and identify measures to improve operation and controls. Once these are identified, implementation costs can be more accurately assessed.

4.6 PHOTOVOLTAICS

The potential for Building-Integrated Photovoltaic panels in the development design was explored, particularly considering rooftops, where most-cost effective systems are available. Rooftop PV installations are compatible with most flat or south-sloped roof surfaces, including green roofs, and can be installed over parking areas. Appendix G includes a detailed feasibility assessment for solar installations at Toronto VPC and Tecumseh.

To align with the carbon reduction budget, we have reduced the proposed installation sizes to 57 KW, which we anticipate would have an installed cost roughly equal to one year's carbon reduction budget.

The table below shows applicability to each facility, and, estimated impact on carbon.

Cost ($)	Maximum Cost ($)	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)		
			Natural Gas	Electricity	Carbon
$350,000	$100,000	25-30+	0%	4%-32%	Varies

While the simple payback period for an extensive solar installation is relatively long, electrical rates for Ontario are expected to provide long-term reliable return on investment. The lifespan of the system is expected to almost double the simple payback.

- → This calculation does not include any incentives, including tax credits
- → VPC may not be able to opt-in to Class A rates, which would provide significant additional financial benefits from PV, since the peak electrical demand predicted for Site 1 may not exceed 1MW

→ Because VPC already includes substantial on-site generation, there may be grid connection limitations associated with a PV installation, and, difficulty in monetizing the benefits if used behind the meter. Paybacks would be reduced if the turbo-expander had to be curtailed to allow the PV to operate – in this case Tecumseh or a 3rd site may be more appropriate for PV installation. We have shown the business case below for VPC using the current net electricity rate of $0.05/kWh (about 1/3 of the grid rate.) The PVs are assumed to reduce generator operation, as well.

TABLE 4-10: Photovoltaics Building-by-Building Savings and Costs

Building	Natural Gas (m3)	Electricity (kWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	Lifetime Capital Cost Per Ton ($/tCO2)
Toronto (VPC)	3,700	213,286	$11,856	$350,000	29.5	38	-$56
Tecumseh	0	444,970	$66,746	$730,000	10.9	65	$578

5 IMPLEMENTATION PLAN

The measures shown above are our estimates of likely savings and costs based on the data provided about your portfolio, assuming each project is implemented individually. However, an efficient implementation plan will be able to leverage the scale of your portfolio to reduce the cost per building. In addition, we considered that retro-commissioning and smart BAS are expected to have short returns, and will help confirm the feasibility of all other carbon-saving measures.

As a result, we propose the following implementation plan and carbon reduction targets:

5.1.1 RE-COMMISSIONING INVESTIGATIONS & SMART BUILDING (2017-2018)

Since **building re-commissioning** has the lowest anticipated aggregate cost, we recommend proceeding with this measure first. You will realize cost-benefit by tendering all 6 buildings at once, particularly since several of your facilities are small and in isolation may not prove cost-effective to evaluate. We anticipate about a 25% savings if done as a package rather than independently. For re-commissioning,

→ 30% of the budget is allowed for investigation.

→ 70% is allowed for implementing recommendations with costs.

In fall 2017, the first phase of re-commissioning, the investigation phase, could begin. Commissioning investigations should cover both warm and cold weather for best results, extending to 2018, with implementation of recommended measures following, for a total timeline of 2 years to completion of the project.

In addition, for your two largest buildings, which already have building automation systems, we recommend implementing **smart building instrumentation and monitoring**. The trending collected through this measure will help with re-commissioning, verify estimated savings, and identify additional opportunities.

Smart buildings implementation is not weather specific and could be begin before the end of 2017 for the two largest buildings. After re-commissioning of all buildings, selective recommendations for smart BAS retrofits can be made for your smaller buildings to maximize the effectiveness of measures implemented.

The following table summarizes our recommendations:

Name of Measure	Building	Budget	Energy Cost Savings ($/year)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	% Portfolio CO2 Saved when complete
2017 - 2018						
Existing Building Commissioning Investigations	All Buildings	$110,000	$30,300	3.6	67	4%
Smart BAS, analytics, FDD	Toronto (VPC)	$104,900	$19,700	5.9	100	6%
	Markham TOC	$36,000	$6,200	6.4	9	0%
Totals Year 1:		**$250,900**	**$56,200**	**4.5**	**175**	**10%**
2018 - 2019						
Existing Building Commissioning Implementation	All buildings	$250,000	$90,800	2.8	200	12%
Smart BAS, analytics, FDD	As per ReCX findings	$55,250	$15,100	3.7	23	1%
Totals Year 2:		**$305,250**	**$105,900**	**2.9**	**223**	**13%**
Total (All years)		**$556,150**	**$162,100**	**3.4**	**398**	**23%**

5.1.2 HEAT PUMP TASK FORCE (2017-2020)

Our findings indicate that heat pumps have some of the highest potential to reduce energy use on Enbridge's sites, with natural gas heat pumps having an 18% reduction potential and electrically-driven heat pumps having even higher potential.

However, the availability of natural gas heat pumps, both in Canada and worldwide, is limited, which means that prices are currently higher than electrical versions of the same products. These high costs mean that today, the business case for deploying this technology may not be compelling.

Because Enbridge could use natural gas heat pumps to reduce consumption in their own facilities, but also has the opportunity to drive adoption of these devices province-wide, we recommend convening an internal task force to:

- → Identify the barriers to cost-effective natural gas heat pump deployment in the Ontario market;
- → Identify next steps to speed adoption and lower prices;
- → Identify pilot project types required to support internal and customer carbon goals;
- → Identify and engage with vendors and suppliers of this technology;

→ Select Enbridge sites for pilot projects.

Internal stakeholders will include: Enbridge's real estate team; Savings By Design program staff; Commercial, Industrial and Residential retrofit incentive program staff; and corporate sustainability program staff.

We recommend the following timeline:

→ 2017-2018: Convene taskforce; identify barriers; identify pilot project sites.

→ 2018 – 2019: Design development of pilot projects.

→ 2019-2020: Implement pilot project(s) at Enbridge sites.

The following table summarizes our recommendations. We are currently including a budget for one pilot installation.

Name of Measure	Building	Budget	Energy Cost Savings ($/year)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	% Portfolio CO2 Saved when complete
Air source heat pump task force (Year 1)	portfolio	$35,000	n/a	n/a	-	-
Air source heat pump task force (Year 2)	portfolio	$35,000	n/a	n/a	-	-
Air source heat pump pilot site (Year 3)	TBD	$132,500	$1,010	131.2	10	1%
Totals (all years):		**$202,500**	**$1,010**	**200.5**	**10**	**3%**

5.1.3 DEMAND CONTROL VENTILATION (2017-2019)

The roll-out of demand control ventilation requires an understating of:

→ the mechanical systems in the building, including the condition of dampers, motors, speed drives, ductwork layouts and existing controls systems;

→ the building's zoning, operating hours and operating schedule, and

→ the existing sequence of operations for all fresh-air units.

In each building, the primary carbon savings available due to demand control ventilation will be related to the reduction in fresh air volumes (by any control mechanism) but the best operating cost savings will be achieved by reducing motor speeds where feasible, to eliminate relatively high-cost, on-peak electrical energy use.

We recommend that demand control ventilation feasibility evaluation be included in the 2017-2018 re-commissioning investigation. The anticipated additional cost is shown below (this is the cost to have the mechanical contractor for each building accompany the building commissioning agent to most accurately evaluate the condition of motorized dampers and actuators.) Note that the cost of evaluating DCV potential separate from a recommissioning project would be higher.

To implement demand control ventilation, a mechanical engineer should be retained to prepare and assist with tendering the required scope of work for each building. We recommend that implementation of demand control ventilation be scheduled for the 2019-2020 year.

The following table summarizes our recommendations.

Name of Measure	Building	Budget	Energy Cost Savings ($/year)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	% Portfolio CO2 Saved when complete
Demand Control Ventilation Investigation (Year 1)	portfolio	$16,200	n/a	n/a	-	-
Demand Control Ventilation - Implementation (Year 3)	portfolio	$118,800	$19,100	n/a	113	-
Totals (all years)		**$155,000**	**$19,100**	**8.1**	**113**	7%

Note that the required controls retrofits and upgrades may be most cost effectively implemented in conjunction with other recommissioning implementation measures. If the recommissioning evaluation suggests that an alternative implementation schedule would be more cost-effective, this work could be accelerated to the 2018-2019 year, and longer-payback ReCX implementation deferred instead.

5.1.4 PHOTOVOLTAIC SYSTEM (2017-2020)

The long anticipated service life of photovoltaic systems, combined with the reduction of peak electrical load, means that the total lifetime carbon avoided by installing a photovoltaic system is high relative to the year-on-year reduction, meaning photovoltaics could form an economically viable part of a long term carbon reduction strategy.

To meet the budget constraints of this program, we have reduced the proposed PV scope to fit within a single year's budget, and propose that PV installation be planned for Year 5 (2021) of the project, with design and tender carried out in 2020.

We are currently indicating installation at Tecumseh, due to grid constraints at the Toronto VPC site. The following table summarizes our recommendations.

Name of Measure	Building	Budget	Energy Cost Savings ($/year)	Simple Payback (years)	GHG Baseline and Savings (tCO2e)	% Portfolio CO2 Saved when complete
Design of Photovoltaic Collectors	Tecumseh	$30,000	n/a	n/a	-	-
Installation of Photovoltaic Collectors	Tecumseh	$350,000	$34,200	10.2	31	2%
Totals (all years)		**$380,000**	**$34,200**	**11.1**	**31**	2%

6 CONCLUSION

6.1 SUMMARY OF IMPLEMENTATION PLAN

Overall, the proposed implementation plan would have the following costs and carbon savings per year:

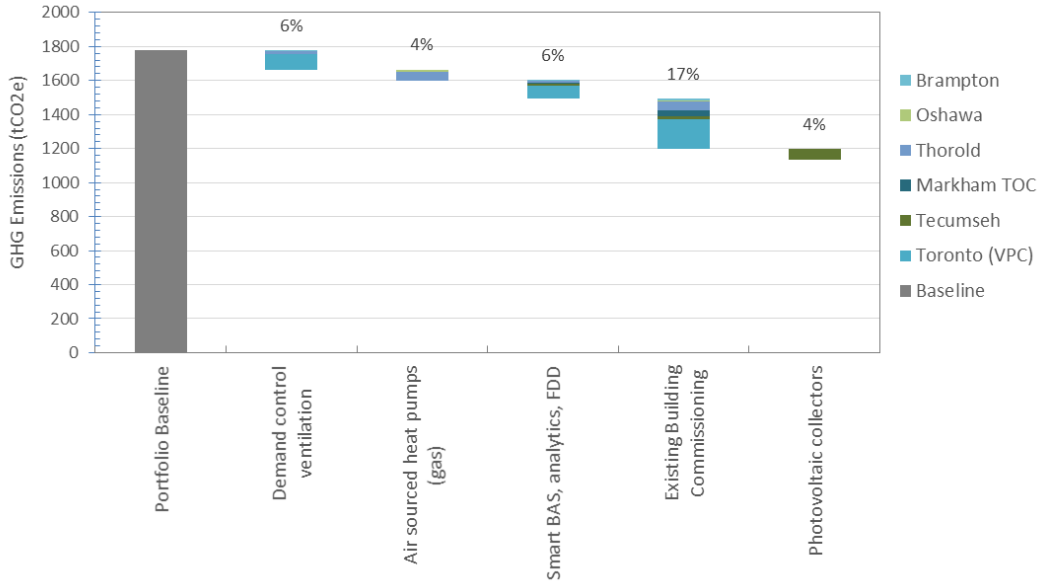
Measure	2017-2018	2018-2019	2019-2020	2020-2021	Total
Existing Building Commissioning	$110,000	$250,000			$360,000
Smart BAS, analytics, FDD	$140,900	$55,250			$196,150
Air sourced heat pumps (gas)	$35,000	$35,000	$132,500		$202,500
Demand control ventilation	$16,200		$138,800		$155,000
Photovoltaic collectors			$30,000	$350,000	$380,000
Total Budget Per Year	**$302,100**	**$340,250**	**$301,300**	**$350,000**	**$1,293,650**
Annual Carbon Reductions:	**175 Tons/yr**	**223 Tons/yr**	**123 Tons/yr**	**32 Tons/yr**	**553 Tons/yr**
Annual Carbon Reductions:	**10%**	**13%**	**7%**	**2%**	**32%**

6.2 SUMMARY OF SAVINGS

Due to the interactive nature of building systems, it is difficult to determine the total savings with precision. However we estimate that the results of implementing the 5-year carbon conservation plan would be as follows.

- → You will save about 550 tons/year of carbon (32% of the portfolio's total carbon emissions);
- → You will save about 3,700,000 ekWh of annual energy consumption (21%);
- → You will save about $260,000 in annual energy cost (22%);
- → It will cost you about $1,300,000 (HST/GST not included) to implement the measures, assuming cost efficiencies available by implementing measures portfolio-wide where practical.
- → The simple payback will be about 8 years overall.

FIGURE 6-1: Final Carbon Savings Waterfall Chart - Recommended Portfolio Carbon Reduction Measures



6.3 NEXT STEPS

This report presents measures that can reduce carbon emissions at your buildings. To realize the benefits outlined in this report, the measures identified must be implemented. Our description of each measure includes our recommendation on how to proceed.

Your next steps are to review, update and finalize a carbon reduction action plan, and decide how implementation will be managed. You will then need to engage support, if appropriate, to begin the year 1 carbon reduction measure investigation phase.

The details that will be uncovered by re-commissioning investigations will increase confidence in the strategies, costs, and savings opportunities across the portfolio, and so this plan should be updated with information gleaned, once those investigations are completed, in year 2 of your program.

WSP can provide the expertise and services that will lead to successful completion of any or all of these operational and retrofit measures.

We trust this report meets your needs and would be pleased to discuss our findings further with you at your convenience. We would also very much like to help you implement these measures, and look forward to taking these next steps with you.

Appendix A

METHODOLOGY

APPENDIX A: METHODOLOGY

Work completed for this assessment included:

1. Kick-off: We met with the project team to conform project intent and deliverables. The project team includes:

NAME	POSITION	ROLE
Steve Dinopoulos	Enbridge, Project Planning & Advanced Design	Enbridge Team Lead
Vlad Mihailescu	Enbridge, DBA & Project Planning | Real Estate Services	Enbridge Project Manager
Ariel Feldman	WSP, Project Principal	Project Manager
Eric Chisholm	WSP, Technical Specialist	Technical Lead
Cara Sloat	WSP, Senior Engineer	Project Associate

2. Preliminary System Review: We performed this review prior to visiting the site through a review of utility bills and facility condition assessments prepared by WalterFedy for each facility.
3. Market Research: We reviewed carbon-saving technologies and prepared a list of strategies which could be feasible for this project.
4. Project Team Update: the project team met June 19th to confirm our understanding of current operational procedures; existing carbon and energy efficiency strategies; and to review plan evaluation criteria and possible plan elements.
5. Analysis: We performed various calculations to estimate both the potential energy savings and implementation costs associated with potential conservation measures;
6. Focus and Review: The project team met on August 9th to review interim calculations and focus the carbon investigations on to key measures most likely to provide operational cost savings and good carbon outcomes.
7. Reporting: We summarized our findings and the recommended next steps in this report.

Appendix B

PRELIMINARY MEASURE LIST

APPENDIX B: PRELIMINARY MEASURE LIST

The list presented below summarises all energy efficiency measures which were considered for this report. Bolded measures are expected to save natural gas, and therefore have a higher impact on carbon for Ontario buildings.

- Building form
  - Daylighting
  - **Insulate / reclad walls**
  - **Insulate** & add green/white roof
  - **High performance windows (triple-pane**, dynamic shading)
  - **Transpired solar thermal collectors**
  - **Solar thermal water heating**
- Occupant
  - Plug/process load management
  - Space consolidation
  - Data Centre efficiency
- Lighting
  - LED
  - Occupancy control
  - Addressable lighting
- Controls
  - Smart BAS, analytics, FDD
  - Existing Building Commissioning
- HVAC
  - Variable speed motors
  - **Demand control ventilation**
  - **Air-side heat reclaim**
  - **On-site waste heat recovery**
  - **Air sourced heat pumps (electric or gas)**
  - **Heat pump DHW**
  - **Variable refrigerant flow (VRF/VRV)**
  - **Geo-exchange system**
  - **Biomass heating**
  - Biogas heating
- Generation & Storage
  - Photovoltaic collectors
  - Wind turbines
  - Hydrogen fuel cell
  - Battery storage
  - Thermal energy storage
  - District energy

Appendix C

DEFERRED MEASURES

APPENDIX C: DEFERRED MEASURES

The list presented below summarises energy efficiency measures which were considered for this report and for which preliminary analyses were completed. These measures were deferred primarily due to the smaller absolute impact they have on carbon, but also for longer paybacks relative to the selected measures.

AIR-SIDE HEAT RECLAIM

Each building uses air handling units to provide fresh air to occupants. Washroom exhaust is located about 25 ft from the supply air intake for the main air handler. By ducting the building exhaust and the building relief dampers to an air-to-air heat exchanger, about 65% of the heating and air conditioning energy from the exhausted air can be recovered to pre-heat or pre-cool the incoming air.

The table below describes the measure's feasibility and impact on carbon in more detail. The figures below assume that air-side heat reclaim is implemented only after demand control ventilation has been installed.

TABLE 6-9: Air-side Heat Reclaim Measure Summary

Cost ($/ft2)	Minimum Project Cost	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)			Simple Payback (years)	Average Value of Carbon Savings ($/ton CO_{2e}, lifetime)*
			Natural Gas	Electricity	Carbon		
$1.49	$15,000	20	5-14%	$88/ton	4-9%	60-210	$88

*This metric is the simple total of energy savings and capital costs, divided by the total of carbon saved, over the equipment lifetime. Positive numbers indicate net cost savings. Negative numbers indicate net cost.

To implement this retrofit measure, consult with a building services mechanical engineer to conduct a detailed assessment of the costs and paybacks of this measure. A preliminary recommendation can be made during the re-commissioning process, should the expected payback for a specific sub-system be enough better than the average to justify implementation.

DE-STRATIFICATION FANS

Each building has number of open warehouse and material handling spaces. These spaces are heated and cooled by air conditioning and overhead radiant heaters. In the heating season, as much as 5°C of temperature stratification can be expected inside these spaces, increasing heat loss through the roof. In the summer, comfort is only created by air temperature, since the roof top units serving the space are designed for minimal air movement. By adding high-level de-stratification ceiling fans, the heat loss through the roof will be reduced by up to 5% in the winter time. In the summer, the thermal comfort range for occupants can be extended by about 3°C by using ceiling fans as the first stage of cooling, before turning on the air conditioning.

The table below describes the measure's feasibility and impact on carbon in more detail.

Cost ($/ft2)	Minimum Project Cost	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)			Simple Payback (years)	Average Value of Carbon Savings ($/ton CO_{2e}, lifetime)*
			Natural Gas	Electricity	Carbon		
$0.90	$5,000	25	1%	0%	0.3 – 1%	55-144	-$700 - +$360

To implement this retrofit measure, consult with your air conditioning service provider for a proposed design and price to install these fans. A recommendation can be made during the re-commissioning process, should the expected payback for a specific portion of a building be enough better than the average to justify implementation.

AIR SOURCED HEAT PUMPS (ELECTRIC)

Each building has gas-fired heating systems (boilers or air handler-based) and electric cooling (provided by rooftop units which have standard efficiency air conditioning or by a chilled water plants on site.), and gas-fired heating. New technologies using inverter-driven air conditioning compressors have allowed heat pumps to be designed, which use the same direct expansion air conditioning system to both heat and cool the building. The units can be installed in a drop-in configuration to replace existing roof top units, and air-to-water models can also be designed to supply water-cooled building systems. They can provide heating without relying on electric resistance backup to -20°C, while using only 30% as much energy in heating, and providing up to 50% electricity savings in cooling.

The table below describes the measure's feasibility and impact on carbon in more detail.

Cost ($/ft2)	Minimum Project Cost	Measure Lifespan (years)	Building-Level Savings by Energy Source or Emission (%)			Simple Payback (years)	Average Value of Carbon Savings ($/ton CO_{2e}, lifetime)*
			Natural Gas	Electricity	Carbon		
$8	$30,000	25	38% - 97%	-6 – 50%	30% - 40%	300 - never	-$1000

To implement this end-of-life equipment replacement measure, consult with a building services mechanical engineer to conduct a detailed assessment of the costs and paybacks of this measure. A recommendation can be made during the re-commissioning process, should the expected payback for a specific portion of a building be enough better than the average to justify implementation. In particular, a more detailed look at how this kind of system could be beneficial at VPC though increased use of the turbo-expander to create low-cost, behind the meter electricity for building heating.

BATTERY STORAGE

We have assumed that a lithium-ion battery array could be installed at each facility, with energy recovery from the battery room for heating purposes. This measure does not reduce annual energy consumption (total energy consumption actually increases slightly), but it does reduce peak electricity demand, "real" carbon impact on the grid as a result of reduced peak demand, improve resiliency, and result in annual cost savings, due to lower demand charges.

These systems are most effective for Class A ratepayers (an opt-in electricity rate structure for users over 1MW average monthly peak demand per year). This measure was deferred in part because no

facility we reviewed is large enough to be Class A except Toronto VPC, which already has a behind-the-meter electricity peak management system (turbo-expander and generator) in place.

Although this is not a priority measure, you can learn more about these systems for your facilities, you can reach out to battery storage vendors to provide quotes and verify the costs and paybacks noted above. Some vendors have turnkey installations that are paid for out of energy cost savings, which could allow deployment.

VPC PLANT REHEAT VIA BUILDING A/C SYSTEM OR AMBIENT EXCHANGE SYSTEM

The building currently has a natural gas turbo-expander generation system incorporated into its building heating system. This system shares a heating plant with the building. Natural gas distribution requires pre-heat prior to entering the turbo-expander. Typically, this re-heat needs to operate at 60°C.

Recent technology developments have made it possible to reduce the required re-heat temperature using vortex tube technology. This is a device that takes high-pressure gas and, in the course of its depressurizing, using what is known as the vortex phenomenon, converts the inlet gas flow energy into two low-pressure streams, one cold and one hot, which exit the vortex tube separately. Vortex Tubes are specially designed cylindrical devices with no moving parts. Using the vortex tube, the building's A/C distribution could be supplied by the natural gas plant.

We believe up to 590,000 eKwh in chiller operating costs, and 60,400m3 in re-heat gas could be avoided using this system, or, about 3% of the carbon generated by the portfolio. However, because detailed information about the capacity of the turbo-expander wasn't available, there could be additional opportunities for savings not included here.

To implement this major retrofit measure, you will need to either work with your utility side engineering team, or retain a building services mechanical engineer and oil and gas process engineer to work together to conduct a detailed assessment of the feasibility, costs and paybacks of this measure.

Appendix D

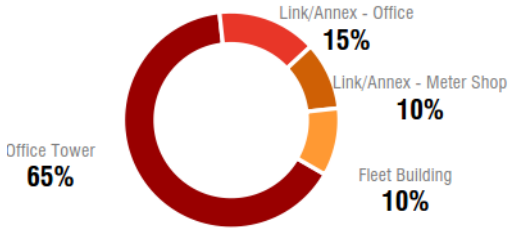
BUILDING DESCRIPTIONS

APPENDIX D: BUILDING DESCRIPTIONS

Note: all diagrams in this section are sourced from WalterFedy's 2016 building assessments for these properties and included for ease of reference only

TORONTO (VPC)

BUILDING DETAILS

Name and Address	Toronto (VPC) Regional Operations Depot 500 Consumers Road, Toronto, ON
Gross Floor Area	Total Gross Floor Area: – 346,600±SF: – Office Tower: 225,000 ±SF – Link/Annex - Office: 51,600 ±SF – Link/Annex – Meter Shop: 35,000 ±SF – Fleet Building: 35,000 ±SF 
Year Constructed	1968 – First 2 stories 1978 – Stories 3-5.
Number of Levels	5
Cladding	- 10 year-old flat PVC mechanically-fastened roof system - Office: pre-cast concrete panels. - Office tower penthouse & repair building: corrugated metal siding. - Fixed single-glazed aluminum punched windows (85%) or double glazed (15%.)
Parking	900 parking spaces provided including 40 for fleet.
Site	15 acres, (20% building), 7.5 acres parking
Current Occupancy	1,154

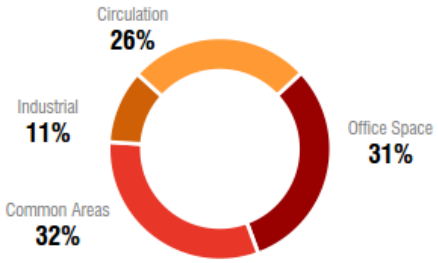
The following table summarizes the building systems:

SYSTEM	DESCRIPTION
HVAC General	- Original to building (estimated 35 years old) Perimeter induction units and VAV air handling system served by 2 gas-fired hot water boilers, chillers, with 9 HVC system pumps. - Repair shop served by RTUs - 1200A, 600V three phase
Controls	- Standalone controls, assume pneumatic given age

SYSTEM	DESCRIPTION
Heating	- 2 Thermific hydronic heating boilers (Boiler #1: M/N – N3000-MFD; S/N – GY34-13-37236, and Boiler #2: M/N – N3000-MFD; S/N – GY34-13-37227) with a rated output of 2,580,000 BTUH each, installed 2005. - Repair shop is served by two packaged Trane 10 ton units, and two 7.5 ton Carrier units.
Cooling	- Central chiller plant serving induction units and air handlers - Fitness centre (system unknown) - Repair shop is served by rooftop units.
Ventilation	- Gas-fired humidification for office areas through the 5 main air handlers. - Greenheck Repair shop make-up air unit includes 225MBH heater, and, gas-fired pre-heat boiler. - Commercial kitchen for cafeteria (20 linear ft. of hoods)
Hot Water	- Central 502,640 BTUH water heater (tank type, with storage tank.) - Commercial dishwashing and cooking equipment for cafeteria
Domestic Cold Water	- Municipal water/sewer - Assumed use for chilling plant cooling tower
Lighting	- T8 & retrofitted LED fixtures in office areas - T8 fluorescent fixtures and high bay metal halide fixtures in repair shop. - Metal Halide wall-mounted lighting units and pole-mounted light standards provide illumination for the site, generally installed in 1999 - LED front parking lot lighting

TECUMSEH ENGINEERING/ TECUMSEH GAS

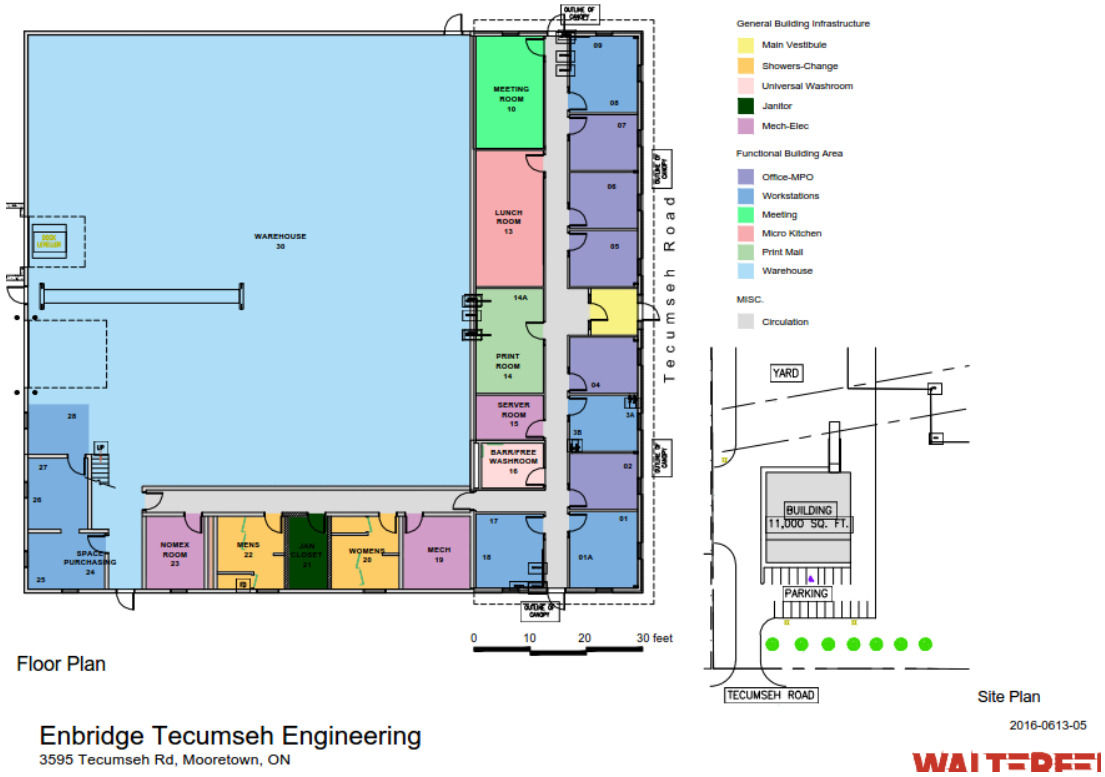
BUILDING DETAILS

Name and Address	Tecumseh Operations Depot & Tecumseh Gas And Tecumseh Engineering Building, 3595 Tecumseh Rd, Mooretown	
Gross Floor Area	Operations Depot: – Gross Floor Area: ±44,491 SF – Mezzanine area ± 1,629 SF – Office Space: ±11,248 SF – Common Areas: ± 7,934 SF – Industrial: ±13,528 SF – Circulation: ±10,151 SF	Engineering: – Gross Floor Area: ±12,506 SF – Mezzanine Area: ±1,506 SF – Office Space: ± 2,467 SF – Common Areas: ±1,075 SF – Industrial: ± 6,354 SF – Circulation: ±1,104 SF
Year Constructed	2009 (Engineering building) 2016 (Operations Depot)	
Number of Levels	1 plus mezzanine	
Cladding	Operations Depot: – PVC, flat, mechanically fastened roof system – Split-face block and corrugated metal cladding – Double-glazed IGUs in aluminum frames	Engineering: – conventional built-up modified bitumen (BUR), steel roof – brick masonry with concrete block walls. – Double-glazed IGUs in aluminum frames
Parking	113 spaces	
Site Area	4.8 Acre (5.1% building coverage) * 1.2 acre yard * 0.2 acre parking	
Current Occupancy	19 hotelling (Engineering) 71 (Operations Depot)	
Number of Occupants (design)	Not Available	

The following table summarizes the building systems:

SYSTEM	SCRIPTION – OPERATIONS	DESCRIPTION - ENGINEERING
HVAC General	- Rooftop Units with supplementary radiant heaters	- Rooftop Units with supplementary split DX
Controls	- Yes (?)	- Yes (?)
Heating	- Packaged gas-fired rooftop units - Overhead radiant gas-fired heaters	- 96,000 BTU Carrier rooftop unit (2009)

SYSTEM	SCRIPTION – OPERATIONS	DESCRIPTION - ENGINEERING
Cooling	- Packaged gas-fired rooftop units	- 8.5 ton Carrier rooftop unit (2009) - 1.5 ton Fijitsu split A/C unit (2009)
Ventilation	- Rooftop Unit Supply - Air handling units (2?) - 3 make-up air units (?) - Three ERVs - Welding area exhaust	
Hot Water	- Domestic Storage Hot Water Tank	- Domestic Storage Hot Water Tank
Domestic Cold Water	- Municipal water/sewer	- Municipal water/sewer
Lighting	- T8 fluorescent lighting fixtures - Exterior metal halide fixtures	- T8 fluorescent lighting fixtures - Exterior metal halide fixtures



Floor Plan

Site Plan

Enbridge Tecumseh Engineering
3595 Tecumseh Rd, Mooretown, ON

2016-0613-05

Enbridge Tecumseh Gas
3595 Tecumseh Rd, Mooretown, ON

MARKHAM (TOC)

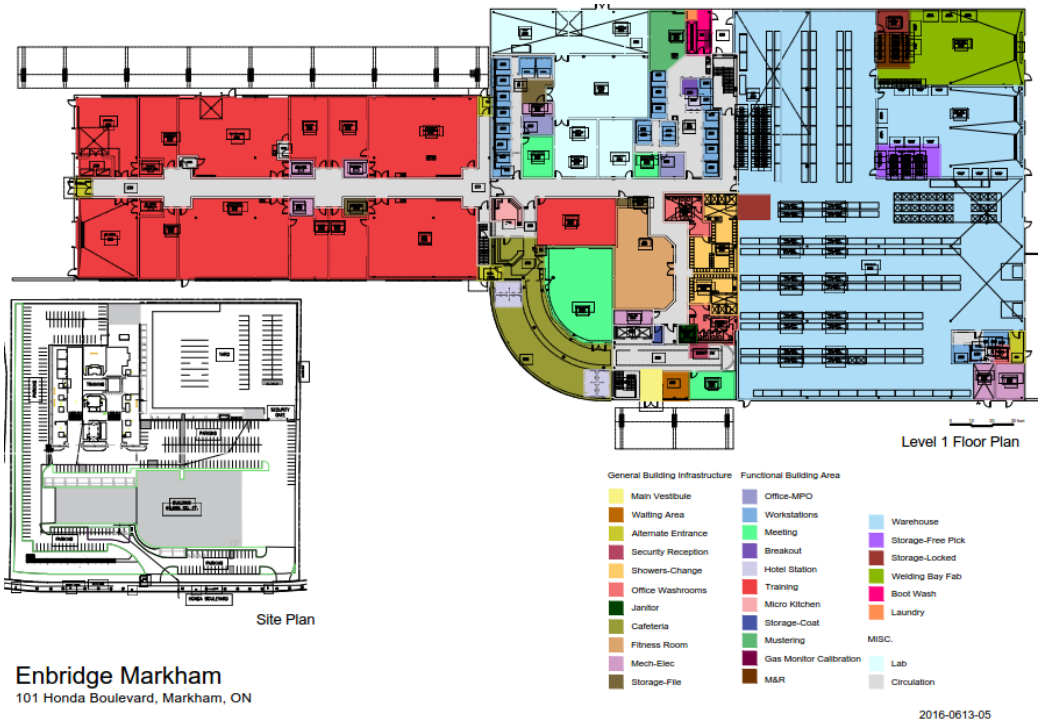
BUILDING DETAILS

Name and Address	Markham Operations Depot, 101 Honda Boulevard, Markham, ON
Gross Floor Area	99,700 ft2, consisting of: – Office Space: 17,300 ±SF – Training: 12,900 ±SF – Industrial: 24,700 ±SF – Common Areas: 19,500 ±SF – Circulation: 25,300 ±SF
Year Constructed	2011
Number of Levels	3 stories
Envelope	- Fixed insulated double glazed aluminum punched windows, with insulated glazed curtain wall system at the front elevation - Panelized wall system (?) - Single ply Polyvinyl Chloride Membrane (PVC), near-flat, mechanically fastened roof system installed in 2015 - 9 pyramidal glazed skylights throughout facility.
Parking	35 cars, 41 trucks, 10 equipment, all above grade.
Site Area	3.9 acres.
Current Occupancy	293
Number of Occupants (design)	233

The following table summarizes the building systems:

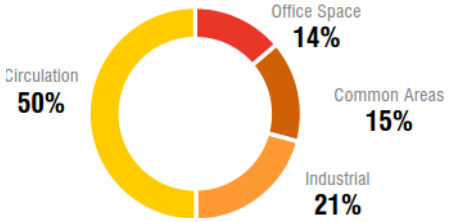
SYSTEM	DESCRIPTION
HVAC General	- Central Boilers, Chillers, Radiant tube heaters and unit heaters - Two packaged rooftop units provide 120,000 and 140,000 BTUs of heating each. - 1200 A/600 V three phase service
Controls	- Stand alone
Heating	- two 'Thermal Solutions' natural gas fired boilers (B1: M/N –TS1000; B2: M/N - TS1000) at 1,000 BTUH each - 8 warehouse area natural gas fired forced infrared heaters - 7 warehouse area forced air unit heaters
Cooling	- Two 'York' water Chilled Chillers (C1: YCWL00848E58; C2: YCWL00848E58) rated at 75 Ton each - rooftop mounted air cooled 'Waltco' Cooling Tower (M/N – WGX-0618-75) rated at 600 Gallons per minute
Ventilation	- Dedicated air handlers (?) - Welding bay exhaust
Hot Water	- 200 MBH storage hot water tank, and, 200 MBH natural gas water heater.

SYSTEM	DESCRIPTION
Domestic Cold Water	- Domestic well water and septic tank sanitary
Lighting	- First generation LED fixtures for interior lighting. - Exterior lighting LED



THOROLD

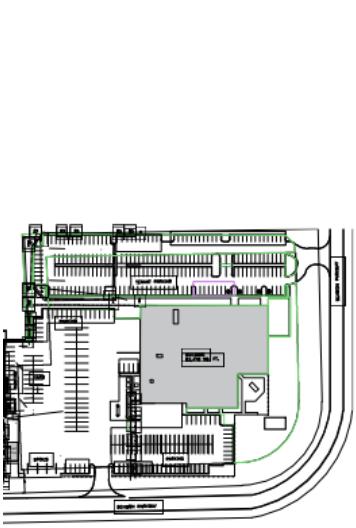
BUILDING DETAILS

Name and Address	Thorold Regional Operations Centre 3401 Schmon Parkway, Thorold, ON
Gross Floor Area	Gross Floor Area: ±89,051 SF - Tenant Space ±41,444 SF - Office Space: ±12,870 SF - Common Areas: ±14,325 SF - Industrial: ±19,269 SF - Circulation: ±46,731 SF - *** data centre: ? 
Year Constructed	1992
Number of Levels	2
Cladding	- Single ply Polyvinyl Chloride Membrane (PVC), near-flat, mechanically fastened roof system installed in 2016 - Fixed insulated single glazed aluminum punched windows, with insulated glazed curtain wall system at the west (front) elevation - sheet metal cladding
Parking	356 spots.
Current Occupancy	122

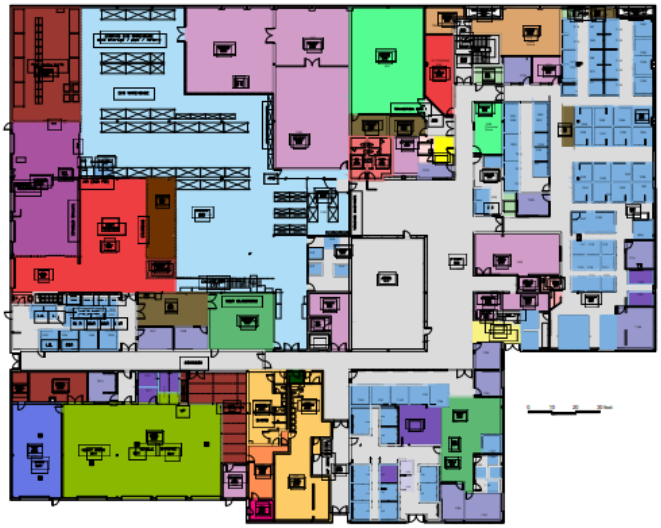
The following table summarizes the building systems:

SYSTEM	DESCRIPTION
HVAC General	- Roof top air handling units, split cooling and radiant heater units - 800A, 600V three phase
Controls	- Enerstat – System 10
Heating	- Rooftop units - Radiant overhead heating systems (10 heaters, 80MBH – 200 MBH estimated capacity each.) - 4 unit heaters (75 MBH – 300 MH each)
Cooling	- Rooftop units o Seven 15 ton Lennox units, replaced in 2016 o Nine Carrier units (5 – 12.5 tons), replaced in 2004 o The Carrier Lan room air handlers. - Five (?) Liebert split systems serving a data centre - One multistack 30 ton watercooled chiller serving the data centre - One Motivair Free cooling chiller
Ventilation	- Exhaust serves: o washroom exhausts (6000 cfm) o Washbay (fleet) (3000 cfm in 3 fans.)
Hot Water	- 360,000 BTUH storage water heating tank
Domestic Cold Water	- Municipal water/sewer - Irrigation system

SYSTEM	DESCRIPTION
	- Plumbing fixtures original to 1989 construction
Lighting	- Office: T8 tube lighting fixtures which was converted from T12 (2012) - Warehouse: T5 tube lighting fixtures converted from (?) (2012) - Exterior LED wallpacks and light standards

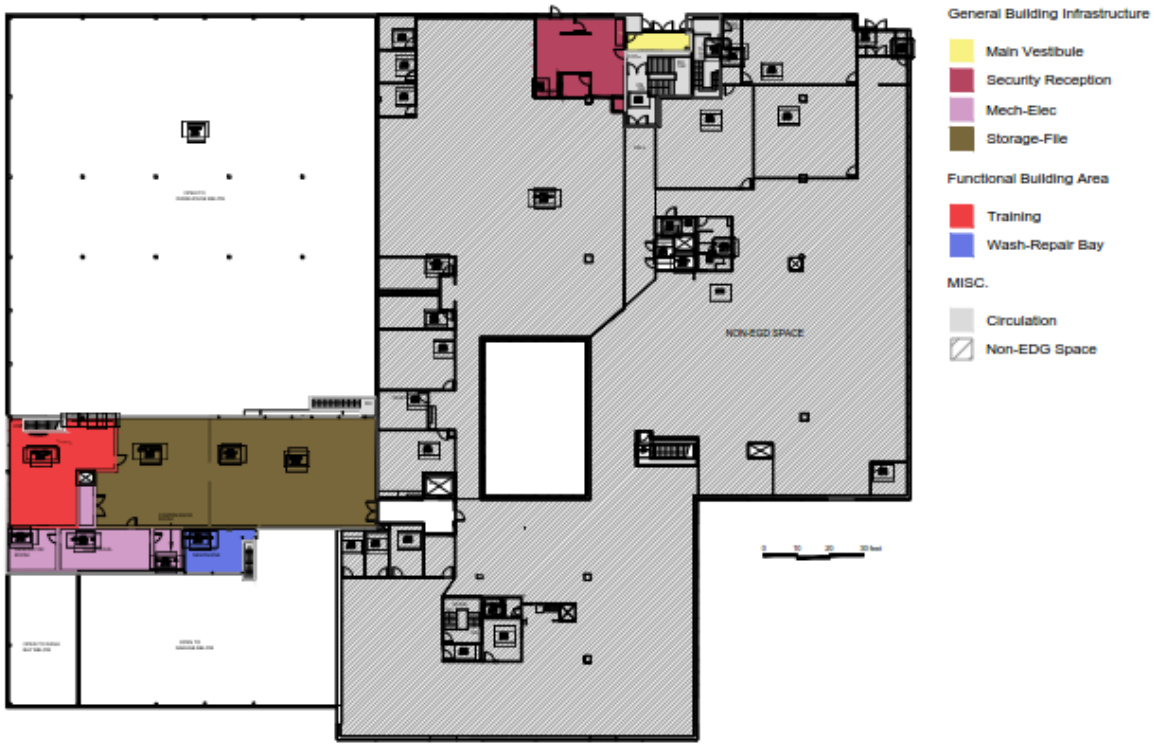


Site Plan



Level 1Floor Plan

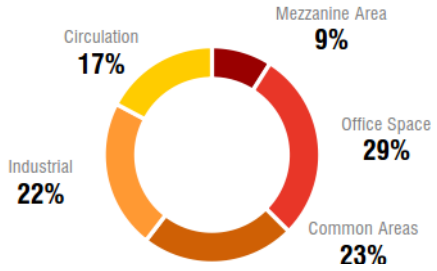
Enbridge Thorold
3401 Schmon Parkway, Thorold, ON



Level 2 Floor Plan

OSHAWA

BUILDING DETAILS

Name and Address	Oshawa Operations Depot, 1350 Thornton Rd S, Oshawa
Gross Floor Area	Gross Floor Area: 12,116 SF - Office Space: 4,755 SF - Common Areas: 1,307 SF - Industrial: 3,642 SF - Circulation: 2,412 SF 
Year Constructed	1989
Number of Levels	1
Cladding	- architectural concrete block masonry, requiring repair (spalling) or retrofit - Mod. Bit roofing system, replacement recommended. - Fixed insulated double glazed aluminum punched windows.
Parking	70 cars/vans, 24 trucks, 10 equipment
Site	3.89 Acres (7.5% building) - 1.6 Acre Yard - 0.57 Acres Parking
Current Occupancy	57
Number of Occupants	57

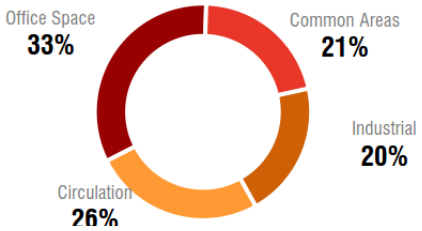
The following table summarizes the building systems:

SYSTEM	DESCRIPTION
HVAC General	- Office – Rooftop HVAC units - Warehouse – Radiant tube and forced air unit heaters - 400 A/600 V, 3 phase
Controls	- Stand Alone Thermostats
Heating	- Office: Two 10 year old Lennox indoor direct fired natural gas furnaces - Warehouse: Lennox natural gas fired forced air ceiling mounted unit heaters
Cooling	- Two 3.5 Ton Split systems, serving indoor furnaces.
Ventilation	- Office – furnaces - Warehouse - ? - Welding shop exists, assumed to have hood
Hot Water	- Storage domestic hot water tank, 2016
Domestic Cold Water	- Municipal water supply, septic sanitary - The men's and woman's washroom areas are tight.

SYSTEM	DESCRIPTION
	- boot wash and washing machine area - car washing occurs outside in the yard
Lighting	- T8 fluorescent T8 tube lighting fixtures. - Limited access to daylight in warehouse and welding bay areas.

BRAMPTON

BUILDING DETAILS

Name and Address	Brampton Regional Operations Centre - 6 Colony Ct, Brampton
Gross Floor Area	Total Gross Floor Area 14,250 SF: - Ground Floor : 12,200± SF - Mezzanine: 2,050± SF - Office Space: 4,700± SF - Common Areas: 3,000± SF - Industrial: 2,900± SF - Circulation: 3,650± SF 
Year Constructed	1998
Number of Levels	1 with mezzanine
Envelope	- Block masonry and sheet metal cladding. - SBS modified bitumen (BUR), near-flat roof system - Fixed insulated double glazed aluminum punched windows
Parking	57 cars/vans, 12 trucks, 10 equipment, all above grade
Site	3 acres (building is 11% of site)
Current Occupancy	113

The following table summarizes the building systems:

SYSTEM	DESCRIPTION
HVAC General	- Rooftop HVAC units, ceiling mounted radiant tube heaters. - 400 A/600 V three phase service
Controls	-
Heating	- Primarily roof mounted packaged rooftop air handling units: - Three installed in 2003, 6 tons each - One installed in 2012, 7.5 tons - One installed in 2014, 7.5 tons - Supplementary ceiling mounted radiant tube heaters - Supplementary forced air ceiling mounted Reznor unit
Cooling	- Roof top units
Ventilation	- Roof top units supply/exhaust, bathroom exhaust fans. Future: - There are no exhaust vents for removal of fumes at the welding areas, but this is recommended.
Hot Water	- Storage hot water tank
Domestic Cold Water	- Municipal domestic water and septic tank sanitary - 2 men's and 2 women's WCs - Washing machine
Lighting	- T8 fluorescent T8 tube lighting fixtures


General Building Infrastructure
Main Vestibule
Waiting Area
Alternate Entrance
Showers-Change
Janitor
Mech-Elec
Storage-File
Functional Building Area
Office-MPO
Workstations
Meeting
Hotel Station
Micro Kitchen
Print Mail
Mustering
M&R
Warehouse
MISC.
Circulation
Site Plan
0 10 20 30 feet
Floor Plan
Enbridge Colony
6 Colony Court, Brampton, ON
2016-0613-05

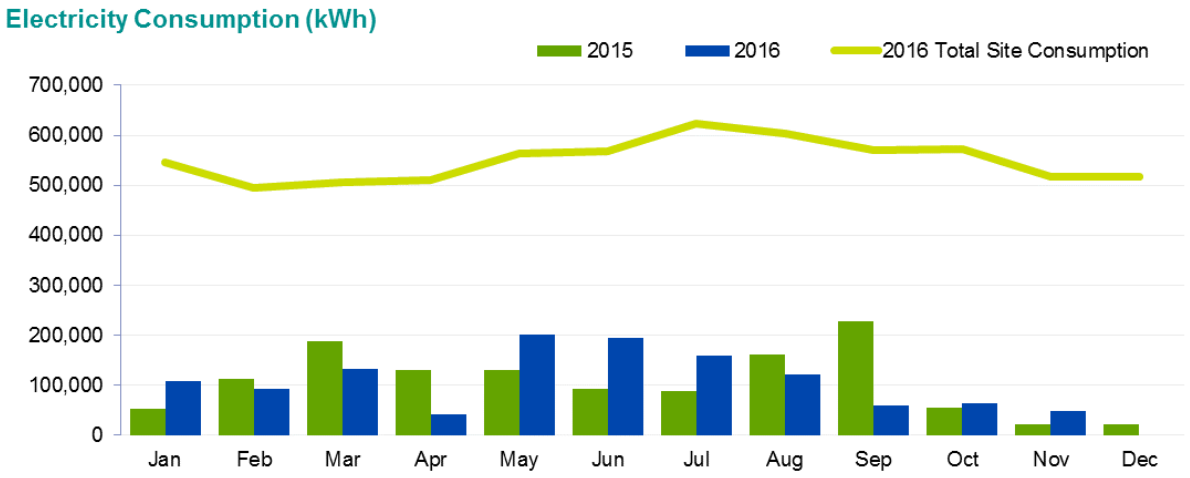
Appendix E

UTILITY DATA

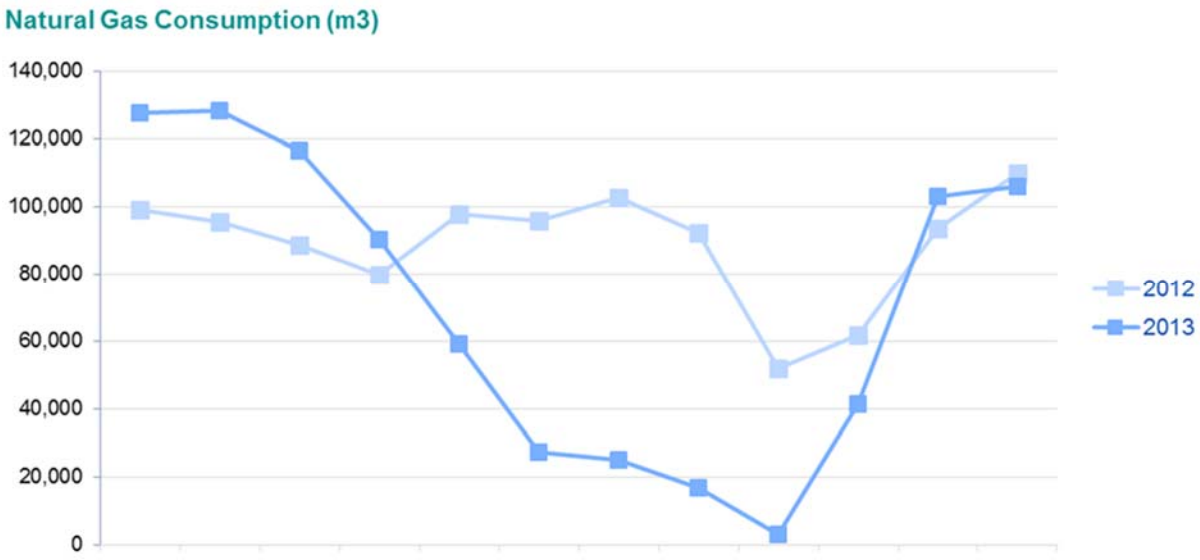
APPENDIX E: UTILITY DATA

TORONTO (VPC)

The following graphs show utility costs used in our analyses. The graph below shows Toronto Hydro grid electricity consumption (bars), as well as full-facility electricity use (line) which represents the sum of turbo-expander generation, peak dispatchable generator generation, and Toronto Hydro grid consumption used on-site.

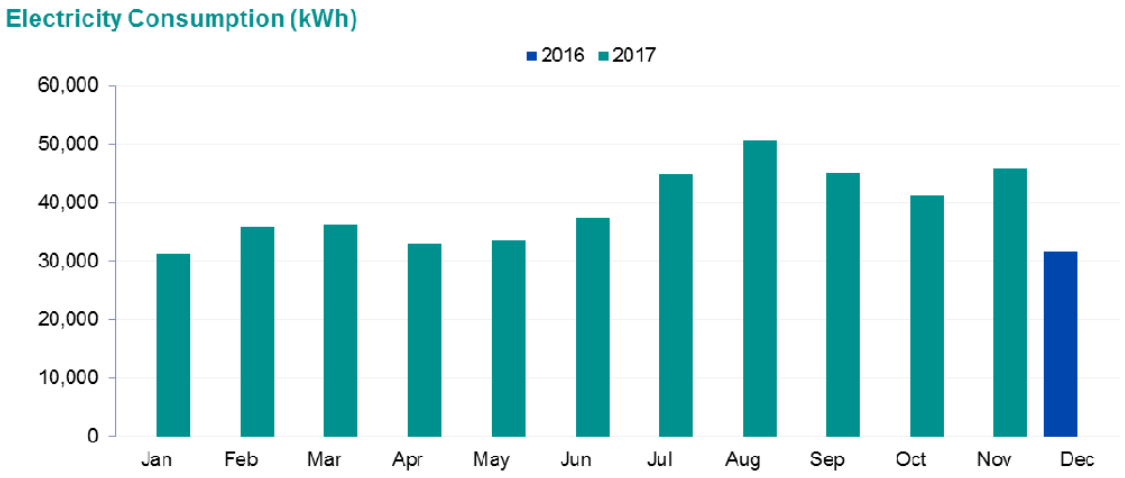


Natural gas consumption data received is shown below.



TECUMSEH ENGINEERING/ TECUMSEH GAS

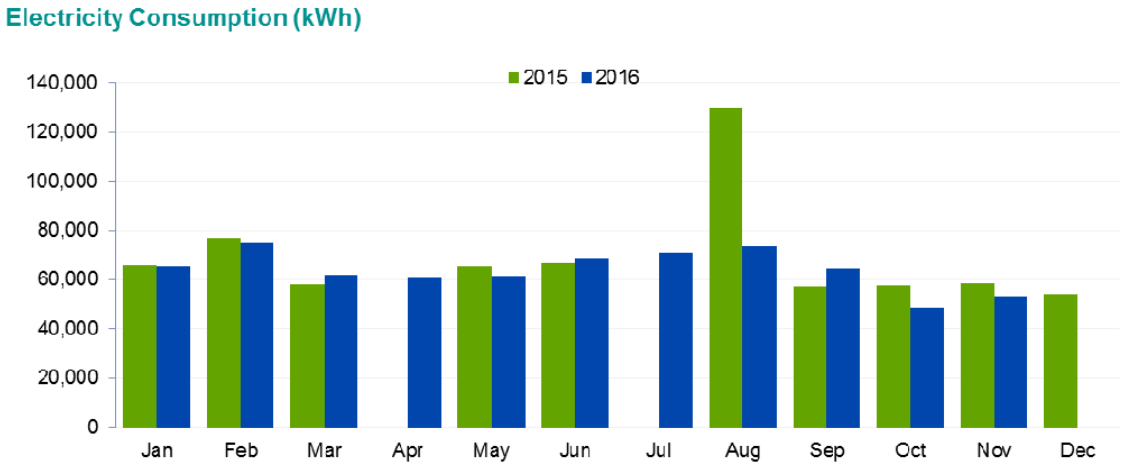
The following graphs show the electrical costs used in our analyses.

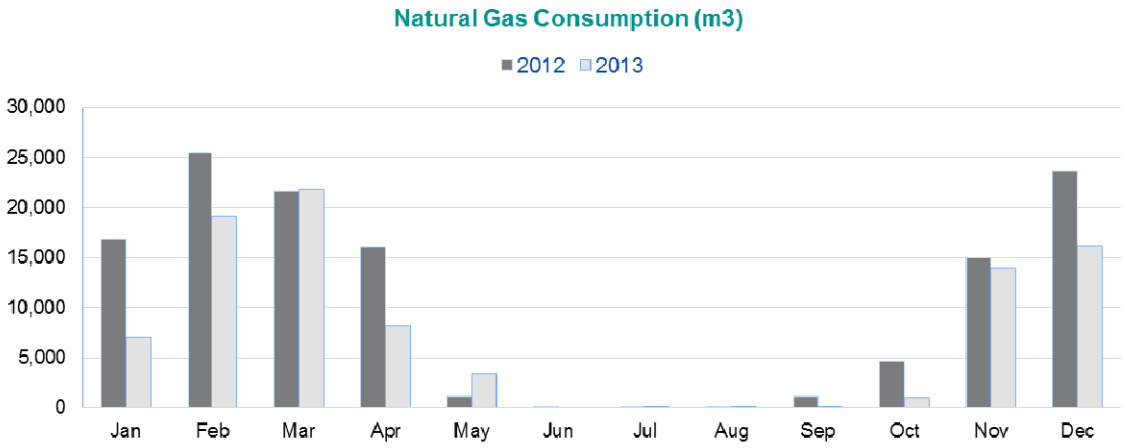


Natural gas trends were not provided for this building, but were based on energy modelling results and available only as yearly output. We assumed 36,100 m^3 of manual gas are used per year.

MARKHAM (TOC)

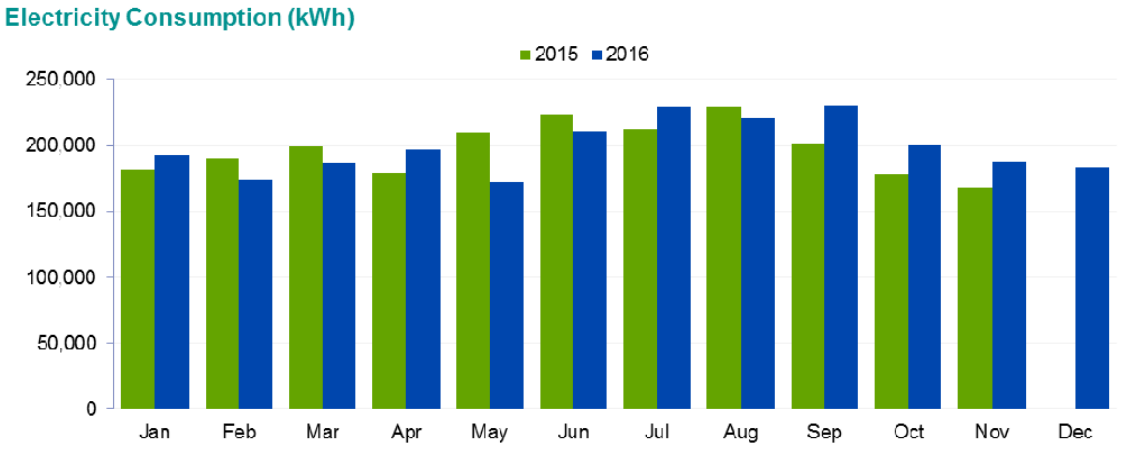
The following graphs show utility costs used in our analyses.

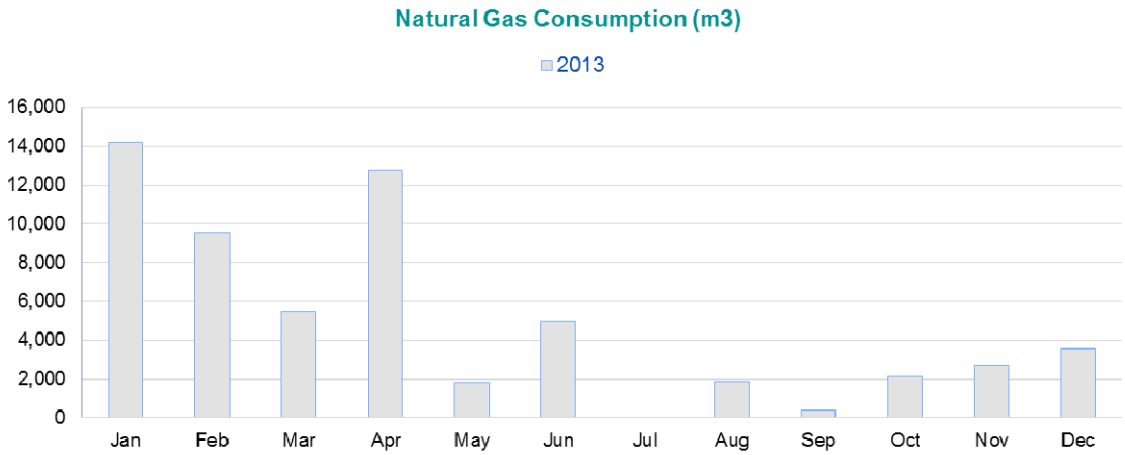




THOROLD

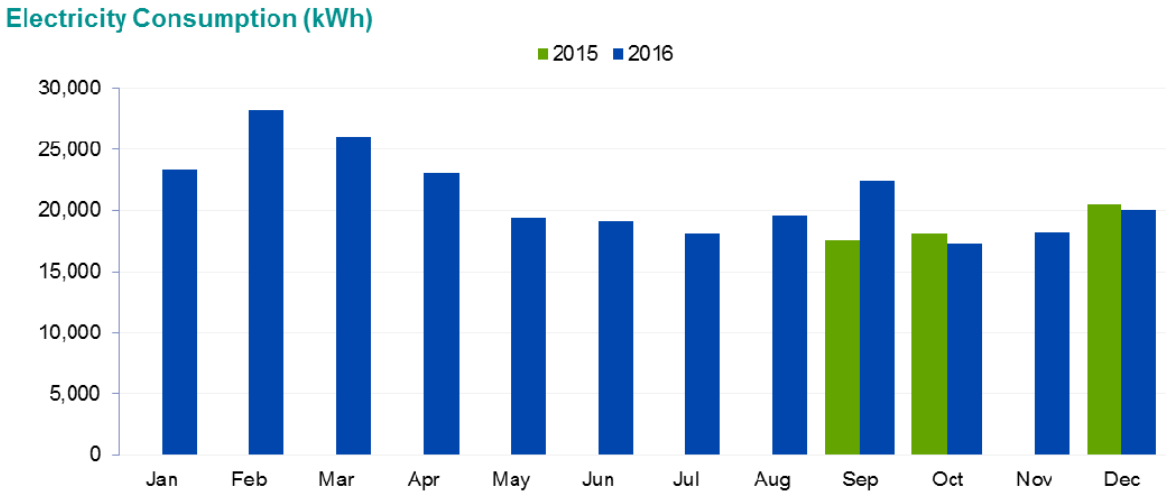
The following graphs show utility costs used in our analyses.

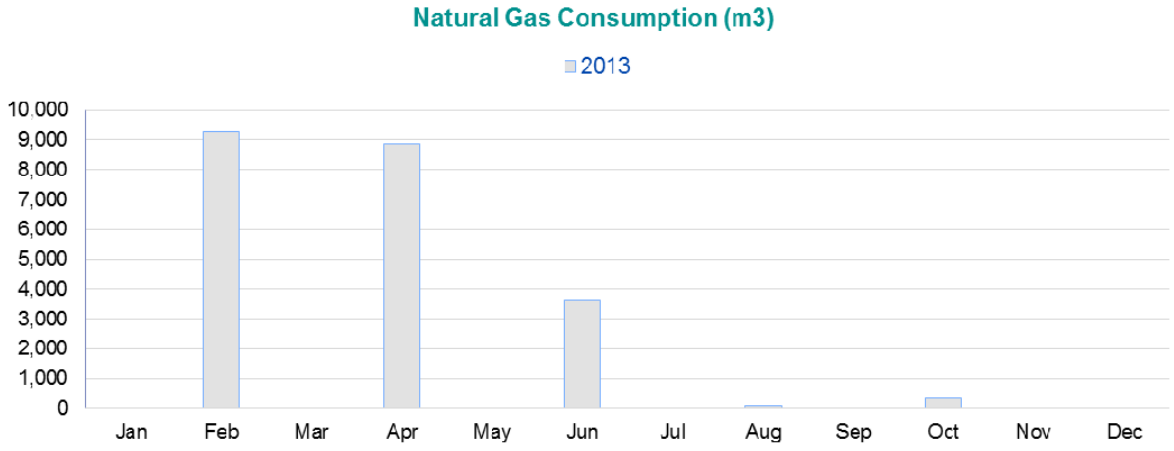




OSHAWA

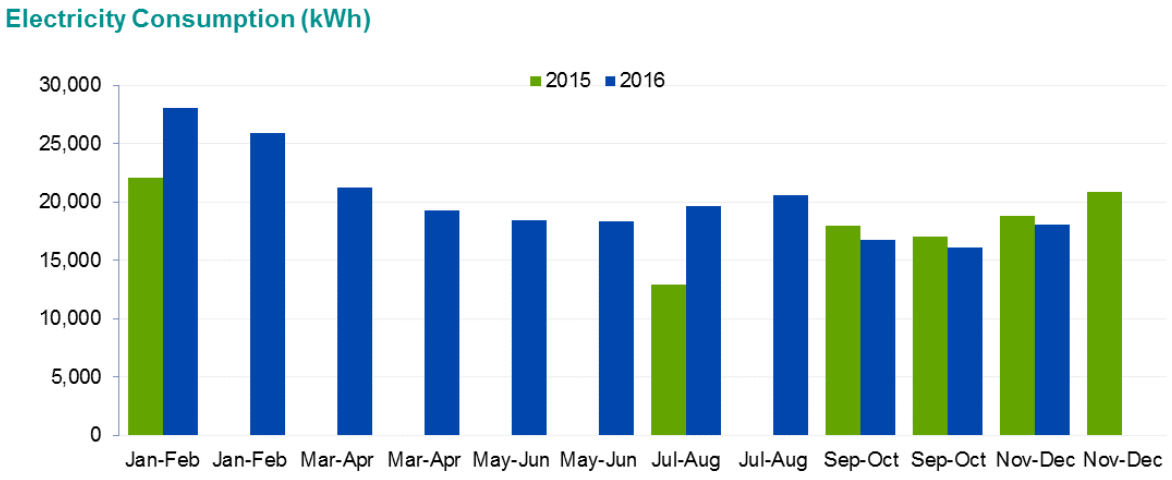
The following graphs show utility costs used in our analyses. Note that the data shown below has a winter electricity use peak, which is characteristic of an electrically heated building, or, heavy and seasonally-dependant process loads. Natural gas meter reading was infrequent, with no December reading logged. Building re-commissioning may identify opportunities to improve efficiency.

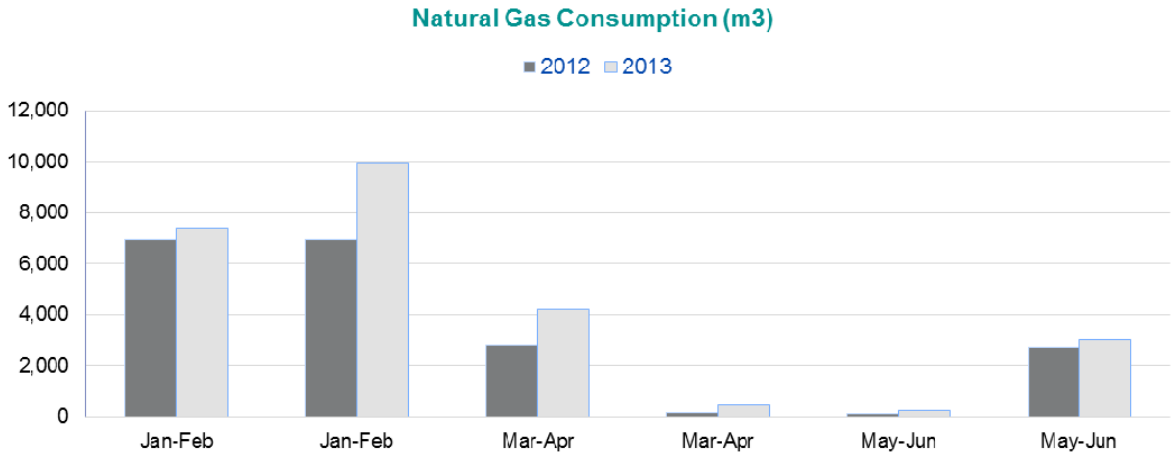




BRAMPTON

The following graphs show utility costs used in our analyses. Note that the data shown below has a winter electricity use peak, which is characteristic of an electrically heated building, or, heavy and seasonally-dependant process loads. Building re-commissioning may identify opportunities to improve efficiency.


Electricity Consumption (kWh)
2015
2016
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-Feb
Jan-Feb
Mar-Apr
Mar-Apr
May-Jun
May-Jun
Jul-Aug
Jul-Aug
Sep-Oct
Sep-Oct
Nov-Dec
Nov-Dec


Natural Gas Consumption (m3)
2012
2013
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-Feb
Jan-Feb
Mar-Apr
Mar-Apr
May-Jun
May-Jun

Appendix F

CARBON REDUCTION MEASURE CALCULATIONS – SUMMARY TABLES

APPENDIX F: CARBON REDUCTION MEASURE CALCULATIONS - SUMMARY TABLES

Building	Measure Name	Years of Measure Duration	Natural Gas Savings (m3)	Electricity Savings (kWh)	Energy Savings (Total ekWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	CO2 Savings (tons/year CO2e)	Lifetime Capital Cost Per Ton ($/tCO2)	Portfolio Impact (% Tons CO2/year avoided)
Toronto (VPC)	Demand control ventilation	17	45,400	21,334	504,506	$14,695	$113,500	7.7	89	$90	5.2%
Toronto (VPC)	Air-side heat reclaim	20	19,300	-13,907	191,834	$5,089	$311,000	61.1	35	-$302	2.0%
Toronto (VPC)	Air sourced heat pumps (gas)	20	109,600	-98,772	1,068,485	$27,903	$3,418,875	122.5	194	-$738	11.3%
Toronto (VPC)	Smart BAS, analytics, FDD	8	20,600	334,178	554,104	$23,017	$116,550	5.1	88	$96	5.1%
Toronto (VPC)	Existing Building Commissioning	6	38,600	634,938	1,046,566	$48,370	$208,500	4.3	194	$70	11.3%
Toronto (VPC)	Photovoltaic collectors	25	3,700	213,286	253,054	$11,856	$350,000	29.5	38	-$56	2.2%
Toronto (VPC)	Battery storage	10	-283	-77,016	-80,034	$5,403	$1,021,000	189.0	42	-$2,315	2.4%
Toronto (VPC)	VPC Plant Reheat Via Building A/C System or ambient exchange system	20	12,900	135,008	271,955	$10,672	$1,237,000	115.9	44	-$1,159	2.6%
Tecumseh	Air-side heat reclaim	20	1,100	-1,800	9,853	$48	$85,000	1,774.6	2	-$2,314	0.1%
Tecumseh	Air sourced heat pumps (gas)	20	9,600	-11,389	91,152	$1,095	$623,500	569.2	17	-$1,809	1.0%
Tecumseh	Smart BAS, analytics, FDD	8	1,300	38,531	51,850	$6,428	$25,000	3.9	8	$413	0.5%
Tecumseh	Existing Building Commissioning	6	2,400	73,210	98,515	$13,913	$35,000	2.5	18	$440	1.1%
Tecumseh	Photovoltaic collectors	25	0	444,970	444,970	$66,746	$730,000	10.9	65	$578	3.8%
Tecumseh	Battery storage	10	100	-2,995	-2,129	$694	$139,500	201.1	2	-$7,366	0.1%
Markham TOC	Air-side heat reclaim	20	7,700	-3,150	78,421	$1,722	$149,000	86.5	14	-$406	0.8%

Building	Measure Name	Years of Measure Duration	Natural Gas Savings (m3)	Electricity Savings (kWh)	Energy Savings (Total ekWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	CO2 Savings (tons/year CO2e)	Lifetime Capital Cost Per Ton ($/tCO2)	Portfolio Impact (% Tons CO2/year avoided)
Markham TOC	Air sourced heat pumps (gas)	20	16,600	-7,043	169,404	$3,665	$818,250	223.2	30	-$1,223	1.8%
Markham TOC	Smart BAS, analytics, FDD	8	5,900	23,828	86,764	$6,218	$40,000	6.4	15	$83	0.9%
Markham TOC	Existing Building Commissioning	6	11,200	45,274	164,852	$13,079	$50,000	3.8	30	$159	1.7%
Markham TOC	Battery storage	10	200	-5,704	-4,016	$1,566	$244,500	156.1	3	-$6,662	0.2%
Thorold	Demand control ventilation	17	8,700	4,129	96,876	$3,242	$24,500	7.6	17	$105	1.0%
Thorold	Air-side heat reclaim	20	3,800	-2,696	37,627	$727	$133,000	182.9	7	-$871	0.4%
Thorold	Air sourced heat pumps (gas)	25	23,200	-35,724	210,895	$1,488	$350,000	235.2	39	-$323	2.3%
Thorold	Smart BAS, analytics, FDD	8	1,400	120,865	135,780	$18,933	$35,500	1.9	20	$714	1.2%
Thorold	Existing Building Commissioning	6	2,700	229,643	257,982	$41,261	$44,500	1.1	49	$698	2.8%
Thorold	Battery storage	10	0	-28,935	-28,719	$6,268	$218,000	34.8	16	-$975	0.9%
Oshawa	Demand control ventilation	17	1,500	688	16,146	$571	$8,500	14.9	3	$25	0.2%
Oshawa	Air-side heat reclaim	20	600	-449	6,272	$101	$18,000	177.9	1	-$705	0.1%
Oshawa	Air sourced heat pumps (gas)	20	5,900	-3,821	58,856	$1,099	$132,500	120.6	11	-$520	0.6%
Oshawa	Smart BAS, analytics, FDD	8	700	12,929	20,361	$2,480	$25,000	10.1	3	-$201	0.2%
Oshawa	Existing Building Commissioning	6	1,300	24,564	38,687	$5,351	$35,000	6.5	7	-$67	0.4%
Oshawa	Battery storage	10	100	-3,095	-2,465	$799	$29,500	36.9	2	-$1,187	0.1%
Brampton	Demand control ventilation	17	1,500	688	16,146	$568	$8,500	15.0	3	-$24	0.2%
Brampton	Air-side heat reclaim	20	600	-449	6,272	$103	$21,500	208.7	1	$858	0.1%

Building	Measure Name	Years of Measure Duration	Natural Gas Savings (m3)	Electricity Savings (kWh)	Energy Savings (Total ekWh)	Energy Cost Savings ($/year)	Measure Cost ($)	Simple Payback (years)	CO2 Savings (tons/year CO2e)	Lifetime Capital Cost Per Ton ($/tCO2)	Portfolio Impact (% Tons CO2/year avoided)
Brampton	Air sourced heat pumps (gas)	20	6,500	-3,650	65,236	$1,324	$156,000	117.8	12	$551	0.7%
Brampton	Smart BAS, analytics, FDD	8	800	12,350	21,141	$2,358	$25,000	10.6	3	$227	0.2%
Brampton	Existing Building Commissioning	6	1,600	23,465	40,168	$5,109	$35,000	6.9	7	$98	0.4%
Brampton	Battery storage	10	100	-2,957	-2,259	$747	$35,000	46.8	2	$1,574	0.1%

[1] ekWh – equivalent kilowatt hour. A unit of energy equal to a load of one kilowatt over the duration of one hour. The "e" in ekWh, short for "equivalent", signifies conversion of other units of energy into kWh.
[2] Costs shown reflect the cost after incentives are applied. HST **not** included. We provide an explanation of our opinion of costs in Section 1.3
* Costs shown reflect the incremental cost, refer to full measure write-up for more details
* Each measure/opportunity is sequential (savings is relative to energy after preceding measures) to avoid double-accounting potential carbon savings.

Appendix G

PV STUDY

MEMO

TO: Ariel Feldman, WSP

FROM: Enrique Sissa and Claire McKenna, WSP

SUBJECT: Enbridge Net Zero Carbon Feasibility Study

DATE: June 19, 2017

FEASIBILITY STUDY SUMMARY

This memorandum summarizes the findings of the technical study conducted to determine to feasibility of achieving net zero energy and net zero carbon dioxide equivalent emissions on an annual basis using rooftop solar, and solar mouned on the ground and parking lots at two Enbridge facilities, Victoria Park Centre at 500 Consumers Road, Toronto, ON and the gas storage center at 3595 Tecumseh Road, Mooretown, ON.

METHODOLOGY

In order to determine the potential for achieving net zero energy and net zero carbon dioxide equivalent emissions for the two Enbridge sites examined in this study, annual energy use prediction based on modeled data of the buildings was compared to the total potential energy production using site-optimized solar arrays on building roofs, parking lots, and adjacent green field area.

The carbon dioxide equivalent (CO2e) emissions for each site and for potential solar energy production were calculated based on the local greenhouse gas emissions factors associated with natural gas and electricity delivered in Ontario.[1]

To determine each site's energy and carbon emissions offet capacity, on-site solar production modeling was performed using Helioscope, a highly detailed solar energy calculation software. The model for the two sites takes into account site location, solar array geometry, photovoltaic module performance data, 10 year normalized weather data, and the effects of shading with the surroundings.

The solar PV systems were modeled based on optimal oritentation for each site.

[1] Based on Canada's National Inventory Report 1990-2015, Part 2, Annex 6, Table A6-1, written in 2017.

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- Rooftop systems were allocated such that there was no shading from local obstructions and the he array azimuth matched the roof azimuth. The arrays were oriented at a 10° in keeping with industry standard ballasted mounting systems.
- Ground mounted systems were oriented at 40° tilt and due south, which is optimal for annual energy production at the site.
- Parking lot mounted arrays were oriented at 5° in keeping with industry standard solar carport design.

The basis of design solar PV module for all energy production simulations is the monocrystalline Canadian Solar 280 W.

SUMMARY OF BUILDING PERFORMANCE

Energy Use

- Victoria Park Centre[2]
  - Natural gas: 9,282,328 kWh
  - Electricity: 1,248,027 kWh
    - Total 10.53 GWh
- Tecumseh[3]
  - Natural Gas: 384,975 kWh
  - Electricity: 466,372 kWh
    - Total of 851,347 kWh

Total = 11,381,702 kWh or 11.4 GWh

Tons of CO2E (Ontario Factor)

- Victoria Park Centre
  - Natural gas : 1586 mT
  - Electricity: 50 mT
    - Total of: 1636 mT CO2Ee
- Tecumseh:
  - Natural Gas: 19 mT
  - Electricity: 66 mT
    - Total of 85 mT of CO2e

Total = 1721 mT of CO2Ee

SUMMARY OF SOLAR PRODUCTION

Solar Energy Production

- Victoria Park Centre
  - PV on Roof: 1,131,00 kWh
  - PV over Parking Lot: 86,400 kWh (Parking Lot 1) and 255,400 kWh (Parking Lot 2)
    - Total 1.47 GWh
- Tecumseh:
  - PV on Roof: 191,000 kWh
  - PV on greenfield (10 acres): 3,030,000 kWh
    - Total 3.22 GWh

[2] Based on measured data, December 2015 to November 2016.
[3] Based on annual energy model simulation used for LEED compliance.

Total = 4.2 GWh

CONCLUSION

The maximum solar energy production available on the two sites (see images at the end of the memo) is about 4.69 GWh per year or 211 mT of CO2e.

PV Production per site

- Victoria Park Centre
  - 1.47 GWh or 66 mT of CO2e represents the 14% of total energy use and 4% for carbon emissions offset.
- Tecumseh
  - 3.22 GWh or 145 mT of CO2e or and represents the 378% of total energy use ad 166% of carbon emissions offset.

This is enough to achieve zero net energy and carbon for Tecumseh site, but not for Victoria Park Centre, due to very high energy use. Although, some surplus energy produced in Tecumseh site may be used to offset a small percentage of Victoria Park Center.

However, given the solar availability at the both sites, both sites together can achieve about 41% total annual energy offset and 12% carbon emissions offset.

PV System Cost

2017 PV system costs were projected from the National Survey Report of PV Power Aplications in Canada (2014). The average annual price decline per watt was analyzed for the most current 5 years listed in the report (2010-2014) for each system type, and extrapolated to determine an estimate for current PV system cost in Canada. This report did not provide data for carport PV systems, so a 20% premium was added to this system type. The added cost includes structure supporting the solar and site work associated with the electrical infrastructure and building connection.

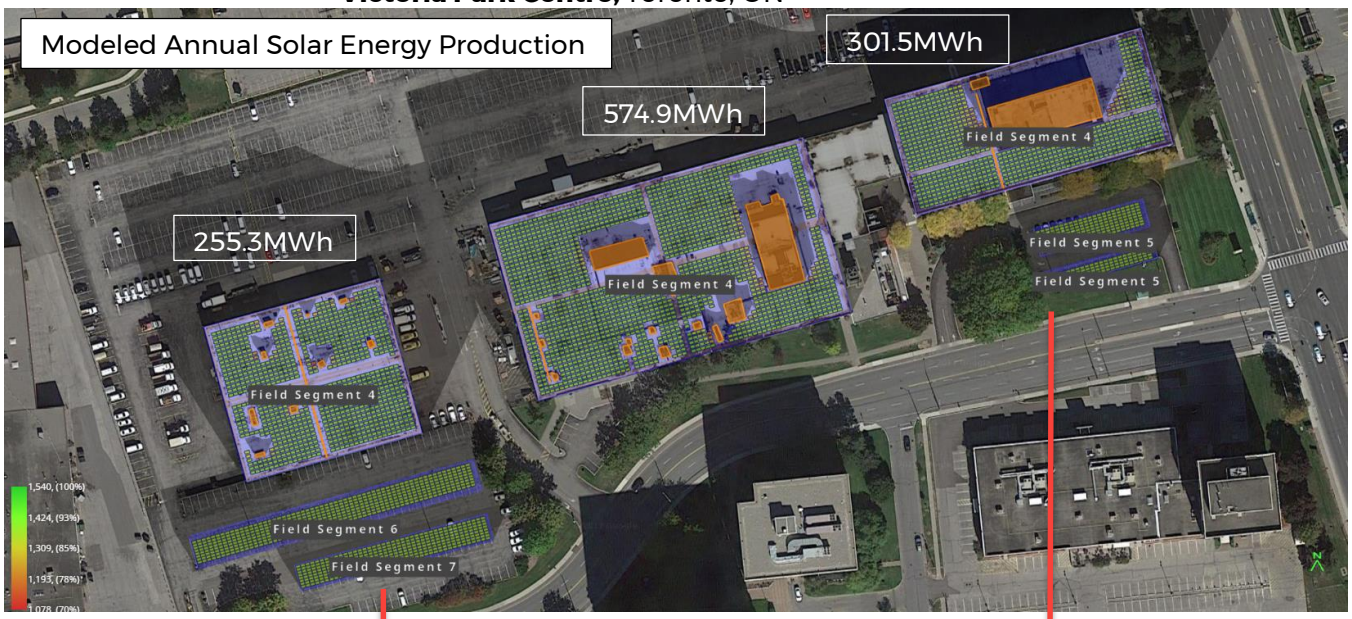
It is recommended that the owner contact a local solar provider to determine local pricing.

- Commercial and Industrial Rooftop PV Systems (2017 estimate): $2.04/W
- Ground Mounted Utility Scale PV Systems (2017 estimate): $2.01/W
- Carport PV Systems (2017 estimate): $2.45/W

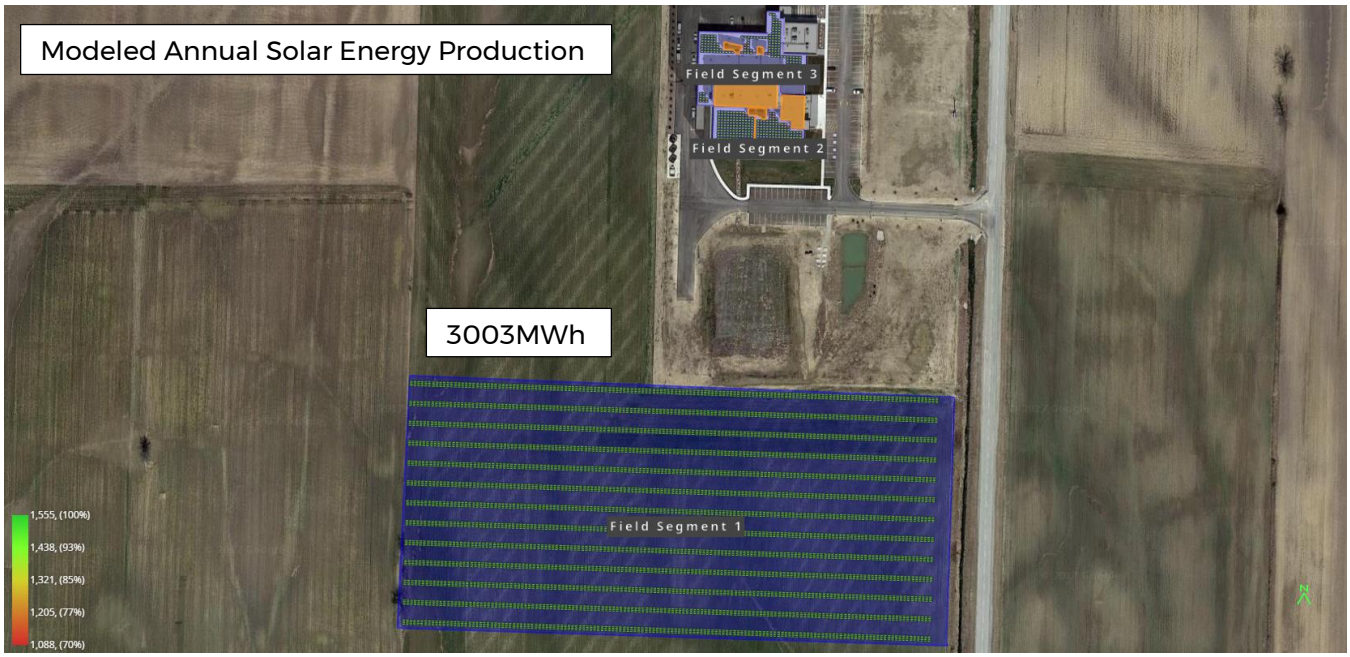
Summary of PV System Costs
- Victoria Park Centre
  - PV on Roof: 962.3 kW @ $2.04/W = $1.96M
  - PV over Parking Lot: 296.9 @ $2.45 = $727,400
- Tecumseh:
  - PV on Roof: 161.6 kW @ $2.04/W = $329,600
  - PV on greenfield (10 acres): 2.74 MW @ $2.01/W = $5.5M

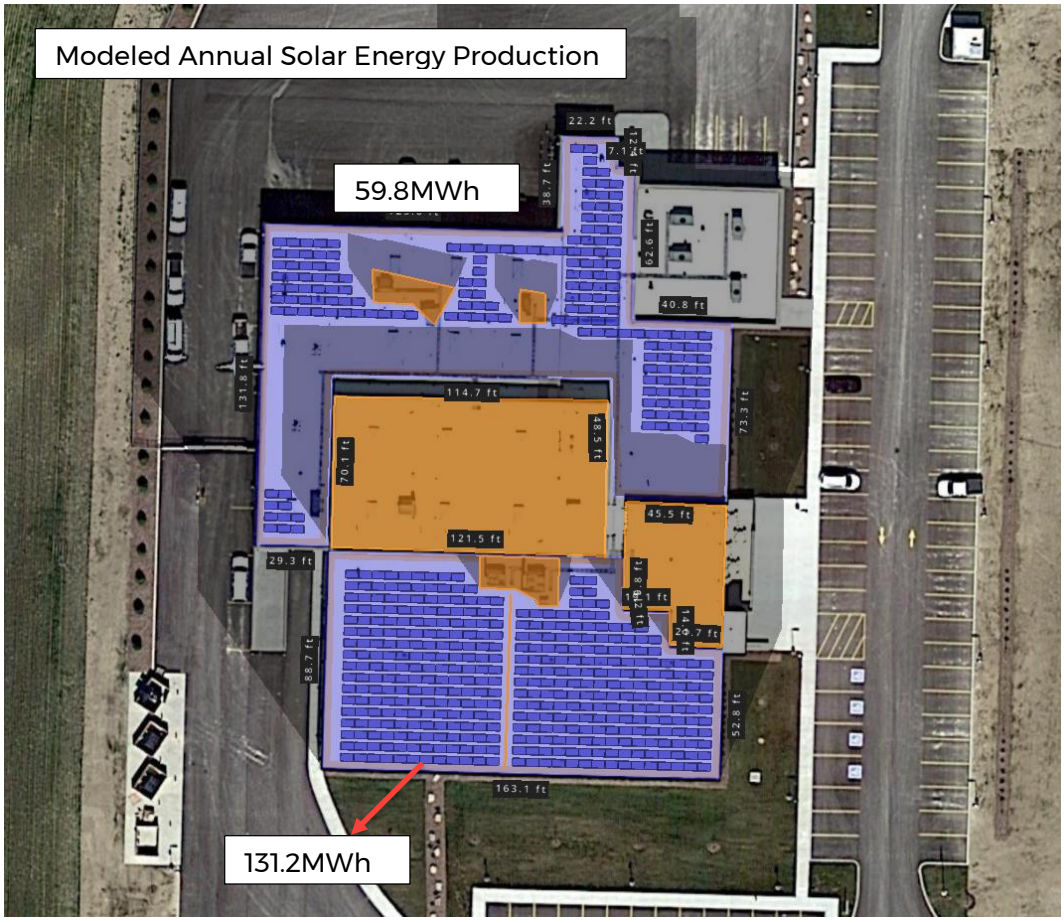
PV Design Images

Victoria Park Centre, Toronto, ON



Enbridge Gas Storage Facility, Mooretown, ON





Appendix H

LIMITATIONS

APPENDIX H: LIMITATIONS

WSP Canada Inc. is the “Consultant” referenced throughout this document.

- The scope of our work and related responsibilities related to our work are defined in our project authorization (“Conditions of Assignment”).
- Any user accepts that decisions made or actions taken based upon interpretation of our work are the responsibility of only the parties directly involved in the decisions or actions.
- No party other than the Client shall rely on the Consultant’s work without the express written consent of the Consultant, and then only to the extent of the specific terms in that consent. Any use which a third party makes of this work, or any reliance on or decisions made based on it, are the responsibility of such third parties. Any third party user of this report specifically denies any right to any claims, whether in contract, tort and/or any other cause of action in law, against the Consultant (including Sub-Consultants, their officers, agents and employees).The work reflects the Consultant’s best judgement in light of the information reviewed by them at the time of preparation. It is not a certification of compliance with past or present regulations. Unless otherwise agreed in writing by the Consultant, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity; it is written to be read in its entirety.
- Only the specific information identified has been reviewed. No physical or destructive testing and no design calculations have been performed unless specifically recorded. Conditions existing but not recorded were not apparent given the level of study undertaken. Only conditions actually seen during examination of representative samples can be said to have been appraised and comments on the balance of the conditions are assumptions based upon extrapolation. Therefore, this work does not eliminate uncertainty regarding the potential for existing or future costs, hazards or losses in connection with a property. We can perform further investigation on items of concern if so required.
- The Consultant is not responsible for, or obligated to identify, mistakes or insufficiencies in the information obtained from the various sources, or to verify the accuracy of the information.
- No statements by the Consultant are given as or shall be interpreted as opinions for legal, environmental or health findings. The Consultant is not investigating or providing advice about pollutants, contaminants or hazardous materials.
- The Client and other users of this report expressly deny any right to any claim against the Consultant, including claims arising from personal injury related to pollutants, contaminants or hazardous materials, including but not limited to asbestos, mould, mildew or other fungus.

STAFF INTERROGATORY #28

INTERROGATORY

Ref: Exhibit B / Tab 2 / Schedule 1 / p. 2
Exhibit C / Tab 5 / Schedule 2 / p. 26, Table 3

Preamble:
In Exhibit C, Tab 5, Schedule 2, Table 3, Enbridge Gas compares the savings potential identified in the OEB MACC study and the savings found in Enbridge Gas' DSM Plan. Enbridge Gas adjusted the savings potentials found in the OEB's conservation potential study[1] (OEB CPS) and the OEB MACC because it claims that they were gross (i.e., did not exclude efficiency upgrades that would occur in the absence of DSM programming).

The OEB CPS indicates it included natural conservation, and notes that it gave special consideration to:

- Naturally-occurring improvements in equipment efficiency
- Expected penetration of more efficient equipment into the building stock
- Known, upcoming changes in building and equipment energy performance codes and standards

Questions:

a) Please review the totals provided in Table 3 to ensure they are accurate.

b) Please explain why the province-wide gross residential and commercial savings in Enbridge Gas' Table 3 (second column) do not match those shown in the OEB MACC report (Table 10 indicates that the 2018-2020 commercial sector abatement potential is 108 million m^3 for the mid-range LTCPF[2]; Table 14 shows that residential sector abatement potential is 144 million m^3 for the mid-range LTCPF).

   If revisions are required, please update all necessary tables.

a) Please explain why Enbridge Gas believes that the opportunity identified in the OEB MACC should be adjusted for free ridership.

b) Please confirm that Enbridge Gas understands that the OEB MACC analysis is based on the data and analysis from the OEB CPS, which indicates that the reference case included natural conservation.

[1] EB-2015-0117
[2] OEB's Long-Term Carbon Price Forecast, EB-2016-0359

Witness: D. Johnson

c) Please explain how the adjustment factors Enbridge Gas used to reduce the OEB MACC potential are reasonable, given that the reference case included natural conservation.

d) Please provide Enbridge Gas' data and analysis used to calculate the annual savings achieved at the end of 2020 from Enbridge Gas' DSM plan for the residential, commercial, and industrial sector, including the annual savings achieved in 2018 and 2019. Please indicate the achievement of their targets (in %) assumed for 2017, 2018, 2019, and 2020 in this calculation.

e) Please explain whether the 2018 annual savings from Enbridge Gas' DSM plan calculated for d) above are consistent with the 2018 DSM volume reductions indicated in Exhibit B.

RESPONSE

a) Enbridge identified an error in the table sums of columns 2 and 3, however this did not impact the totals in columns 5 and 6. The corrected values are included below.

Customer Segment	Province-Wide Gross Savings in MACC Study (Mid-Range LTCPF)	Net Savings	% of Potential in EGD Franchise	Net Potential in EGD Franchise as per MACC	DSM Plan as originally filed in EB-2015-0049
Residential	97,000,000	82,450,000	62%	51,119,000	56,224,675
Commercial	99,000,000	83,160,000	58%	48,232,800	169,335,715
Industrial	96,000,000	48,000,000	44%	21,120,000	
Total	**292,000,000**	**213,610,000**	**-**	**120,471,800**	**225,560,390**

b) The values in the second column of Table 3 are the cost effective portion under the Mid-Range LTCPF Scenario while the values referenced above are the totals not accounting for cost effectiveness. For example in residential, there is 97 million cost effective m3 of a total 144 million m3 (page 41 of MACC final report).

Witness: D. Johnson

a) It is Enbridge's position that the savings from the OEB CPS are gross savings. The methodology applied by ICF Consulting in the OEB CPS is consistent with that used by ICF (formerly Marbek) and Navigant Consulting in the 2008 and 2014 studies respectively. In both studies completed for Enbridge, the results were gross natural gas savings.

> *"*All savings reported in this study are gross, rather than net, meaning that the effect of possible free ridership is not included in the reported savings, per Enbridge's guidance and for consistency with past studies*."*[3]

As a result, a Net to Gross ("NTG") or free ridership and spillover adjustment factor needs to be applied to gross savings estimated in the OEB MACC study to determine potential net savings in an attempt to determine the true cost effectiveness of a particular initiative.

In addition, the CPS did not take into account the Climate Change Action Plan and Federal funding on energy efficiency. The significant amount of funding for energy efficiency programing could result in changing NTG adjustments to the Company's DSM programs.

b) Enbridge understands that the OEB MACC is based on data and analysis from the OEB CPS which only incorporates a baseline efficiency adjustment which accounts for improvements in technology and changes to codes and standards as Board staff have noted. The study did not account for NTG.

c) In response 2a) Enbridge has outlined the rationale for applying a NTG adjustment factor to the gross savings from the OEB CPS and ultimately the MACC study. The specific figures applied are based on NTG ratios included as part of Enbridge's Multi-Year (2015-2020) DSM Plan.[4]

d) Enbridge has provided a spreadsheet with the details of this analysis in response to Board Staff IR #24 a) found at Exhibit I.1.EGDI.STAFF.24. For each year, 100% of the achievement target was used.

e) Please see the company's response to Board Staff IR#14 b) found at Exhibit I.1.EGDI.STAFF.14.

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[3] 2015-04-01, EB-2015-0049, Exhibit C, Tab 1, Schedule 1, Page 12 of 160

[4] Freeridership values applied are 15% for residential, 16% for commercial and 50% for industrial as filed in EB-2014-0354, Exhibit B, Tab 1, Schedule 2, page 9. Commercial freeridership has been determined as a simple average of 12% freeridership in the commercial sector and 20% freeridership in the multi-residential sector.

Witness: D. Johnson

APPrO INTERROGATORY #4

INTERROGATORY

Reference: i) EB-2017-0224 Exhibit C Tab 1 Schedule 1
ii) EB-2017-0224 Exhibit C Tab 1 Schedule 2
iii) EB-2017-0255 Exhibit 3 Tab 4

Preamble: Enbridge Gas Distribution Inc. ("**Enbridge**") is seeking ratepayer funding for a Low Carbon Initiative Fund ("**LCIF**") in the amount of $2 million.

Questions:

a) Has Enbridge sought funding for this LCIF from the Climate Change Action Plan ("**CCAP**")? If not, please explain why.
b) Please confirm that many of the same initiatives being proposed by Enbridge (Table 1 Schedule 2), are also being evaluated by Union Gas Limited ("**Union**") as outlined in reference iii).
c) For projects funded by Enbridge, will Enbridge share the results with Union?
d) In light of the common ownership of Enbridge and Union, and the highly similar nature of the two utility's operations, please explain why a single LCIF with coordinated prioritizing of projects would not be a more efficient method of investigating new technologies.
e) How is Enbridge coordinating its activities with other Canadian and international utilities?
f) Please explain if any of the activities proposed to be funded from the LCIF could be funded from the DSM budget?

RESPONSE

a) Enbridge has had discussions with the Government to fund specific abatement initiatives, however the Company has not had any indication from the government that they are prepared to financially support a natural gas utility led fund.

b) Enbridge and Union have both proposed similar technologies, however they anticipate pursuing separate projects. Where overlap is identified, the utilities intend to continue to collaborate.

Witnesses: D. Johnson
F. Oliver-Glasford
R. Sigurdson

c) Yes, Enbridge anticipates that results will be shared with Union.

d) Please refer to the response to Board Staff Interrogatory #16a, filed at Exhibit I.1.EGDI.STAFF.16.

e) Enbridge actively participates in a number of industry associations, including the Canadian Gas Association, Gas Technology Institute, and The Energy Solutions Centre, amongst others. Enbridge has been actively engaged in discussion with utilities from Québec and California, through conferences, associations, and other channels as applicable. These same associations as well as the consulting firms with which the Company has worked with have provided insights from other jurisdictions.

f) Enbridge's low-carbon strategy includes three pillars: a) energy efficiency, b) low-carbon technology innovation, and c) greening the grid. The LCIF is intended to broadly capture ideas and projects not covered through DSM, including facility-related projects.

Witnesses: D. Johnson
F. Oliver-Glasford
R. Sigurdson

APPrO INTERROGATORY #5

INTERROGATORY

Reference: i) EB-2017-0224 Exhibit C tab 5 Schedule 1
ii) EB-2017-0224 Exhibit D Tab 1 Schedule 1
iii) EB-2017-0255 Exhibit 3 Tab 5

Preamble: Enbridge is seeking approval for two additional FTEs at an annual cost of $350,000. APPrO would like to understand the degree of cooperation between the utilities and if further coordination is possible to reduce the cost burden on customers.

Questions:

a) In light of the common ownership between Enbridge and Union and the application by Enbridge (EB-2017-0306) for approval to amalgamate the two utilities, please outline the current degree of coordination of C&T activities between the two companies.
b) In reference i) Enbridge is seeking approval for 2 additional FTEs. ii) Enbridge outlines that it currently has 8 FTEs engaged in C&T activities and in reference iii) Union indicates that it has 12.5 FTEs engaged in C&T activities for a total of 20.5 FTEs between the two companies. In reference iii), Union has outlined the responsibilities of its FTE roles and there is overlap between the responsibilities of the current roles in Union and the proposed new roles in Enbridge. As an example, one of the responsibilities of the one of the new Enbridge FTEs is:

> *An annual technology scan and related intelligence on new and emerging technologies for achieving GHG reductions;*

Union indicates that the responsibility of its Manager Customer Technology and Innovation is:

> *Assessment of emerging technologies and innovations for the natural gas end-user in the residential, commercial, and industrial markets that reduce GHG emissions.*

The responsibilities of these two roles seem to be very similar if not identical. Please explain why greater coordination with Union is not possible in order to reduce or eliminate the need for these additional FTEs?

Witness: F. Oliver-Glasford

c) In the event that the Board approves the amalgamation of the two utilities as requested, please describe the organizational structure that would prevail as it relates to cap and trade responsibilities, when this would occur, as well as any limitations in managing this responsibility from a single department.

RESPONSE

Please refer to Board Staff Interrogatory #16 filed at Exhibit I.1.EGDI.STAFF.16.

Witness: F. Oliver-Glasford

APPrO INTERROGATORY #6

INTERROGATORY

Reference: i) EB-2017-0224 Exhibit C Tab 5:

Preamble: Enbridge is investigating the potential to use surplus electricity to produce hydrogen for storage and subsequent injection into its natural gas system. APPrO would like to understand the implications of injecting hydrogen into the natural gas system.

Questions:

a) Please describe the status of this potential project.
b) Union Gas is also investigating this opportunity. Please describe if Enbridge is pursuing this independently or in cooperation with Union. Please explain.
c) Please indicate if Enbridge has developed a maximum hydrogen content for its natural gas supply. If so, please specify the maximum percentage.
d) Please indicate if Enbridge has had consultations with large volume customers, including gas-fired generators, on the potential changes to the composition of the natural gas stream and the potential implications to their combustion equipment.
e) Hydrogen has been known to migrate through steel and impact the integrity of steel pipelines. Has, or will Enbridge investigate the risks of injecting hydrogen into pipelines to ensure that there are no unintended consequences from this initiative prior to the implementation of this initiative? If a study has been undertaken, please provide a copy of the study.

RESPONSE

a) Enbridge is in the process of commissioning a utility scale Power to Gas plant to produce and store hydrogen. The Company is at the preliminary stages of its research, planning, investigating and analyzation of the injection phase of the project.

b) Enbridge is pursuing this project independently, but will share any results of this with Union where appropriate.

c) The Company has not yet determined a maximum hydrogen content for its natural gas supply.

Witnesses: S. McGill
D. Teichroeb

d) The project is not at the stage to engage in consultations with specific user groups; however this has been identified as an important part of the process described in response (a)

e) The investigation into the potential perceived risks associated with injecting hydrogen into Enbridge's distribution system to ensure that there are no unintended consequences is a key component of the planned investigation as stated in response (a). Maintaining the safety and integrity of the distribution system is paramount. Studies will be undertaken in this regard, but they are at a very early stage.

Witnesses: S. McGill
D. Teichroeb

APPrO INTERROGATORY #7

INTERROGATORY

Reference: i) EB-2017-0224 Exhibit C Tab 5:
ii) EB-2017-0255 Exhibit 3 Tab 5

Preamble: Enbridge and Union each are proposing to use significant consulting resources to augment their internal expertise. In light of the common ownership of the two companies and the formal merger application that is underway, APPrO would like to understand if there are synergies in the consulting budgets between the two companies that could reduce the burden on ratepayers.

Questions:

a) In reference i) Enbridge notes that it has a $400,000 consulting budget for "support and Market Intelligence". Similarly, Union has $670,000 for a variety of work. Table 3 in reference i) outlines the specific consulting work that is proposed by Enbridge and there appears to be a high degree of correlation with the consulting work proposed by Union in Table 2, reference ii). Please indicate why this consulting work between Enbridge and Union cannot be coordinated to reduce the ratepayer burden?

RESPONSE

a) Please refer to response to Board Staff Interrogatory #16 filed at Exhibit I.1.EGDI.STAFF.16.

Witnesses: A. Langstaff
F. Oliver-Glasford

BOMA INTERROGATORY #4

INTERROGATORY

Reference: EB-2017-0224, Exhibit B Tab 2, Schedule I, Page 4 of 8 Plus Appendix A

> *"The total customer-related obligation was determined by using the 2018 volumetric natural gas forecast for all customers, adjusted for gas-fired generation, Demand Side Management ("DSM'), incremental customer- related abatement, mandatory and voluntary participants, as well as volumes derived from biomass, or consumed outside of Ontario."*

For each year of the forecast, please indicate which forecast of DSM is used. Is the data for 2016 and 2017 based on evaluated results?

RESPONSE

The 2018 DSM forecast is based on the 2015-2020 Plan decision including adjustments for the target adjustment mechanism, and included in a partially effective basis. The evidence filed at Exhibit B, Tab 2, Schedule 1 and referenced above, is only in relation to 2018 forecasts. There are no published 2016 or 2017 evaluated results at this time.

Witness: D. Johnson

BOMA INTERROGATORY #5

INTERROGATORY

Reference: EB-2017-0224, Exhibit A Tab 1, Schedule 2, Page 2 of 4

When does Enbridge Gas Distribution expect to issue a multi-year plan? What will be the decision criteria for issuing a multi-year plan?

RESPONSE

Section 5.1 the Board's Framework[1] provides the following options:

> To provide the Utilities with the opportunity to gain experience with Cap and Trade, the OEB will accept plans of the following duration for the first compliance period (2017-2020):
>
> - One annual Compliance Plan for 2017 followed by a three-year plan for the remainder of the first compliance period (2018-2020); or
> - Annual Compliance Plans for each of the first two years (2017 and 2018), followed by a two-year plan for the remainder of the first compliance period (2018-2020).

As discussed in Exhibit B, Tab 1, Schedule 1, the Company felt it was most reasonable to file a one year plan for 2018. As required by the Framework, Enbridge currently anticipates filing a two-year plan for 2019 to 2020 as per the Board's timeline on August 1, 2018.

[1] Report of the Board – Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities (EB-2016-0363), pg. 16

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

BOMA INTERROGATORY #6

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab 1, Schedule 1, Page 1 of 1 S

> *"As can be seen in this 2018 Compliance Plan, Enbridge has applied the learnings from one year of experience under Cap and Trade..."*

Please list the learnings from one year of experience under Cap and Trade.

RESPONSE

Please refer to the response to SEC Interrogatory #14, filed at Exhibit I.1.EGDI.SEC.14.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

BOMA INTERROGATORY #7

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab 4, Schedule 1, Appendix A, Page 8 of 11

> *"The initiative report consists of the total amount of GHG reductions, avoidance or removals achieved for the reporting period expressed in tonnes of CO2e, calculations related to GHG sources, sinks and reservoirs, a description of the leakage assessed, and any violations of legal requirements that may have an impact on the amount of GHG reductions, avoidance and removals achieved during the reporting period. The initiative report must be verified by an accredited verification body. The accredited body will visit the project site once for each initiative report."*

What organizations are considered accredited verification bodies? Does this mean that there is no follow-up to determine if reductions are sustained?

RESPONSE

A list of accredited verification bodies can be found on the following websites:

1. Standards Council of Canada ("SCC") - http://www.scc.ca/en/accreditation/greenhouse-gas

2. American National Standards Institute ("ANSI") - https://www.ansi.org/Accreditation/environmental/greenhouse-gas-validation-verification/Default

Verification is required for each annual activity report. The regulatory requirements for verification may be found in the Ontario Offset Credits regulation. Please refer to O. Reg. 539/17.

Witnesses: A. Langstaff
J. Murphy

BOMA INTERROGATORY #8

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab 4, Schedule 1, Appendix A, Page 10 of 11

> *"All of these protocols are being developed via a 'top-down' process, i.e. the Ontario and Quebec governments have chosen which protocols are being developed. There is no formal procedure for 'bottom-up' protocol developments, however, it may be possible to request certain protocols for other project types, to then be developed 'top down', or possibly also to submit protocols that would then have to be approved."*

Fundamentally, this top down process appears to be an emissions intensity protocol. It appears diametrically opposite to the current bottom up approach used in the evaluation of DSM results. Has Enbridge considered how DSM evaluation might be revised to be made more consistent with emission reductions, e.g., through energy intensity measurement?

RESPONSE

For clarity, the referenced section of Exhibit C, Tab 4, Schedule 1, Appendix A is discussing the process by which the Ontario government is developing offset protocols. The reference to "top-down process" means that the government has developed a list of protocols and these are the ones being developed. At this point in time the Offset Regulation does not include any mechanism for interested parties to develop and propose new offset protocols, which has been referred to as a "bottom-up" process. The offset protocols that are being developed are based on absolute reductions, removals or avoidances, not based on changes to emission intensity.

With regards to DSM evaluation, please refer to BOMA Interrogatory #13, filed at Exhibit I.1.EGDI.BOMA.13.

Witnesses: D. Johnson
J. Murphy
F. Oliver-Glasford

BOMA INTERROGATORY #9

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab S, Schedule 2, Page 12 of 29

> "With respect to the advancement of 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 the injection and transportation of this gas to market. To that end, Enbridge is proposing the "RNG Enabling Program"."

Wouldn't it make more sense to start the enabling program prior to the procurement of RNG?

RESPONSE

Although a formal RNG funding agreement between Enbridge and the Province is not yet in place, the Company understands that the province will require the contemplated RNG RFP process to be completed before the end of the second quarter of 2018. Enbridge is proceeding in a manner to meet the Province's required timelines.

The Company's EB-2017-0319 application requesting OEB approval of its Renewable Natural Gas ("RNG") Enabling and Geothermal Energy proposals was submitted to the OEB on January 17, 2018. The Company has yet to receive a Procedural Order in this matter but expects that the case will proceed in the ordinary course such that the Board will render a decision with respect to each of the proposals later this year.

RNG Enabling Program activities conducted prior to the Board issuing its EB-2017-0319 Decision will be limited to technical evaluations and cost estimates for Enbridge services required in conjunction with RNG production facilities. The Company expects that with approval of the RNG Enabling Program before the end of 2018, it will be possible to have required facilities contracted and placed into service to meet the dates by which RNG producers would be ready to supply.

Witnesses: A. Chagani
S. McGill

BOMA INTERROGATORY #10

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab 5, Schedule 2, Page 25 of 29

> *"An analysis of the MACC study results as compared to the Company's DSM plans shown in Table 3 below indicates that Enbridge's current DSM Plan delivers results for ratepayers that are well in excess of what the MACC study would otherwise indicate is cost-effective under a Mid-Range LTCPF scenario. At present, Enbridge does not have sufficient insight into the underlying analysis of the MACC study to fully understand what is driving the clear differences between the MACC study results, the Conservation Potential Study results and the Utilities' DSM Plans. At a minimum this analysis serves as a reminder that in designing and deploying DSM to date, Enbridge has been aggressive in its pursuit to reduce volumes and emissions through the most cost-effective opportunities available."*

Given that allowable DSM is economic from a total resource cost perspective and from the participating customer cost perspective; shouldn't the MACC and an increase in the funding for existing DSM programs and initiatives reflect the negative cost of the programs and initiatives when compared to other initiatives on the MACC? Has Enbridge considered using a baseline year, say 2016 and treat any additional DSM savings as incremental? Wouldn't this be consistent with the use of baselines with respect to emission reductions?

RESPONSE

Please see the company's response to GEC Interrogatory #24 filed at Exhibit I.1.EGDI.GEC.24.

The fact that the MACC produces an average instead of an incremental value is an issue that Enbridge identified during the development of the MACC.

Witness: D. Johnson

BOMA INTERROGATORY #11

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab S, Schedule 2, Page 26 of 29

> *"In the Framework, the Board also acknowledges that offering customer abatement programs "creates the potential for significant overlap between existing DSM programs and future Compliance Plans… [However, the Board] is confident that any potential overlap can be appropriately addressed through the robust Evaluation, Measurement & Verification ("EM&V") process of the DSM Framework." Enbridge shares the Board's concern regarding the potential for overlap between existing DSM and additional energy efficiency programs under the banner of Cap and Trade Compliance Plans[9] and believes that managing any overlap via the EM&V process will be overly complex and difficult. Enbridge notes that because the Company's Cap and Trade obligation is specific to emissions associated with natural gas volumes, practically speaking the "targeted programs" referenced in the Cap and Trade Framework would take the same approach as existing DSM programs. Whether titled "DSM" or "abatement", the activities in question would use a combination of consumer education, technical expertise, and financial incentives to help customers reduce their natural gas consumption."*

Is Enbridge aware of how the Board views the current EM&V process could distinguish between DSM programs and Abatement Programs? If so please describe.

RESPONSE

Enbridge is not currently aware of the Board's views beyond the concern that they have raised about potential overlap.

Witness: D. Johnson

BOMA INTERROGATORY #12

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab 5, Schedule 2, Page 27 of 29

> *"As indicated in the Company's DSM Mid-Term submission (EB-2017-0127/0128), the Company believes the Board has an opportunity to ensure that the existing DSM Framework does all that it can to support a level of abatement activity that produces the best value for ratepayers. Enbridge believes that in light of the new policy environment, certain features of the DSM Framework should be enhanced to ensure that DSM activity is maximized to meet the needs of ratepayers moving forward."*

Beyond the elements identified on Page 8, please identify any other ways in which the DSM Framework should be enhanced to ensure that DSM activity is maximized to meet the needs of ratepayers moving forward. Could one of those enhancements be to exempt any companies that are Large Final Emitters and focus on the rest with the appropriate reduction to what is referred to above as the 2016 Baseline? Could programs that target public sector buildings be based on the publicly available data resulting from O. Reg. 397/11? Could building related program metrics be revised to reflect the degree to which DSM programs reduce the energy intensity per square foot?

RESPONSE

As noted in the above quotation, Enbridge believes that these topics and questions are relevant to the DSM Mid-term review (EB-2017-0128) where the Company has filed evidence on the following dates: September 1st, 2017, October 2nd, 2017 and January 15th, 2018. Enbridge does not believe that these questions are appropriate within this proceeding.

Witness: D. Johnson

BOMA INTERROGATORY #13

INTERROGATORY

Reference: EB-2017-0224, Exhibit C Tab S, Schedule 2, Page 27 of 29

> *"Enbridge shares the Board's concern regarding the potential for overlap between existing DSM and additional energy efficiency programs under the banner of Cap and Trade Compliance Plans and believes that managing any overlap via the EM&V process will be overly complex and difficult. Enbridge notes that because the Company's Cap and Trade obligation is specific to emissions associated with natural gas volumes, practically speaking the "targeted programs" referenced in the Cap and Trade Framework would take the same approach as existing DSM programs. Whether titled "DSM" or "abatement", the activities in question would use a combination of consumer education, technical expertise, and financial incentives to help customers reduce their natural gas consumption."*

Why does Enbridge believe managing any overlap via the EM&V process will be overly complex and difficult? Given that emission reduction targets are fundamentally reductions in the emissions' intensity and as noted earlier, top down, could not the DSM evaluation framework be simplified and made more transparent by adapting it to the tracking of emission reductions.

RESPONSE

For the reference above, Enbridge was raising the concern about introducing separate energy efficiency programs under the banner of Cap and Trade that do not have clarity around treatment in respect of DSM. This would be exacerbated if new programs under Cap and Trade were measured and reported using different methodologies. A change to the DSM measurement and evaluation process would require approval from the Board, likely within the context of the DSM framework, which is outside the scope of this proceeding. Please see OSEA Interrogatory #11 filed at Exhibit I.1.EGDI.OSEA.11 and Board Staff Interrogatory #24 b), filed at Exhibit I.1.EGDI.STAFF.24.

Witnesses: D. Johnson
F. Oliver-Glasford

CCC INTERROGATORY #14

INTERROGATORY

Re: Ex. B/T2/S1/p. 3

Please describe EGD's involvement with the Green Investment Fund. How much money is EGD receiving and over what time period? How did EGD determine the 2018 volume reductions associated with the program?

RESPONSE

On November 26, 2015, the Government of Ontario announced a commitment to establish a Green Investment Fund (GIF) that will be targeted at reducing greenhouse gas emissions while strengthening the economy.

On February 4, 2016, the Government of Ontario announced a total of $100M GIF allocation, in partnership with Enbridge and Union Gas, to help approximately 37,000 homeowners conduct audits to identify energy-saving opportunities and then complete retrofits. The dollars from the GIF are allocated to Enbridge to deliver a program similar to its existing Home Energy Conservation (HEC) program called the "Whole Home Retrofit" (WHR) program to 20,000 program participants over a three year period, from 2016 to 2019. The GIF will provide $58 million in funding to Enbridge for the WHR program over the term of the agreement.

Enbridge calculates the volume reductions for the GIF/HEC program using the same adjustments associated with the DSM/HEC savings for consistency in forecasting, which equal 691 m^3 per participant. The Company multiplies the volume per participant by the forecasted participants for 2018 and applies the partially effective methodology as used for LRAM forecasting.

Witness: J. Tideman

CCC INTERROGATORY #15

INTERROGATORY

Re: Ex. C/T1/S1/p. 2

Please explain how the 2018 Compliance Plan will differ from the 2017 plan, given Union Gas Limited and Gazifiere are “related”. Please describe the process that Union Gas Limited and EGD undertook in terms of coordinating the development of their 2018 Cap and Trade Compliance Plans. What process will EGD and Union undertake to develop their 2019 plans?

RESPONSE

In 2018, Enbridge, Union Gas and Gazifère are “related persons” as per the Cap and Trade Regulation and must allocate purchasing and holding limits amongst themselves. Aside from this regulatory requirement, Enbridge did not coordinate the development of the Company’s 2018 Cap and Trade Compliance Plan with Union Gas or Gazifère beyond the development of the Abatement Construct and associated Initiative Funnel as well as RNG procurement approach with Union Gas. Further collaboration was not possible given the prohibition in place during 2017 around sharing of information between Enbridge and Union Gas. For further discussion on this matter, please refer to Board Staff Interrogatory #16a filed at Exhibit I.1.EGDI.STAFF.16.

Witness: F. Oliver-Glasford

CCC INTERROGATORY #16

INTERROGATORY

Re: Ex. C/T1/S1/p. 3

The evidence states that many details on the abatement initiatives being supported by the Climate Change Action Plan and the GreenON Fund remain outstanding and that these may impact the Board's Marginal Abatement Cost Curve and marketplace choices. Please explain how the cost curve may be impacted. Will this occur in 2018? If so, what are the potential implications for EGD's proposed plan?

RESPONSE

The key variable in reconciling the Board's Marginal Abatement Cost Curve with Enbridge's market place choices is the injection of funding into the market. For example, should there be GreenON funding of an abatement option through a non-utility channel, then duplicating that program or incrementally increasing that same program would be at a marginal cost of abatement higher for ratepayers relative to what is shown in the MACC absent of funding considerations. Similarly, if an abatement initiative was to be directly funded via the utility, then the cost to deliver that initiative would decrease for ratepayers relative to the cost of that same abatement initiative as shown in the MACC absent funding considerations. This is directly relevant to the decisions Enbridge would take with respect to abatement opportunities planned and their costs to ratepayers relative to procurement of allowances. Please see Board Staff Interrogatory 24 filed at Exhibit I.1.EGDI.STAFF 24 for more discussion related to this topic.

Witnesses: S. McGill
F.Oliver-Glasford

CCC INTERROGATORY #17

INTERROGATORY

Re: Ex. C/T5/S1/p. 3

Please explain what relief EGD is seeking in this application with respect to the "Abatement Construct".

RESPONSE

Enbridge is not seeking any specific relief around the Abatement Construct. It is simply a context upon which the Company is formalizing its approach and thinking to abatement initiatives.

Witness: F. Oliver-Glasford

CCC INTERROGATORY #18

INTERROGATORY

Re: Ex. C/T5/S1/pp. 4-5

The evidence states that abatement programs should be able to draw on a variety of funding sources, including Climate Change Action Plan funding, incremental amounts tracked through the Greenhouse Gas Emissions Impact Deferral Account (GGEIDA) and other Government funding (provincial or federal). Please explain how EGD will decide how programs are to be funded, and the amount of funding for each project.

RESPONSE

It will be up to the government to determine which and how abatement programs will to be funded. Enbridge's role in this respect is to advocate for and leverage funding for the benefit of its ratepayers. Please see response to Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24.

In relation to the use of program funding within the LCIF (which will be recovered through the GGEIDA), please see the response to Board Staff Interrogatory #23 a and b, filed at Exhibit I.1.EGDI.STAFF.23.

Witnesses: S. McGill
F. Oliver-Glasford

CCC INTERROGATORY #19

INTERROGATORY

Re: Ex. C/T5/S1/p. 5

The evidence states that, “There must be recognition of the role natural gas utilities play in advancing the adoption of new technology over extended periods of time.” Please explain what is meant by this statement, and how this will be used in screening abatement programs? What does EGD view as the role of the Ontario natural gas utilities in advancing the adoption of new technologies?

RESPONSE

Please see the response to Board Staff Interrogatory #21 parts b, c and d, filed at Exhibit I.1.EGDI.STAFF.21.

Witnesses: S. McGill
F. Oliver-Glasford

CCC INTERROGATORY #20

INTERROGATORY

Re: Ex. C/T5/S1/p. 5

The evidence states that abatement programs should balance customer cost impacts by leveraging existing infrastructures (particularly utility infrastructure, including physical, brand, billing, program delivery) where appropriate and not by duplicating existing frameworks. Please explain how this principle will be used in screening abatement programs. In addition, please explain how EGD will ensure that abatement programs manage customer cost impacts. How will customer cost impacts be assessed?

RESPONSE

Please refer to the responses to Board Staff Interrogatories #21a and #23a, filed at Exhibit I.1.EGDI.STAFF.21 and Exhibit I.1EGDI.STAFF.23. Also in terms of customer cost effectiveness assessment, the discussion in Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24 may be helpful.

Witnesses: D. Johnson
S. McGill
F. Oliver-Glasford

CCC INTERROGATORY #21

INTERROGATORY

Re: Ex. C/T5/S1/p. 6

EGD has stated that when considering which initiatives to pursue it will consider cost-effectiveness. In assessing an abatement program please explain how EGD will determine cost-effectiveness.

RESPONSE

Please refer to the responses to Board Staff Interrogatories #21a and #23a, filed at Exhibit I.1.EGDI.STAFF.21 and Exhibit I.1.EGDI.STAFF.23. Also in terms of customer cost effectiveness assessment, the discussion in response to Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24 may be helpful.

Witness: F. Oliver-Glasford

CCC INTERROGATORY #22

INTERROGATORY

Re: Ex. C/T5/S1/p. 10

Please explain how EGD arrived at an amount of $2 million per year for the Low Carbon Initiative Fund (LCIF). How will access to funding from additional sources affect the amount EGD intends to spend each year through this fund? Does EGD intend to spend this amount each year even if EGD has access to additional funds?

RESPONSE

Enbridge's determination of a $2 million amount for the LCIF was based on a review of costs associated with investigating and advancing a variety of low-carbon initiatives. Please see the response to Board Staff Interrogatory #23b, filed at Exhibit I.1.EGDI.STAFF.23 for a breakdown of the 2018 LCIF budget. Enbridge also considered what might be a reasonable amount given the size of its overall compliance obligation.

Enbridge will continue to monitor and assess other potential funding sources in an effort to optimize the LCIF. However, LCIF funding is very important as a baseline available amount. As stated in Exhibit C, Tab 5, Schedule 1, page 10, paragraph 24 "The Company believes it must be able to anticipate a steady flow of funding in order to pursue innovative carbon abatement opportunities as well as to ensure the continued flow of ideas through the Initiative Funnel…". Funding from additional sources will be considered on a case by case basis and may result in re-allocation of budget dollars and/or an expanded scope of work to further accelerate an initiative.

Enbridge will manage the LCIF responsibly and will only spend up to $2 million each year if appropriate. For clarity, as discussed in response to CCC Interrogatory #25, filed at Exhibit I.1.EGDI.CCC.25, Enbridge anticipates that the LCIF will continue and be available in future years. The Company will seek any necessary approvals in respect of future years in future Compliance Plan filings. Further, as discussed in response to CCC Interrogatory #23, filed at Exhibit I.1.EGDI.CCC.23, reporting of the Company's activities and progress and future plans for initiatives will be included within annual activity reports and in its Compliance Plan submission to the Ontario Energy Board.

Witnesses: F. Oliver-Glasford
R. Sigurdson

CCC INTERROGATORY #23

INTERROGATORY

Ex. C/T5/S1/p. 10

How will EGD determine what pilots, demos or research to pursue through the LCIF? How will EGD demonstrate the value of these activities to its customers?

RESPONSE

Please refer to the response to Board Staff Interrogatory #23, filed at Exhibit I.1.EGDI.STAFF.23.

Enbridge will report on activities funded through the LCIF, and benefits obtained, as part of future annual report filings. Additionally, Enbridge may demonstrate the value of these activities via communication of additional abatement opportunities available to customers, where applicable.

Witness: R. Sigurdson

CCC INTERROGATORY #24

INTERROGATORY

Re: Ex. C/T5/S1/p. 11

The evidence states that the LCIF will provide the means to accelerate innovative technologies necessary for the Province to meet its renewable energy and emissions reduction targets. If that this the case, why should this fund be financed by natural gas ratepayers and not through provincial funding?

RESPONSE

Please see the Company's response to Board Staff Interrogatory #23e, filed at Exhibit I.1.EGDI.STAFF.23.

Witnesses: F. Oliver-Glasford
R. Sigurdson

CCC INTERROGATORY #25

INTERROGATORY

Re: Ex. C/T5/S1/p. 12

EGD is seeking approval of additional funding of $2.35 million in 2018 related to the LCIF and new FTEs. Is EGD only seeking a one-year approval? What happens to this fund in 2019 assuming the merger between Union Gas Limited and EGD is approved? What happens to the FTEs beyond 2018?

RESPONSE

Enbridge has filed a one year Compliance Plan in this proceeding, in which it has requested the establishment of the LCIF and the addition of two FTEs commencing in 2018. As discussed in Exhibit C, Tab 5, Schedule 1, page 12, paragraph 29 "The Company anticipates that the LCIF amount would be funded annually, requested for future years through Compliance Plan submissions". If approved, the Company anticipates that the new FTEs will continue and be available in future years and the Company will seek any necessary approvals in respect of future years in future Compliance Plan filings.

Enbridge anticipates that the LCIF will be $4 million in 2019 between the two entities even if they merge. However, Enbridge and Union will discuss coordination around compliance planning after the decision on the amalgamation between the organizations. Please refer to the response to Board Staff Interrogatory #16a filed at Exhibit I.1.EGDI.STAFF.16.

Witnesses: F. Oliver-Glasford
R. Sigurdson

CCC INTERROGATORY #26

INTERROGATORY

Re: Ex. C/T5/S2/p. 3

What relief is EGD seeking from the OEB with respect to the Stage 2 abatement initiatives in this proceeding?

RESPONSE

As per Exhibit C, Tab 5, Schedule 2, page 3, Table 1, "Enbridge is seeking OEB approval of funding of up to $2M starting in 2018 in the Low Carbon Innovation Fund ("LCIF") to advance pilot projects and research through stages one to three of the Initiative Funnel that would enable a more complete assessment of promising technologies and opportunities for eventual implementation." In addition, the two incremental FTEs requested will support abatement initiatives.

Witnesses: F. Oliver-Glasford
R. Sigurdson

CME INTERROGATORY #4

INTERROGATORY

Ref: Exhibit C, Tab 5, Schedule 1, page 5 of 15

At Exhibit C, Tab 5, Schedule 1, page 5, EGD states that "Where appropriate, an abatement program proposal will be supported by an assessment which may use a range of funding models and appropriate valuations and assumptions. The assessment would use the best available information at the time but it is important that such information would not be reconsidered on a retrospective basis at the time cost recovery is determined."

(a) Please illustrate what EGD means by "information would not be reconsidered on a retrospective basis". Please use an example.

RESPONSE

a) Given that the compliance obligation is determined by the GHG regulations and related reporting, and not unlike other factors which impact the companies' demand forecast, it is difficult if not impossible to isolate and ascertain how much was achieved by a given abatement initiative beyond using original engineering estimates as is generally accepted in energy efficiency savings determination best practice. In some instances, in the current DSM framework, savings may be adjusted retroactively for the purposes of calculating, for example, the LRAM to consider new information or updated assumptions which may include free ridership adjustments. Undertaking similar adjustments retroactively in respect of, for example, the shareholder incentive however is problematic and introduces a disincentive to the Company. If a form of retroactive re-evalution were undertaken in respect of programs whose object is to reduce GHG's by energy efficiency for the purposes of Cap and Trade, the Company believes that the assumptions relied upon to forecast such savings, cannot be retroactively reviewed and draw into question the ability of the Company to recover the costs incurred in respect of such initiatives.

Witnesses: D. Johnson
F. Oliver-Glasford

CME INTERROGATORY #5

INTERROGATORY

Ref: Exhibit D, Tab 1, Schedule 1, Page 9 of 10

At Exhibit D, Tab 1, Schedule 1, page 9, EGD states "Taking the foregoing into account, Cap and Trade represents approximately 12.8% of the Company's allowed revenue requirement; therefore, assuming the Company's 2018 bad debt forecast, the bad debt attributed directly to the introduction of Cap and Trade is estimated at $960,000."

(a) Why has EGD changed the way it estimates cap and trade related bad debt since EB-2016-0300?

(b) Please comment on the differences, if any, between EGD and Union's method of calculating bad debt.

RESPONSE

(a) Enbridge has not changed its methodology for forecasting Cap and Trade related bad debt. Please refer to Board Staff Interrogatory #12d, filed at Exhibit I.1.EGDI.STAFF.12.

(b) Please refer to Board Staff Interrogatory #12c, filed at Exhibit I.1.EGDI.STAFF.12.

Witnesses: A. Langstaff
D. McIlwraith
F. Oliver-Glasford

CME INTERROGATORY #6

INTERROGATORY

Ref: Exhibit D, Tab 1, Schedule 1, page 6 of 10

At Exhibit D, Tab 1, Schedule 1, page 6, EGD states that "the Company is requesting approval for (or endorsement of) a "Low Carbon Initiative Fund" ("LCIF") of up to $2 million accessible each year starting in 2018 in order to provide funding for carbon abatement activities."

(a) What threshold(s) will a project have to meet before being eligible for Low Carbon Initiative Fund funding?

(b) Is the $2 million funding limit a hard limit? In other words, if the amount of eligible projects was larger than $2 million, would some projects be deferred? If so, on what basis would Union decide which projects to defer?

RESPONSE

a) Enbridge has not identified a “threshold” for eligibility of LCIF funding, however, the Company has identified an approach to screening that is discussed in Board Staff Interrogatory #23 filed at Exhibit I.1.EGDI.STAFF.23.

b) The $2 million funding limit is a targeted limit for LCIF spending. The Company would attempt to avoid going over this amount in any given year.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

ENVIRONMENTAL DEFENCE INTERROGATORY #20

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please provide a copy of the report prepared by ICF entitled “Impacts of Ontario’s Proposed Climate Policy” and dated July 7, 2015.

RESPONSE

Enbridge has checked the reference above and cannot find any reference or mention to the above named report in the Compliance Plan. The above report does not form part of Enbridge’s 2018 Compliance Plan filing, however the Company notes that this report was filed in EB-2016-0300, Exhibit I.1.EGDI.SEC.4, Attachment 1.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

ENVIRONMENTAL DEFENCE INTERROGATORY #21

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please provide a copy of any reports or presentations related to the same topics discussed in ICF, Impacts of Ontario's Proposed Climate Policy, dated July 7, 2015. Please include any reports or presentations by ICF providing updated or revised information following its July 7, 2015 report

RESPONSE

Enbridge has previously filed a related report in EB-2016-0300, Exhibit I.1.EGDI.SEC.4 Attachment 2. The final report was filed in EB-2016-0004, Exhibit S3.EGDI.OGA.3.

Witnesses: A. Langstaff
S. McGill
J. Murphy
F. Oliver-Glasford
D. Teichroeb

ENVIRONMENTAL DEFENCE INTERROGATORY #22

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please provide Enbridge's cumulative TRC net benefits to date from all of its programs since the inception of its DSM program.

RESPONSE

Please see the table below for the TRC net benefits to date.

Year	Net TRC Benefits
2015	$116,328,683
2014	$89,622,342
2013	$79,366,462
2012	$167,684,328
2011	$173,183,348
2010	$184,593,043
2009	$215,833,455
2008	$182,706,679
2007	$199,798,420
2006	$180,667,779
2005	$27,611,534
2005	$168,061,203
2004	$135,958,467
2003	$125,933,313
2002	$147,498,185
2001	$166,324,425
2000	$74,621,798
1999	$63,289,025

Notes:
2016 values have not been included as the audit has not been finalized
2015 values have not yet been approved by the board

Witness: D. Johnson

ENVIRONMENTAL DEFENCE INTERROGATORY #23

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

(a) Please provide a forecast of the natural gas savings (cubic metres) and GHG emission reductions (tonnes) in 2018 for Enbridge's 2018 DSM programs.

(b) Please provide a forecast of the lifetime natural gas savings (cubic metres) and GHG emission reductions (tonnes) for Enbridge's 2018 DSM programs. Please use the methodology used to calculate the gas and emissions reductions for the 2017 programs in EB-2016-0300, Exhibit I.5.EGDI.ED.1 (updated April 5, 2017), or explain why a different methodology would be appropriate.

RESPONSE

a) See Exhibit B, Tab 2, Schedule 1, Table 3. This corresponds to a reduction of 58,386 tonnes CO_2e.

b) The forecast lifetime natural gas savings is 1,315,490,694 lifetime m^3. This corresponds to GHG reduction of 2,466,545 lifetime tonnes.

The methodology is slightly different than EB-2016-0300, Exhibit I.5.EGDI.ED.1 as that calculation utilized the as filed numbers, while this one uses the 2018 forecast that aligns with part a) above. Please note that answer a) above is a partially effective volume measurement for 2018 while answer b) utilizes the fully effective volume. Please see the response to Board Staff Interrogatory #14, filed at Exhibit I.1.EGDI.STAFF.14 for additional information.

Witness: D. Johnson

ENVIRONMENTAL DEFENCE INTERROGATORY #24

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please provide an estimate of the value of the lifetime GHG emissions reductions from Enbridge's 2018 DSM programs using forecast annual GHG reductions and the Board's Long-Term Carbon Price Forecast Report. The table below is an illustration of the required analysis. Please complete that table for the 2018 DSM program as a whole and for the 2018 DSM program each sector (residential, commercial, etc.). Please make, state, and discuss any assumptions as necessary, including any assumptions used to allocate the lifetime savings to each year. Please make best efforts to provide a response and include any caveats if necessary.

Value of Lifetime GHG Emissions Reductions from 2018 DSM Program					
	2018	2019	…	Last year of lifetime savings	Total for all years
Forecast annual gas savings (m^3)					
Forecast annual GHG reduction (t co2e)					
Forecast carbon price					
Value of GHG reduction					

RESPONSE

Please see Attachment.

Witness: D. Johnson

Value of Lifetime[1] GHG Emissions Reductions from 2018 DSM Residential Program																	
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Forecast Annual Gas Savings m3[2]	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	16,756,884	268,110,144
Forecast Annual GHG Reductions (t C02e)[3]	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	31,419	502,707
Forecast Carbon Price ($/t C02e)[4,5]	$17.00	$18.00	$18.00	$19.00	$20.00	$21.00	$31.00	$36.00	$43.00	$50.00	$57.00	$60.88	$65.02	$69.44	$74.16	$79.20	n/a
Value of GHG Reduction	$534,126	$565,545	$565,545	$596,964	$628,383	$659,802	$973,994	$1,131,090	$1,351,024	$1,570,958	$1,790,892	$1,912,673	$2,042,734	$2,181,640	$2,329,992	$2,488,431	$21,323,792

Value of Lifetime[1] GHG Emissions Reductions from 2018 DSM Commercial and Industrial Program																	
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Forecast Annual Gas Savings m3[2]	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	59,891,949	958,271,184
Forecast Annual GHG Reductions (t C02e)[3]	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	112,297	1,796,758
Forecast Carbon Price ($/t C02e)[4,5]	$17.00	$18.00	$18.00	$19.00	$20.00	$21.00	$31.00	$36.00	$43.00	$50.00	$57.00	$60.88	$65.02	$69.44	$74.16	$79.20	n/a
Value of GHG Reduction	$1,909,056	$2,021,353	$2,021,353	$2,133,651	$2,245,948	$2,358,245	$3,481,220	$4,042,707	$4,828,788	$5,614,870	$6,400,952	$6,836,217	$7,301,080	$7,797,553	$8,327,787	$8,894,076	$76,214,855

Value of Lifetime[1] GHG Emissions Reductions from 2018 Total DSM Program																	
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Forecast Annual Gas Savings m3[2]	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	76,648,833	1,226,381,328
Forecast Annual GHG Reductions (t C02e)[3]	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	143,717	2,299,465
Forecast Carbon Price ($/t C02e)[4,5]	$17.00	$18.00	$18.00	$19.00	$20.00	$21.00	$31.00	$36.00	$43.00	$50.00	$57.00	$60.88	$65.02	$69.44	$74.16	$79.20	n/a
Value of GHG Reduction	$2,443,182	$2,586,898	$2,586,898	$2,730,615	$2,874,331	$3,018,048	$4,455,213	$5,173,796	$6,179,812	$7,185,828	$8,191,844	$8,748,889	$9,343,814	$9,979,193	$10,657,778	$11,382,507	$97,538,648

1. For simplicty assumes a 15 year measure life for all measures, although some components may have a longer measure life.
2. Forecast residential gas savings (including Low Income Part 9)less gas savings from proposed O-Power Program, commercial and industrial gas savings (including Low Income Part 3) as filed in the Multi-Year DSM Plan (EB-2015-0049) escalated by 2% productivity factor;
3. Assumes a conversion rate of 1.875 kg of C02e per cubic meter of gas
4. Assumes the Mid-Range LTCPF 2018 - 2028 Carbon Price (Real 2017 CAD) per the "Long Term Carbon Price Forecast Report" (ICF, 2017)
5. Assumes Mid-Range LTCPF 2029-2033 Carbon Price (Real 2017 CAD) esclated using the Minimum LTCPF methodology per the 'Long Term Carbon Price Forecast Report'(ICF, 2017) of 5% annual growth plus 1.8% inflation

ENVIRONMENTAL DEFENCE INTERROGATORY #25

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Although the benefits of conservation (e.g. reduced gas usage and reduced bills) stretch out over many years, the costs are often primarily borne in the first year. Please describe and assess options to match the benefits and the costs associated with conservation in time over the lifetime of the measures, including financing conservation by including it in rate base or with debt.

RESPONSE

Although an interesting concept, Enbridge believes this topic is beyond the scope of this Compliance Plan proceeding and would warrant discussion with all stakeholders and a decision by the Board having regard to the submissions.

Witnesses: D. Johnson
S. McGill
F. Oliver-Glasford

ENVIRONMENTAL DEFENCE INTERROGATORY #26

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Although the benefits of conservation (e.g. reduced gas usage and reduced bills) stretch out over many years, the costs are often borne primarily in the first year. If conservation were treated as a capital cost, and included in rate base, the costs would better match the benefits in time and the first year rate impact would decrease significantly.

What would the first year rate impact be of one dollar of conservation spending if it was (a) rate based instead of treated as an operating cost or (b) financed using the lowest cost debt available to Enbridge?

Please make, state, and discuss any assumptions as necessary, including any assumptions used to allocate the lifetime savings to each year. Please make best efforts to provide a response and include any caveats if necessary.

RESPONSE

Please see response for Environmental Defence Interrogatory #25 filed at Exhibit I.1.EGDI.ED.25.

Witness: D. Johnson

ENVIRONMENTAL DEFENCE INTERROGATORY #27

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please provide all studies and internal analysis prepared by or for Enbridge with respect to the costs and benefits of proposing incremental customer abatement as part of its 2018 Cap and Trade Compliance Plan.

RESPONSE

Enbridge relied primarily on the MACC study for this purpose and its analysis is presented in Exhibit C, Tab 5, Schedule 2, pages 25 to 28.

In addition Enbridge did analysis using the Conservation Potential Study. Please see the response to Board Staff interrogatory #24 part a filed at I.1.EGDI.STAFF.24 for additional detail.

Witnesses: D. Johnson
J. Tideman

ENVIRONMENTAL DEFENCE INTERROGATORY #28

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please provide a table listing Ontario most current GHG emissions reductions targets.

RESPONSE

Ontario's GHG emission reduction targets are listed in the Climate Change Mitigation and Low-carbon Economy Act, 2016 in Section 6. (1), which states:

> 6. (1) The following targets are established for reducing the amount of greenhouse gas emissions from the amount of emissions in Ontario calculated for 1990:
>
> 1. A reduction of 15 per cent by the end of 2020.
> 2. A reduction of 37 per cent by the end of 2030.
> 3. A reduction of 80 per cent by the end of 2050.

Witnesses: A. Langstaff
J. Murphy

ENVIRONMENTAL DEFENCE INTERROGATORY #29

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Approximately what percent of Ontario's GHG emissions are currently attributable to natural gas (please provide the most up-to-date figure available).

RESPONSE

Based on the information available in the latest National Inventory Report ("NIR"), which was released in 2017 but is based on 2015 data, the buildings sector in Ontario represents approximately 22% of the GHG emissions for the province.[1]

Ontario has released 2016 GHG reporting data, which shows that emissions from natural gas distribution represent approximately 26% of emissions reported in 2016.[2] Enbridge notes, however, that not all sectors (such as waste and agriculture) are required to report their emissions and therefore this is not as comprehensive a report as the NIR. This percentage is therefore assumed to be an over estimation.

[1] Environment and Climate Change Canada, National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada (2017), Part 3,Table A12-7, page 82.

[2] Government of Ontario, Greenhouse Gas Emissions Reporting by Facility: https://www.ontario.ca/data/greenhouse-gas-emissions-reporting-facility

Witness: J. Murphy

ENVIRONMENTAL DEFENCE INTERROGATORY #30

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

By letter dated February 9, 2017, the Board established a Technical Advisory Group for the development of a Long-Term Carbon Price Forecast (LTCPF) and a Marginal Abatement Cost Curve (MACC). This included two members from Enbridge. Please provide a copy of all documents circulated through that process relating to the MACC that are in Enbridge's possession. Please include documents emailed to and from Enbridge's representatives on the Advisory Group relating to the MACC, but do not limit it only to those individuals (e.g. include other documents or data that may have been provided to ICF by other Enbridge staff).

RESPONSE

Please see the following attachments for documents that were circulated through the Technical Advisory Group ("TAG") in relation to the Marginal Abatement Cost Curve ("MACC") process. These documents relate to the TAG meetings and to the Draft MACC Report. Enbridge has also included correspondence related to the LTCPF that was provided to the OEB as part of the TAG process.

Attachment 1: Enbridge comments on TAG Meeting Mtg 1 (March 1)
Attachment 2: Enbridge MACC Comments (June 29)
Attachment 3: Enbridge TAG Comments Meeting Mtg 2 (June 13 FINAL)
Attachment 4: LTCPF and MACC Decision Table (March 9)

Witness: F. Oliver-Glasford
M. Suarez

Enbridge's Written Comments towards the Board's Marginal Abatement Cost Curve Study – Post the First Technical Advisory Group meeting on Feb 21, 2017

Questions:

1) Conservation Potential Study (CPS) Data: What scenario data from the CPS should be used as a basis for the greenhouse gas abatement potential of measures on the MACC? i.e., should a cost-effectiveness screen be applied when selecting which measures to include or exclude from the MACC?

Enbridge would prefer the hybrid technical/achievable approach. The technical aspect allows the study to as widely cast the net on possible technologies and abatement programs whereas the achievable aspect ensures that the achievable potential is considered. However, Enbridge requests that regardless of approach that the following is also included:

a) The report explicitly articulates that the basis of consideration is scoped to those measures included in the Conservation Potential Study (CPS); or,
b) That should heat pumps be included, so should other measures that may be electric be considered. For example, if air source heat pumps are included in the MACC so too should geothermal and technologies that may decrease electricity usage. In this manner, a MACC that considers the provincial energy supply and related infrastructure and their full costs may be assessed with a broader lens.

Additionally, given the report uses the CPS as the starting point, the various areas of agreement or disagreement should be noted at the front to provide transparency around context.

2) Definition of MACC cost of abatement (i.e. $/ tCO_2e metric): (slide 16) What should be included in the cost measurement?
   - Should program admin costs (those related to program delivery, and those related to the C&T program) be included?
   - Should avoided natural gas costs include all the same aspects as DSM avoided costs (commodity costs, upstream and downstream capacity costs)?
   - Carbon costs are intended to be included as an avoided cost, i.e. assessing lifetime $/t against compliance instruments. If not, how would you suggest incorporating the 10-year LTCPF?
   - Based on the discussion, no costs shall be included for non-energy benefits that are not yet quantified (such as economic, social, and environmental benefits captured under DSM's "TRC-plus" 15% adder).

Enbridge believes that the costs to be included in the assessment should be any costs which are directly relevant to consideration versus a carbon allowance. Those costs include:

- Program costs related to all aspects of program delivery (customer incentives, program costs, administration costs (those related to DSM as well as those (if any) related to the portion attributable to the C&T program for abatement initiative coordination/governance)
- Natural gas avoided (or added) costs (commodity cost, upstream and downstream capacity costs)
- Electricity avoided (or added) cost (commodity cost, upstream and downstream capacity costs)
- Customer costs for technology installation (upfront incremental capital costs, installation costs, ongoing operation and maintenance)
- Carbon cost as net present value based on the anticipated measure life of a technology/solution
- Enbridge believes that the manner in which more "traditional" MACC studies are developed with respect to non-energy benefits should be used as the basis for this study.
- Public-facing MACC visuals should consider excluding upstream capacity costs and downstream distribution system costs as these may be variable and dependent on unique realities for utilities. While a contingency range should be part of the estimates to the OEB, utilities should be allowed to explain why these components of cost might diverge.

3) Treatment of additionality: (slide 20) Should the MACC display "all" available customer abatement potential, or only the incremental potential beyond DSM? Should a qualitative discussion of the impact of other abatement activities in the market (such as DSM and future CCAP programs) be included?

The MACC should display "all" available customer abatement potential versus only the incremental potential beyond what is outlined in the DSM Multi-year Plan out to 2020. However, there should be some recognition in the report about the base versus incremental potential. Said another way, the total pool of "all" available customer abatement potential should be captured in totality but with caveats outlining the breakdown between the base captured in the DSM Multi-year Plan and incremental.

4) Granularity of MACC categories (bars): (slides 18-19) What "categories" should be displayed as bars on the MACC curve? Should they be end-uses (e.g. residential space heating, industrial process, etc.), or sub-sectors (e.g. offices, hospitals)? Discussions suggested that displaying sectors (residential, commercial, industrial) or individual measures (efficient boiler, optimized industrial process, etc.) were too high level or too granular, respectively.

Should the study capture only what is in the CPS and articulate as such so that the public can understand the scope, then the appropriate level for the information would be at the sub-sector level. However, if the scope captures technologies that may be considered beyond those from the CPS including electric and renewable energy options, then the appropriate granularity for the information would be at the individual measure level.

5) Timeframe: (slide 8) What timeframe is appropriate for the final MACC diagram?

   Some options:
   a) 10-year timeframe from 2018-2028 (including net costs and benefits)
   b) "Snapshot" in 2020
   c) By compliance period (2018-2020) to account for compliance obligation

Enbridge supports the MACC diagram by compliance period, recognizing the many dynamic aspects in carbon policy and related CCAP implementation. Enbridge also understands that MACC are typically developed at a point in time because they do not easily capture and reflect various energy policy pathways (i.e. market and policy choices, the cascading effects of the savings of the most to the least implemented technologies or energy solution portfolios). As such, a shorter timeframe than the 10-year timeframe (2018 to 2028) may provide a reasonable middle ground between providing a snapshot and thus one data point, and a time range that is too far out without the necessary energy pathways considerations to be viable for making investment decisions over the coming several years. It will be likely that a new MACC will be required well before 2028.

This opinion expressed, it is also Enbridge's view that energy efficiency benefits that go beyond 2020 are not unnecessarily diminished.

6) General: Please comment on the usefulness of including other qualitative or quantitative analyses to test the robustness of the results for both the LTCPF and MACC

All quantitative assumptions and caveats should be clearly articulated in the public LTCPF and MACC. In this way they can best be contextualized by may seek to use the information.

The LTCPF should include the secondary market price forecasts as a consideration in determining the upper bounds of carbon pricing should the Ontario market not link with WCI.

Drawing on the mid-range LTCPF assumption that posits the WCI market to be in annual shortage by 2019 and a cumulative shortage by 2020, this version of the MACC should allow utilities with the flexibility to pursue abatement options that may be non-economic so as to ensure compliance.

Other Enbridge comments:

The MACC results require consideration of "certainty". Given Enbridge has a compliance obligation that it has no choice but to meet - even if qualitatively - a discussion needs to take place that outlines that buying an allowance is certain in its

outcome, but that the various abatement opportunities are not necessarily so. They may produce savings different then the achievable/anticipated above or below the achievable/anticipated levels for many reasons, some of which are out of the control of the utilities or its customers (i.e. weather, the cost of the commodity, etc.).

Enbridge supports the issuing of all detailed information that ICF provides to the OEB to also be provided to the natural gas utilities so that they can best integrate the analysis into their compliance plan development were appropriate.

The process for TAG input would benefit, time permitting, from having ICF share back what they heard from the various stakeholders and how the information was incorporated before it is finalized.

Enbridge's Submission on the draft Marginal Abatement Cost Curve Study

June 29, 2018

Enbridge is pleased to have the opportunity to provide comment on the draft Marginal Abatement Cost Curve (MACC) and respectfully provides the following summarized list of considerations for the Ontario Energy Board, Board Staff and ICF in preparation of the final MACC and its subsequent consideration in the 2018 Compliance Plans.

Areas of Strength

1) Well respected and knowledgeable consultants in carbon and economic analysis in Ontario
2) Expert and stakeholder involvement in the process through the Technical Advisory Group (TAG)
3) Solid knowledge base and diversity of perspective of TAG members
4) Allowance for comments to be fed into the process
5) Commitment and focus to providing a MACC within a short timeframe for the Utilities
6) Leverage of the Conservation Potential Study (CPS) which saved time and work from stakeholders

Areas for Improvement/Opportunity

1) Timelines were not laid out at the outset for each meeting and follow-up deadline for comments making it difficult to juggle competing priorities and perhaps not allowing for the full value of input from the TAG members
2) Detailed analysis was difficult to follow as there were some changes to how the data from the CPS was manipulated for the purposes of the MACC. Thus it was difficult to assess the efficacy of those changes and their impacts.
3) The report requires complete clarity to the reader that what is provided for energy efficiency is not the "marginal" cost curve but instead the "average" cost curve. This point is not clear and is absolutely critical given the large investments and targets in play in the existing DSM plans out to 2020 and the additional energy efficiency programming and related savings being proposed to the Green ON Fund.
4) The report fails to discuss that the underlying CPS recognizes what is known as natural conservation built into the utilities forecasts from code changes and the like, but does not capture any recognition of free-ridership values. This is exceedingly difficult to include given free-ridership values vary often from program to program or sector to sector, however, it is an important point that has been raised already in the process and should be captured clearly in the document. When savings opportunities are discounted by 50% for example, the Utility must engage and the customer must fund double the gross savings to see recognition of the 50% net value.
5) On the point of the energy efficiency section of the report being an average cost of abatement versus showing the incremental cost of abatement beyond the DSM Plan, it is critical that the study does not assume that people understand the non-linear relationship between spending and savings in DSM. Natural gas DSM activity is indeed mature in Ontario – which is a good thing. However, it means that the technologies, measures and programs deployed are becoming increasingly expensive as it is necessary to look to less cost effective opportunities and harder to reach markets.
6) It should be pointed out that the timing for investment/spend may not coincide with the achievement of results. This timing mismatch is not necessarily an issue, but ratepayers should be aware of it in any event.

7) Upfront costs have not been identified as occurring in "cost-effective" programs. Up front bill impacts on customers, even participating customers, will not equal savings in the first year(s). Where a financial contribution from customers is required, success relies on customers seeing value and buying in. In addition, volumes of savings are gross, not net (i.e. do not include free ridership)
8) "Un-combusted" methane emissions counted as combusted under current regulations
9) Only counts the displacement of NG, with no additional carbon offset benefits (i.e. for farm based digesters)
10) High cost of RNG in general that is perhaps not adequately informed by recent local information nor inclusive of offset values generated from RNG feedstock
11) The study by ICF is not consistent with the logic of other RNG studies and includes (within battery limits) and thus in the price of equipment that may exist or is practically required or is mandated, and excludes revenues from other sources such as tipping fees.
12) Inclusion of "uneconomic" potential to meet aggressive ramp up of volumes.
13) Prior studies assumed that most feedstocks would be waste and that disposal was part of the inputs of the facility for little to no cost.
14) Hydrogen production is excluded.

Areas of General Observation or Note

1) Enbridge has a carbon obligation that it must, with a 100% certainty meet, with a specific number of "allowances" or "credits" in its compliance account on November 1, 2021 to remit.
2) A MACC is well known to have a useful set of data to be used in conjunction with other inputs towards policy setting – and is designed from first principles to that aim.
3) MACCs are based on a point in time and do not reflect changing energy pathways, evolving policy or changes in market/technology funding that form the basis for different MACC values. Therefore, MACCs are best for point in time analysis versus longer-term planning.
4) The timing of the MACC will help inform Enbridge's Compliance Plans moving forward but its application to the 2018 Compliance Plan may be limited.
5) The MACC does not, and could not be expected to factor in CCAP funding decisions on energy efficiency and technology incentives.
6) The next MACC would be compiled for the 2021 to 2023 period.

Recommendations

1) Ensure that it is clearly articulated that the energy efficiency information is not "marginal" but is in fact "average". This does not jump out at the reader and is critical in understanding what is being presented.
2) The budget in order to achieve the level of savings outlined in the MACC is not documented. Although the MACC is from the Utility perspective, it is ultimately the ratepayers that pay the bill and thus they should understand the bill impacts.
3) Document clearly that the values in the CPS are gross, and do not include the applicable net-to-gross (i.e. free-ridership) values.
4) Ensure that it is clearly articulated that a bottom up analysis of RNG, or perhaps location specific updated information on RNG feedstocks may provide more compelling values for RNG as an abatement initiative.
5) Provide more transparency to the analysis/modelling behind the RNG outputs.
6) Allow the Utilities to put forward Utility specific facility related MACCs – 3rd parties can be utilized if deemed appropriate.

7) The OEB, in assessing compliance and cost-effectiveness of the Compliance Plan, can take into account upfront costs of such abatement programs. Or, allow the Utility to pursue the programs via the DSM or CCAP route rather than directly via the C&T Compliance Plan.
8) The OEB, in assessing compliance and cost-effectiveness, can take into account un-combusted methane emissions. Or, allow the Utility to wait until regulations recognizing un-combusted methane before embarking on such programs.
9) The OEB, in assessing compliance and cost-effectiveness, can recognize the site-specificity of RNG projects. Or, allow the Utility to pursue RNG via CCAP.
10) Suggested edits are included in the attached marked up draft MACC study to be helpful

Final Comments

Enbridge Gas Distribution has been pleased to be afforded the opportunity to provide input through the MACC development process via the Technical Advisory Group. It was a strong group of people with a solid knowledge base and a diversity of experience and viewpoints. Although the process was overly condensed given the importance of the resultant document, it was respectful, streamlined and professional in execution.

The resulting draft MACC Report provided to the TAG for final comment contains valuable data that will assist in the screening of potential of abatement programs. However, it should be clearly noted as just one of several inputs that are available to use to inform the design of abatement programs in the Compliance Plan. When using the MACC Report, inherent limitations on it should be recognized as well as planning horizon and spending timeframe and regulations should be taken into account. The solutions may require further discussion among the regulatory bodies, the Utilities and stakeholders.

Enbridge's Written Comments towards the Board's Marginal Abatement Cost Curve Study – Second Technical Advisory Group meeting on June 6, 2017

Overall Comments:

There has been a lot of work done on the MACC in a short amount of time. Enbridge is appreciative of the work as well as the opportunity to review the material in progress and provide comment. To that end, we respectfully provide the comments, clarifications and question below.

Energy Efficiency Topics

1) **The Marginal Cost of Abatement shown is from dollar one invested in energy efficiency and is not representative of the marginal cost of abatement incremental to existing DSM plans.**

In our comments submitted on the Feb 21, 2017 meeting EGD indicated the following:

> The MACC should display "all" available customer abatement potential versus only the incremental potential beyond what is outlined in the DSM Multi-year Plan out to 2020. However, there should be some recognition in the report about the base versus incremental potential. Said another way, the total pool of "all" available customer abatement potential should be captured in totality but with caveats outlining the breakdown between the base captured in the DSM Multi-year Plan and incremental.

Enbridge reiterates its comments from February to ensure it is clear we are supportive of the approach taken in the material circulated for June 6, but also to ensure that adequate clarity is provided in the report as to the fact that the values shown are at the marginal cost of abatement from one dollar invested in energy efficiency versus the marginal cost of abatement from the incremental dollar spent on energy efficiency after consideration of what is already accounted for in our DSM planning.

It must be articulated that the marginal cost for achieving energy efficiency savings is not linear with increased spend. We know from historical results in DSM that each additional increment of energy efficiency becomes more difficult and more expensive to achieve. This is even more so as we recognize net-to-gross ratios, building code advances, and other marketplace realities.

2) **The Conservation Potential Study shows the gross values of conservation potential without consideration of a traditional net-to-gross application.**

While there was clarification that the CPS does include "natural conservation", it must be made clear that "natural conservation" includes conservation of conservation outside

of the direct aims of DSM (i.e. building code changes etc.). DSM savings are layered on top of "natural conservation" assumptions to develop our forecasts on average annual consumption. To state that the CPS is based on values net of net-to-gross application would be false. The amount of savings that is shown needs to be understood in that vein.

3) Please confirm that the study uses the Program Administrator Cost Test for cost/benefit analysis versus the Total Resource Cost Test or Societal Cost Test.

4) Please confirm that this study is based on a CPS that uses 2015 as its baseline, this would mean that some of the achievable potential may have already been captured from actual results in 2016 and 2017.

5) Please confirm that the $/tonne is based on lifetime costs, even though the X-axis tonne reductions are annual tonnes in the year 2020.

6) Please confirm that the potential tonnes of CO2e abated in 2020 include all present day (as is the basis of the potential study) and not as stated "based on incremental measures initiated in 2018, 2019 and 2020.

7) Could you confirm that you will be able to provide a write up in the final version clearly articulating how avoided energy costs are included in the $/tonne analysis?

8) Would you confirm whether the air source heat pump analysis includes the additional cost to the distribution and transmission system of increased electric demand? This is important context as per ICF's own comment that fuel switching is different in its opportunities and implications than gas on gas efficiency measures/savings. This discussion is important for inclusion in the MACC study.

9) Broadly speaking, Enbridge will require more insight as to how the utility will practically speaking take the numbers provided in the study and apply them to Compliance Plan analysis.

GHG Reporting and Cap and Trade Regulation Topics

10) Methane emissions are covered by the cap and trade regulation.

Enbridge is aware of comments made by ECO on the MACC slides regarding the scope of the MACC, and wishes to clear up any confusion that may exist on the coverage of cap and trade on emissions from natural gas distribution.

The point of regulation for natural gas distribution is the custody transfer station. This ensures that all natural gas, except gas sent to downstream distributors, capped participants, out of province or to storage facilities, is captured in the distributors cap

and trade obligation. This includes not only combustion at the end user, but also natural gas that is vented, flared, fugitives, as well as unaccounted for gas. Based on this, abatement activities that focus on reducing fugitive and vented emissions from the natural gas distribution system would in fact be a viable option for reducing emissions. Enbridge however notes that as stated by ICF, facility-related emissions, including venting and flaring, make up approximately 1% of the emissions for which Enbridge holds a cap and trade obligation. Enbridge is working to better understand the opportunities for reducing facility-related emissions, and is not in a position to provide details to ICF at this time for inclusion in the MACC study. Enbridge also notes that while there are many studies in the public domain that may provide costs and emission savings from natural gas abatement projects, it would be inappropriate to use these studies for development of the OEB MACC as many of these studies are based on American natural gas distribution system or upstream facilities.

RNG Topics

11) In order to have a full cost benefit analysis of RNG feedstock sources, the value generated from offsets, needs to be factored in. EGD recognizes that ICF and the Board are aware of this fact, but it is such an important point it warrants repeating. There does not appear to be full consideration of recent RNG pricing policies in British Columbia and California. Further, the development of the proposed MACC does not appear to take into account RNG forecasts included in Fuels Technical Report prepared by Navigant on behalf of the Ontario Ministry of Energy as input to the province's 2017 Long Term Energy Plan.

12) Studies on RNG used for the MACC are somewhat stale given how quickly the market is evolving. As such, EGD notes there would be value to updated information and study.

13) Gasification was identified in the 2011 Alberta Innovates Report as a longer term source of RNG that could provide approximately 70% of future RNG supply at lower costs, but does not appear to be captured in the list of feedstock streams. EGD believes that this is viable option that should be considered.

Facility Related Topics

14) Enbridge requires local and company specific inputs to assess facility related abatement opportunities. Internally, the Company is in the process of investigating facility abatement opportunities. As outlined by EGD, this may show the necessity for a Utility specific MACC for the purposes of facility related opportunities/projects.

	Original Question for TAG	Recommendations
1	Conservation Potential Study (CPS) Data: (slide 15) What CPS data should be used as a basis for the GHG abatement potential of measures on the MACC? i.e., should a cost-effectiveness screen be applied when selecting which measures to include or exclude from the MACC? Options discussed: a) Technical Potential – use all measures identified as technically feasible, without applying "realistic" adoption rates. b) Economic Potential - only use measures identified that pass a cost-effectiveness screen, without applying "realistic" adoption rates. c) Achievable Potential – only use measures identified that pass a cost-effectiveness screen, applying "realistic" adoption rates and program costs. d) Hybrid Technical / Achievable Approach – apply the adoption rates developed in the CPS achievable potential scenario to all measures identified in the technical potential, developing adoption curves for those measures that were not included in the CPS achievable potential scenario. Separately assess heat pumps (given large potential but very low cost-effectiveness).	1) Proceed with option d), because it allows for inclusion of all measures, assuming realistic adoption rates. 2) The report should explicitly articulate that the scope of customer abatement measures is limited to the measures included in the potential study. 3) The adoption rates and associated costs shall reflect realistic customer incentive levels (approximately 40% of incremental measure cost, ie the BAU scenarios from the potential study). 4) All assumptions/caveats (those taken from the potential study, and new ones) should be explicitly stated, or should reference the potential study, including those related to building code changes, in both the public-facing MACC and the excel deliverable. The excel deliverable should provide data on adoption curves and rates used on all measures. 5) Include a qualitative comment on the impact of reducing electricity usage on emissions, but that this is out of the scope of this NG utility-focused MACC.
2	Definition of "cost" metric ($/ tCO2e metric): (slide 16) What should be included in the cost measurement? ***[i.e., do we consider utility costs or societal costs in the MACC's cost metric?]*** • Should program admin costs (related to program delivery and the C&T program) be included? • Should avoided natural gas costs include all the same aspects as DSM avoided costs (commodity costs, upstream and downstream capacity costs)? • Should carbon costs be included as an avoided cost • Should non-energy benefits be included	1) Use utility perspective for public-facing document, so that MACC shows realistic $/t estimates. Use avoided natural gas costs developed in the potential study. 2) Program Delivery Costs shall be included in the costs (similar to what was done for achievable potential measures). 3) Non-energy benefits shall be discussed qualitatively as being over and above the benefits shown in the MACC, but not included as an adder quantitatively. 4) ICF to note what assumptions they used about costs and mitigation potential for individual measures (do they vary over time or assumed to stay the same throughout the life of the equipment?) 5) Re. including the cost of carbon - if possible, ICF to do 2 separate runs with the cost of carbon and without the cost of carbon to allow for comparison. If not possible, ICF to include the cost of carbon as a benefit for abatement measures.

	Original Question for TAG	Recommendations
3	Treatment of additionality: (slide 20) Should the MACC display "all" available customer abatement potential, or only the incremental potential beyond DSM? Should a qualitative discussion of the impact of other abatement activities in the market (such as DSM and future CCAP programs) be included?	1) Include all available customer abatement potential in the MACC. 2) Discuss the impact of other programs (DSM, GIF, CCAP, codes, standards, etc.) qualitatively in the report (providing quantitative #s on impact if there are any).
4	Granularity of MACC categories (bars): (slides 18-19) What "categories" should be displayed as bars on the MACC curve? Options discussed: • Individual measures • End-uses (e.g. residential space heating, industrial process, etc.) • Sub-sectors (e.g. offices, hospitals) • Sectors Discussions suggested that displaying sectors (residential, commercial, industrial) or individual measures (efficient boiler, optimized industrial process, etc.) were too high level or too granular, respectively.	1) Use end-use categories, with the height of the bar showing the "average" $/t for measures in that group. Error bars should mark the min and max $/t for measures contained in that group. 2) Cascaded values are to be included. ICF to include a "systems" category to capture abatement occurring across end-uses (e.g., high efficiency new construction) explaining in the report if there are any limitations or interactive effects that will not be accounted for in the curve, and potential magnitude. 3) Heat pumps will be separated from other space-heating end-uses in residential and commercial. 4) ICF to note how changes in building code have been taken into account.
5	Timeframe: (slide 8) What timeframe is appropriate for the final MACC diagram? Options discussed: a) 10-year timeframe from 2018-2028 (including net costs and benefits) b) "Snapshot" in 2020 c) By compliance period (2018-2020) to account for compliance obligation	1) Y-axis is costs (annualized over the measure's lifetime) over annual abatement potential of each abatement opportunity. X-axis is abatement potential during the 2018-2020 compliance period (i.e., abatement achieved in years 2018, 2019, and 2020, or annual average over that period). 2) To calculate avoided carbon cost for long-lived measures, ICF to extrapolate LTCPF linearly from 2028 and beyond for technologies that will remain installed (and achieving carbon reductions) beyond 2028. 3) State that how/where discounting rates were applied. 4) ICF to review list of all capped participants to determined if/how their abatement potential should be removed from the forecast.

	Original Question for TAG	Recommendations
6	LTCPF Suggestions from TAG members include: • setting maximum forecast price as maximum market rate (i.e., including secondary market allowance prices), not the auction max • Conduct sensitivities around exchange rates, WCI linking, offsets in WCI, regulation and policy variables, and success of CCAP programs It was noted that the ICF forecast is considerably higher than other forecasts of the market	1) Provide a qualitative explanation re. the fact that the forecast is a reasonable range, but the price could go higher on the secondary market if the market was short. 2) Explicitly note assumptions around other programs and demand response, as well as ICF`s analysis of Ontario-specific issues (e.g., nuclear shutdown timing) 3) Comment qualitatively on LTCPF sensitivities to exchange rates, WCI linking, reduction in offset %s in WCI, recommending future work, where needed. 4)Recalculate mid-range forecast to be less aggressive, which includes: a) Exclude the California proposal about not allowing use of banked allowances, since it is a proposal at this point. Instead, ICF to discuss how this would impact the forecast if the Cali proposal were to go forward. b) For first compliance period (2018-2020), re-jig forecast to consider 2020 vintages currently being sold in the WCI market and the price that these are being sold at now (e.g., homogenous price until 2020 instead of escalating price)

ENVIRONMENTAL DEFENCE INTERROGATORY #31

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please describe in detail the involvement of Enbridge's DSM team in the development of the Cap and Trade Compliance plan. Please include a list of DSM team members and an approximate estimate of how many hours each spent in relation to the development of the Cap and Trade Compliance plan.

RESPONSE

Enbridge's DSM team was involved in reviewing the MACC development and related draft material as well as engaging in an analysis as to whether incremental energy efficiency was warranted/appropriate. The DSM team was also involved in the development and review of evidence around customer abatement. Although there has recently been changes in accountabilities within Enbridge the following DSM team members have been, or are currently involved in various capacities and stages of the work: Michael Lister, Daniel Johnson, Brandon Ott, Marc Hull-Jacquin, Samantha Byers, John Tideman, Deborah Bullock and Suzette Mills. The number of hours invested is not known, but was significant in nature.

Witnesses: D. Johnson
F. Oliver-Glasford

ENVIRONMENTAL DEFENCE INTERROGATORY #32

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Enbridge seems to suggest that incremental conservation is not available in part because of the amount of new non-ratepayer funded gas conservation. The extent of non-ratepayer funded conservation is relevant to this proceeding for that and other reasons.

Please provide the following information broken out by (a) Enbridge's non-ratepayer funded conservation programs (e.g. those funded by the GIF), (b) Enbridge's ratepayer funded resource acquisition conservation programs, and (c) the sum of those two:

i. The total budget;
ii. The forecast lifetime gas savings (cubic metres); and
iii. The forecast lifetime GHG emission reductions (tonnes).

Please provide this information for 2018, 2019, and 2020.

RESPONSE

Please see the requested information below.

Ratepayer funded Resource Acquisition Programs	**2018**	**2019**	**2020**
Budget ($)	$43,162,456	$42,056,270	$42,908,517
Lifetime NG (million m^3)[1]	1,028.4	1,046.2	1,064.9
Lifetime GHG (tonnes CO_2e)	1,928,250	1,961,630	1,996,690

1. Based on 100% CCM targets per 2015-2020 plan (EB-2015-0049)

Witnesses: D. Johnson
J. Tideman

GIF funded program	2018	2019	2020
Budget ($)	$41,427,354	N/A	N/A
Lifetime NG (million m^3)	257.5	N/A	N/A
Lifetime GHG (tonnes CO_2e)	482,810	N/A	N/A

Sum of ratepayer and GIF funded program	2018	2019	2020
Budget ($)	$109,008,233	$66,421,773	$67,757,376
Lifetime NG (million m^3)	1,285.9	1,046.2	1,064.9
Lifetime GHG (tonnes CO_2e)	2,411,060	1,961,630	1,996,690

In addition to the response above, Enbridge notes that GIF represents only a portion of non-ratepayer funded conservation in the Province. Programs funded through GreenON represent a significant amount of additional non-ratepayer funded conservation, which the company does not have clear visibility into. For additional discussion on the topic of incremental abatement, please refer to the response to Board Staff Interrogatory #24b, filed at Exhibit I.1.EGDI.STAFF.24.

Witnesses: D. Johnson
J. Tideman

ENVIRONMENTAL DEFENCE INTERROGATORY #33

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Please provide a table showing the (a) lifetime gas savings, (b) lifetime GHG emissions reductions, and (c) DSM budget (resource acquisition only) from its DSM programs for the most recent 10 years of available data.

RESPONSE

Year	Total Net CCM (m^3)	Lifetime GHG Reductions (tonnes CO_2e)	Total DSM Program Budget (RA Only) ($)
2015	826,165,451	1,549,060	$17,750,725
2014	719,842,637	1,349,705	$16,580,635
2013	826,908,305	1,550,453	$11,438,046
2012	1,068,976,932	2,004,332	$13,483,273
2011	1,253,824,465	2,350,921	$15,804,705
2010	951,400,634	1,783,876	$14,965,814
2009	1,039,181,252	1,948,465	$18,211,626
2008	1,118,983,811	2,098,095	$15,627,338
2007	1,214,102,754	2,276,443	$13,980,620
2006	1,302,419,361	2,442,036	$15,157,256

Notes:
DSM Program Budget excludes overheads
2016 values have not been included as the audit has not been finalized
2015 values have not yet been approved by the board

Witness: D. Johnson

ENVIRONMENTAL DEFENCE INTERROGATORY #34

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Does Enbridge plan to propose incremental ratepayer funded customer abatement activities for 2019 as a cap and trade compliance tool? If yes, please provide an approximate range of the budget level for those activities that Enbridge believes is worth considering. If no, please fully explain and justify that position.

RESPONSE

Enbridge has not yet determined whether and what incremental ratepayer funded abatement will form part of the 2019/2020 Compliance Plan. Without transparency of the GreenOn funding that may be available, it is difficult to know at this time what abatement the Company might be proposing. Please refer to the response to Board Staff Interrogatory #24, filed at Exhibit I.1.EGDI.STAFF.24.

2019/2020 compliance planning is not in scope for the 2018 Compliance Plan proceeding.

Witnesses: D. Johnson
S. McGill
F. Oliver-Glasford

ENVIRONMENTAL DEFENCE INTERROGATORY #35

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Does Enbridge believe that incremental conservation driven by cap and trade compliance should be implemented via the DSM Framework? Please fully explain the response.

RESPONSE

Please see responses to OSEA Interrogatory #11 filed at Exhibit I.1.EGDI.OSEA.11 and Board Staff Interrogatory #24b filed at Exhibit I.1.EGDI.STAFF.24.

Witness: F. Oliver-Glasford

ENVIRONMENTAL DEFENCE INTERROGATORY #36

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Does Enbridge believe that incremental conservation driven by cap and trade compliance should wait until after the DSM mid-term review is completed? Please fully explain the response.

RESPONSE

Please see response to Board Staff Interrogatory #24b) filed at Exhibit I.1.EGDI.STAFF.24.

Witness: D. Johnson

ENVIRONMENTAL DEFENCE INTERROGATORY #37

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

(a) If incremental conservation driven by cap and trade compliance is only to be implemented after the DSM mid-term review is completed, please discuss the timing of the steps that would be necessary for a prompt ramp up seeing as the DSM mid-term renew will not be completed until December 1, 2018?
(b) Please discuss the pre-planning that would be necessary to begin a ramp up of incremental DSM starting January 1, 2019.
(c) Please discuss whether Enbridge is intending on taking those steps.

RESPONSE

a) Please see the response to Board Staff Interrogatory #24b, filed at Exhibit I.1.EGDI.STAFF.24. If additional cost effective conservation was identified, based on the DSM mid-term policy decisions, any incremental conservation would begin to ramp up in 2019. By this time, perhaps there will also be increased clarity on the types, sectors and magnitude of other marketplace funding towards conservation and energy efficiency in Ontario.

b) Pre-planning would be based on the type and size of any incremental DSM. For example, if the Board were to approve programs that EGD had originally proposed in the 2015 to 2020 Plan but were not approved, less pre-planning would be required as some of the work would have been completed but shelved. Conversely, completely new offers could require significant pre-planning to design, analyze savings on, ensure delivery channels are ready or developed, establish contracting and gain any necessary approvals.

c) At this time Enbridge has no specific plans to undertake the steps mentioned in part b of this question for incremental ratepayer funded DSM and energy efficiency. However, as discussed in the response to Board Staff Interrogatory #24b, filed at I.1.EGDI.STAFF.24, the Company is activity monitoring and bidding on the various RFPs being released by the Green ON Fund.

Witness: D. Johnson

ENVIRONMENTAL DEFENCE INTERROGATORY #38

INTERROGATORY

Reference: Ex. C, Tab 5, Sch. 2, pages 25-28

Would Enbridge be opposed to a portion of conservation-related shareholder incentives being dependent not only on performance in achieving targets, but also on the aggressiveness of the overall conservation achievements (i.e. based on gross TRC benefits, gas savings, or GHG emissions reductions)? Please explain.

RESPONSE

As Enbridge understands this question, it appears to be outside the scope of this proceeding as confirmed by the Board in Procedural Order No. 2.

Witness: D. Johnson

ENERGY PROBE INTERROGATORY #13

INTERROGATORY

Reference: Exhibit B Tab 2 Schedule 1 and Appendix A

Please confirm either that that the Volume forecast of 11,497,761 103m3, is consistent With the evidence in Exhibit C1, Tab 2, Schedule 1 in the 2018 Rate Application, and/or provide/explain the differences in quantitative terms, including the heat content.

RESPONSE

Enbridge confirms that the volume forecast shown in Exhibit B, Tab 2, Schedule 1 is consistent with the volume filed in the 2018 rate application (EB-2017-0086).

The Company notes, however, that there is a variance between the Board-approved volumes from the 2018 rate application and what was included in evidence in that case. The final Board-approved volume is lower than the volume in Exhibit B, Tab 2, Schedule 1 by 4,791 10^3 m^3, which equates to approximately 9,000 tCO_2e.

The following pages update the relevant Tables from Enbridge's filing in this case, to reflect the impact of the updated Board-approved volume for 2018.

Witnesses: J. Murphy
M. Suarez

Updated Table 1 from Exhibit B, Tab 2, Schedule 1

EXHIBIT B-2-1

TABLE 1: 2018 CUSTOMER-RELATED VOLUMES BY RATE CLASS
(10^3m^3)

Line	Rate	Col. 1 Forecast Volumes Before DSM & Abatement	Col. 2 DSM Volume	Col. 3 Customer Abatement Volume[1]	Col. 4 (Col. 1 - Col. 2 - Col. 3) Forecast Volumes After DSM & Abatement[2]	Col. 5 Capped Participant Volumes	Col. 6 Other Exempt Gas Volume[4]	Col. 7 (Col. 4 - Col. 5 - Col. 6) Net Volumes
1.1	1	4,762,598.1	6,807.5	5,558.5	4,750,232.1	364.1	0.0	4,749,868.0
1.2	6	4,847,838.1	18,080.4	0.0	4,829,757.7	156,649.9	0.0	4,673,107.8
1.3	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.4	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.5	110	791,896.2	2,860.4	0.0	789,035.8	367,138.0	0.0	421,897.8
1.6	115	545,114.9	2,283.5	0.0	542,831.4	410,350.3	0.0	132,481.1
1.7a	125	319,562.5	0.0	0.0	319,562.5	0.0	0.0	319,562.5
1.7b	125D[3]	124,896.5	0.0	0.0	124,896.5	0.0	0.0	124,896.5
1.8	135	64,592.0	90.7	0.0	64,501.3	0.0	0.0	64,501.3
1.9	145	50,543.0	406.8	0.0	50,136.2	3,670.7	0.0	46,465.5
1.10	170	291,761.7	609.4	0.0	291,152.3	237,627.7	0.0	53,524.6
1.11	200	169,764.4	0.0	0.0	169,764.4	0.0	169,764.4	0.0
1.12	300	518.6	0.0	0.0	518.6	0.0	0.0	518.6
1	Total Customer-Related	11,969,086.0	31,138.7	5,558.5	11,932,388.8	1,175,800.7	169,764.4	10,586,823.7

Notes:

(1) Incremental customer abatement included in Compliance Plan.

(2) Forecast Volumes After DSM and Abatement are higher than volumes filed in 2018 Rates Application (EB-2017-0086, Exhibit C3, Tab 2, Schedule 1) due to inclusion of unbundled volumes for Rate 125 and Rate 300 (Lines 1.7 a & b, and 1.12) for compliance. Volumes forecast filed in 2018 Rates Application will be updated to reflect forecast of customer abatement volume in Col. 3 above.

(3) Dedicated unbundled customers

(4) Includes volumes delivered to downstream distributor and landfill gas.

Witnesses: J. Murphy
M. Suarez

Updated Table 3 from Exhibit B, Tab 2, Schedule 1

TABLE 3: 2018 SUMMARY OF CUSTOMER-RELATED AND FACILITY-RELATED FORECAST VOLUMES

Line	Description	2018 Forecast
	Customer-Related Volume Forecast	
1	Gross Volumes before DSM and Customer Abatement (10^3m^3)	11,969,086
2	Less: Demand Side Management (DSM) (10^3m^3)	(31,139)
3	Less: Customer Abatement (10^3m^3)	(5,559)
4	Subtotal: Net Volumes (10^3m^3)	11,932,389
5	Less: Throughput to Capped Participants (10^3m^3)	(1,175,801)
6	Less: Gas to Other Exempt Customers (10^3m^3)	(169,764)
7	**Net Customer Related Volumes to end users (10^3m^3)**	**10,586,824**
	Facility-Related Volume Forecast	
8.a.	Company Use Gas - Building (10^3m^3)	1,389
8.b.	Company Use Gas - Boiler (10^3m^3)	4,079
8.c.	Company Use Gas - Fleet (10^3 m^3)	1,147
8	Total Company Use Gas (10^3m^3)	6,615
9	Unaccounted for Gas (10^3m^3)	106,077
10	Compressor Fuel (10^3m^3)	15,957
11	**Net Facility-Related Volumes (10^3m^3)**	**128,649**
12	**Total Customer-Related and Facility-Related Volumes (Line 7 + Line 11) (10^3m^3)**	**10,715,473**

Witnesses: J. Murphy
M. Suarez

Updated Table 1 and Table 2 from Exhibit B, Tab 3, Schedule 1

EXHIBIT B-3-1

TABLE 1: 2018 CUSTOMER-RELATED EMISSIONS BY RATE CLASS

		Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Line	Rate	Net Volumes[1]	CO_2 Emissions[2]	CH_4 Emissions[3]	N_2O Emissions[4]	Net CO_2e Emissions[5]
		(10^3m^3)	(Tonnes CO_2)	(Tonnes CH_4)	(Tonnes N_2O)	(Tonnes CO_2e)
1.1	1	4,749,868.0	8,849,004.1	175.7	166.2	8,904,230.8
1.2	6	4,673,107.8	8,705,999.8	172.9	163.6	8,760,334.1
1.3	9	0.0	0.0	0.0	0.0	0.0
1.4	100	0.0	0.0	0.0	0.0	0.0
1.5	110	421,897.8	785,995.6	15.6	14.8	790,901.0
1.6	115	132,481.1	246,812.3	4.9	4.6	248,352.6
1.7a	125	319,562.5	595,344.9	11.8	11.2	599,060.5
1.7b	125D	124,896.5	232,682.2	4.6	4.4	234,134.4
1.8	135	64,501.3	120,165.9	2.4	2.3	120,915.9
1.9	145	46,465.5	86,565.2	1.7	1.6	87,105.5
1.10	170	53,524.6	99,716.3	2.0	1.9	100,338.7
1.11	200	0.0	0.0	0.0	0.0	0.0
1.12	300	518.6	966.15	0.02	0.02	972.2
1	Total Customer-Related	10,586,823.7	19,723,252.6	391.7	370.5	19,846,345.6

Notes:

(1) Exhibit B, Tab 2, Schedule 1, Table 1, Col. 6

(2) Col. 1 x Table 2, Line 2, Col. 1 x 1000

(3) Col. 1 x Table 2, Line 2, Col. 2 x 1000

(4) Col. 1 x Table 2, Line 2, Col. 3 x 1000

(5) Col. 2 + (Col. 3 x Table 2, Line 3, Col. 2) + (Col. 4 x Table 2, Line 3, Col. 3)

TABLE 2: CONVERSION FACTORS

		Col. 1	Col. 2	Col. 3
Line		CO_2 Emission Factor[6]	CH_4 Emission Factor[7]	N_2O Emission Factor[7]
2	Tonne/m^3	0.001863	0.000000037	0.000000035

Line		Methane[8]	Nitrous Oxide[8]
3	Global Warming Potential for Carbon Dioxide Equivalent	21	310

Notes:

(6) Ontario Ministry of Environment and Climate Change's "Guideline for Quantification, Reporting and Verification for GHG Emissions - July 2017", Table 400-2

(7) Ontario Ministry of Environment and Climate Change's "Guidelines for Quantification, Reporting and Verification for GHG Emissions - July 2017", Table 20-4

(8) Ontario Regulation 143/16 "Quantification, Reporting and Verification of Greenhouse Gas Emissions", Schedule 1

Updated Table 5 from Exhibit B, Tab 3, Schedule 1

TABLE 5: 2018 SUMMARY OF CUSTOMER-RELATED AND FACILITY-RELATED FORECAST GHG EMISSIONS

Line	Description	2018 Forecast
	Customer-Related GHG Emissions Forecast	
1	Customer-related Forecast Volume (10^3 m^3)	10,586,824
2	ON.400 Emission Conversion Factor (tonnes CO_2e/m^3)	0.001875
3	**Customer-Related Emissions (tonnes CO2e)**	**19,846,346**
	Facility-Related GHG Emissions Forecast	
4	Facility-related Forecast Volume (10^3 m^3)	128,649
5	ON.20 Emission Conversion Factor (tonnes CO_2e/m^3)	0.001939
6	**Facility-Related Emissions (tonnes CO2e)**	**242,464**
	Total Compliance Obligation	
7	**Total Compliance Obligation (tonnes CO2e)**	**20,088,810**

Updated Table A1 from Exhibit G, Tab 1, Schedule 1, Appendix A

TABLE A1

TABLE 1: 2018 CUSTOMER-RELATED VOLUMES, EMISSIONS, COST OF EMISSIONS AND UNIT RATE

		Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
Line	Rate	Budget Forecast Volumes[1]	LFE, Customer Abatement, Capped Participants and Other Exempt Gas Volumes[2]	Net Volumes[3]	Net CO_2e Emissions[4]	Assumed Cost of Allowances[5]	Cost of CO_2e Emissions[6]	Unit Rate[7]
		(10^3m^3)	(10^3m^3)	(10^3m^3)	(Tonnes CO_2e)	($/tonne CO_2e)	($)	(¢/m^3)
1.1	1	4,755,790.6	5,922.6	4,749,868.0	8,904,230.8	18.99	169,091,342.9	
1.2	6	4,829,757.7	156,649.9	4,673,107.8	8,760,334.1	18.99	166,358,743.7	
1.3	9	0.0	0.0	0.0	0.0	18.99	0.0	
1.4	100	0.0	0.0	0.0	0.0	18.99	0.0	
1.5	110	789,035.8	367,138.0	421,897.8	790,901.0	18.99	15,019,210.1	
1.6	115	542,831.4	410,350.3	132,481.1	248,352.6	18.99	4,716,216.8	
1.7a	125	319,562.5	0.0	319,562.5	599,060.5	18.99	11,376,158.7	
1.7b	125D[8]	124,896.5	0.0	124,896.5	234,134.4	18.99	4,446,211.3	
1.8	135	64,501.3	0.0	64,501.3	120,915.9	18.99	2,296,192.5	
1.9	145	50,136.2	3,670.7	46,465.5	87,105.5	18.99	1,654,133.1	
1.10	170	291,152.3	237,627.7	53,524.6	100,338.7	18.99	1,905,431.2	
1.11	200	169,764.4	169,764.4	0.0	0.0	18.99	0.0	
1.12	300	518.6	0.0	518.6	972.2	18.99	18,461.7	
1	Total Customer-Related	11,937,947.3	1,351,123.6	10,586,823.7	19,846,345.6	18.99	376,882,102.0	3.5599

Notes:

(1) Exhibit B, Tab 2, Schedule 1, Table 1, Col. 1 - Col. 2

(2) Exhibit B, Tab 2, Schedule 1, Table 1, Col. 3 + Col. 5 + Col. 6

(3) Col. 1 - Col. 2

(4) Exhibit B, Tab 3, Schedule 1, Table 1, Col. 5

(5) The carbon proxy price for rate setting purposes was based on the California Carbon Allowance ICE 21 day strip price for delivery from September 1 through to September 29, 2017.

(6) Col. 4 x Col. 5

(7) (Col. 6 / (Col. 3 x 1000)) x 100

(8) Dedicated unbundled customers

Customer-Related Unit Rate Calculation

Cap and Trade Customer Related Charge = Cost of CO_2e Emissions / Net Volumes
= $ 377,052,654.1 / 10,591,614.6 10^3m^3
= 3.5599 ¢/m^3

Witnesses: J. Murphy
M. Suarez

Updated Table A2 from Exhibit G, Tab 1, Schedule 1, Appendix A

TABLE A2

TABLE 2: 2018 FACILITY-RELATED VOLUMES, EMISSIONS, COST OF EMISSIONS AND UNIT RATES

		Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Line		Volumes[1]	CO_2e Emissions[2]	Assumed Cost of Allowances[3]	Cost of CO_2e Emissions[4]	Unit Rate
		(10^3m^3)	(Tonnes CO_2e)	($/tonne CO_2e)	($)	(¢/m^3)
2.1	Company Use					
2.1.1	Fleet	1,147.2	2,150.6	18.99	40,839.4	
2.1.2	Buildings	1,388.8	2,603.5	18.99	49,440.1	
2.1.3	Boilers	4,078.8	7,909.9	18.99	150,209.5	
2.1	Company Use	6,614.8	12,664.0	18.99	240,489.0	0.0016
2.2	Unaccounted For Gas (UAF)	106,077.0	198,854.8	18.99	3,776,252.8	0.0320
2.3	Compressor Fuel	15,957.3	30,945.5	18.99	587,655.9	0.0050
2	Total Facility-Related	128,649.1	242,464.3	18.99	4,604,397.7	0.0386

Notes:

(1) Exhibit B, Tab 2, Schedule 1, Table 2

(2) Exhibit B, Tab 3, Schedule 1, Table 3, Col. 5

(3) The carbon proxy price for rate setting purposes was based on the California Carbon Allowance ICE 21 day strip price for delivery in each month of 2018.

(4) Col. 2 x Col. 3

(5) Cost of CO_2e emissions / (Total customer-related volume + Rate 332 Volume) = [Col. 4 / ((Exhibit A1, Table 1, Line 1, Col. 1 + 2,850,078 10^3 m^3) x 1000)] x 100

(6) Cost of CO_2e emissions / (Total customer-related volume - Rate 125D customers - landfill gas volume) = [Col. 4 / ((Exhibit A1, Table 1, Line 1, Col. 1 - Line 1.7b, Col. 1 - Line 1.12, Col. 2) x 1000)] x 100

(7) Cost of CO_2e emissions / (Total customer-related volume excluding unbundled customers (Rates 125 and 300) + Rate 325 Volume) = [Col. 4 / ((Exhibit A1, Table 1, Line 1, Col. 1 - Line 1.7a, Col. 1 - - Line 1.7b, Col. 1 - Line 1.12, Col. 1 + 190,328 10^3 m^3)) x 1000] x 100

Facility-Related Unit Rate Calculations

Company Use = Cost of CO_2e Emissions for Company Use / (Total Customer-Related Volume + Rate 332 Volume)
= $ 240,489.0 / (11,942,738.2 + 2,850,078) 10^3m^3
= 0.0016 ¢/m^3

Unaccounted For Gas Volumes = Cost of CO_2e Emissions for Unaccounted For Gas / (Total Customer-Related Volume Excluding Rate 125D and Landfill Gas)
= $ 3,776,252.8 / (11,942,738.2 - 124,896.5 - 0) 10^3m^3
= 0.0320 ¢/m^3

Compressor Fuel Volumes = Cost of CO_2e Emissions for Compressor Fuel / (Total Customer-Related Volume Excluding Unbundled Customers + Rate 325 Volume)
= $ 587,655.9 / (11,942,738.2 - 319,562.5 - 124,896.5 - 518.6 + 190,328.0) 10^3m^3
= 0.0050 ¢/m^3

Facility-Related Charge = 0.0016 + 0.0320 + 0.0050 ¢/m^3
= 0.0386 ¢/m^3

Witnesses: J. Murphy
M. Suarez

ENERGY PROBE INTERROGATORY #14

INTERROGATORY

Reference: Exhibit B, Tab 4, Schedule 1, Page 2, Table 1

a) Please update the Intercontinental Exchange (ICE) 21-day strip price for California Carbon Allowances (CCA) using December 2017 data and exchange rates.
b) Is there a current spread between California and Ontario carbon prices? If so, what is that spread?
c) If a spread were to occur between Ontario and California carbon prices, how will Enbridge deal with that spread (positive or negative)?

RESPONSE

a) A 21-day strip price using December 2017 data has been provided in the table below:

21- day strip period	ICE Price (USD)	Exchange Rate (USD/CAD)	ICE Price (CAD)
November 30 – December 29	$15.27	1.2745	$19.46

The 21-day strip price assumes delivery in each month of 2018. The exchange rate noted above also assumes the same 21-day strip price and delivery in each month of 2018.

b) Assuming identical vintage and delivery date, at present the Ontario carbon allowance trades at a 'USD/CAD exchange rate' multiple to the California carbon allowance.

c) Enbridge is not permitted to provide this information for reasons of confidentiality as set out in the Climate Change Mitigation and Low-carbon Economy Act, 2016 ("Climate Change Act"), Cap and Trade regulations and the Report of the Board in respect of the Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities (EB-2015-0363) ("Framework").

Witnesses: A. Langstaff
J. Murphy

ENERGY PROBE INTERROGATORY #15

INTERROGATORY

Reference: Exhibit C Tab 1 Schedule 1

Preamble: Enbridge has assumed that in 2018 it will be a related person with Union Gas Limited ("Union") in Ontario and Gazifère Inc. ("Gazifère") in Québec, and will therefore be required to share and allocate the purchase and holding limits between the three entitities.

The Company's planning further assumes that it will not be a related person to any additional entities in 2018.

a) Please indicate how this fits with the Affiliate Relations Code.
b) Please indicate how 2018 administrative costs will be allocated once Amalco is in place.

RESPONSE

a) The allocation of purchasing and holding limits between the three entities is separate and apart from the Affiliate Relationships Code. Allocation is a requirement of Ontario Regulation 144/16: The Cap and Trade Program Sections 40(3) and 42(2).

b) Please refer to Board Staff Interrogatory #16a, filed at Exhibit I.1.EGDI.STAFF.16.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #16

INTERROGATORY

Reference: Exhibit C, Tab 4, Schedule 1, Appendix A, page 5

Has Ontario updated any protocols other than the Landfill Gas Offset Protocol? If so, please provide a list and any changes these protocols are expected to have on Enbridge's application.

RESPONSE

Please refer to the response to Energy Probe Interrogatory #2, filed at Exhibit I.1.EGDI.EP.2.

Witness: J. Murphy

ENERGY PROBE INTERROGATORY #17

INTERROGATORY

Reference: Exhibit C, Tab 4, Schedule 1, Appendix A, page 8

Given that Enbridge will be purchasing offsets and, potentially, partnering in offset projects, how does Enbridge intend to deal with the risk of reversals? Will Enbridge's shareholder eat the cost of any reversals or will Enbridge recover those costs from ratepayers?

RESPONSE

Enbridge's strategy with respect to offset credits is provided for the Board's consideration under confidential cover in Exhibit C, Tab 4, Schedule 1. Enbridge is not permitted to provide this information for reasons of confidentiality as set out in the Climate Change Mitigation and Low-carbon Economy Act, 2016 ("Climate Change Act"), Cap and Trade regulations and the Report of the Board in respect of the Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities (EB-2015-0363) ("Framework").

Enbridge believes that by the utilization of the Board's Guiding Principles, it appropriately minimizes risks to its ratepayers.

Additionally, please refer to the response to Energy Probe Interrogatory #3c filed at Exhibit I.C.EGDI.EP.3.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #18

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1, page 7

Does Enbridge have a threshold of money it will allocate to individual pilot projects?

RESPONSE

Enbridge has not identified a threshold (or a maximum) of money it will allocate to individual pilot projects. Please see response to Board Staff Interrogatory #23, filed at Exhibit I.1.EGDI.STAFF.23, for more discussion around project selection and funding levels.

Witness: F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #19

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1, page 9

a) Within the GGEIDA, does Enbridge have a target percentage of administrative costs in relation to total costs?
b) Has Enbridge/Clear Blue compared its 1.8% to other utilities in California, Quebec and to Union? If so please provide this comparison.

RESPONSE

a) and b) Please refer to the response to Energy Probe Interrogatory #4, filed at Exhibit I.C.EGDI.EP.4.

Witnesses: A. Langstaff
F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #20

INTERROGATORY

Reference: Exhibit C, Tab 6, Schedule 1, page 6

Given the increased activity surrounding carbon markets and the increase in the number of credits traded in Over the Counter (OTC) markets, how will Enbridge deal with a situation where carbon credits in the OTC are selling below the floor price?

RESPONSE

Enbridge is not permitted to provide this information for reasons of confidentiality as set out in the Climate Change Mitigation and Low-carbon Economy Act, 2016 ("Climate Change Act"), Cap and Trade regulations and the Report of the Board in respect of the Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities (EB-2015-0363) ("Framework").

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #21

INTERROGATORY

Reference: Exhibit C, Tab 6, Schedule 1, page 6

Will Enbridge seek to recover non-compliance costs from ratepayers or is its shareholder responsible for those costs?

RESPONSE

Enbridge believes that the risk of non-compliance is minimized through planning undertaken on the basis of the Board's Guiding Principles in conjunction with the Company's comprehensive governance approach. Should non-compliance costs be incurred they would be sought for recovery on the merits of the situation at that time.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #22

INTERROGATORY

Reference: Exhibit C Tab 6 Schedule 1 Page 14

The Company notes that there is no contractual mechanism or rate class parameters for natural gas fired power generators on an unbundled distribution rate to comply with annual forecasts.

a) Please indicate the Rates applicable to Power Generators
b) Please provide the 2018 volume and emissions forecasts for Power Generators by rate class and total
c) If there is a difference in volume during the year how will this be recorded and how will these costs be recovered? Please explain in detail

RESPONSE

a) The Cap and Trade proposed unit rates applicable to Power Generators, which were provided in Exhibit G, Tab 1, Schedule 1, Appendix B, are shown below:

Rate Class	**Customer Related Charge**	**Facility Related Charge**
125 (Non-Dedicated)	3.5599 ¢/m^3	0.0336 ¢/m^3
125 (Dedicated)	3.5599 ¢/m^3	0.0016 ¢/m^3
300 (Firm or Interruptible)	3.5599 ¢/m^3	0.0336 ¢/m^3

b) The 2018 volumes and emissions forecasts, which were provided in Exhibit C, Tab 2, Schedule 1 and Exhibit C, Tab 3, Schedule 1 respectively, are shown below:

Rate Class	**Volume (10^3 m^3)**	**GHG Emissions (tCO_2e)**
125 (Non-Dedicated)	319,562.5	599,060.5
125 (Dedicated)	124,896.5	234,134.4
300 (Firm or Interruptible)	518.6	972.2
Total	444,977.6	834,167.0

c) All customers, excluding LFE and other exempt customers, are charged the customer-related Cap and Trade unit rate based on their actual consumption. Therefore, actual net customer-related volumes which vary from

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

forecast would not result in customer Cap and Trade related amounts to be recovered or refunded, as higher (or lower) volumes would automatically result in higher (or lower) customer related Cap and Trade recoveries, which would offset the higher (or lower) cost of compliance (emission allowance requirement), each of which would be recorded in the Greenhouse Gas Emissions Compliance Obligation – Customer Related Variance Account ("GGECOCRVA").

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #23

INTERROGATORY

Reference: Exhibit D, Tab 6, Schedule 1, page 5

a) Given the proposed amalgamation of Union and Enbridge, have the utilities considered any consolidation of their cap and trade compliance activities? If there has been any consolidation, please provide evidence. Including cost reductions.
b) How are compliance costs allocated to Gazifere? Please explain. Has this allocation been approved by the Regie?

RESPONSE

a) Please refer to the response to Board Staff Interrogatory #16a filed at Exhibit I.1.EGDI.STAFF.16.

b) Gazifere is a separate participant in the Cap and Trade program, and is currently responsible for the development, reporting and implementation of their own Cap and Trade activities.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

ENERGY PROBE INTERROGATORY #24

INTERROGATORY

Reference: Exhibit G, Tab 1, Schedule 1, page 6

a) Please calculate the 2018 cap and trade rate and bill impacts for customers including administrative and other carrying costs.
b) For a residential customer, Cap and Trade charges will increase to $86 in 2018 compared to 2017. Please explain in detail the drivers for the increase, including lower volumes, carbon price etc.
c) How much funding has Enbridge received from the Province in 2017 and what is expected in 2018?
d) Please provide Enbridge's view whether lack of Bill transparency is resulting in low customer understanding and acceptance of C&T
e) How many customers accessed ("hits") and how many completed the on-line C&T calculator in 2017?

RESPONSE

a) Please refer to Board Staff interrogatory #31c filed at Exhibit I.4.EGDI.STAFF.31 for the impact of the administrative costs on the typical residential customer. The actual carrying costs associated with the GGEIDA's balance will not be known until the time of disposition.

b) The primary driver is due to the increase in carbon prices based on the design of the Cap and Trade program, which increase the price of allowances by 5% plus the rate of inflation each year.

c) It is not clear what "funding" is being referenced in this question. Enbridge has not received any funding specific to the implementation of Cap and Trade. Enbridge and its customers will benefit from some programs being implemented using the proceeds from Cap and Trade.

d) Enbridge has not seen any information that would clearly support the assumption that "lack of Bill transparency is resulting in low customer understanding and acceptance of C&T", but Enbridge has not done specific research in this regard.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

e) Please refer to Board Staff interrogatory #29b) filed at I.3.EGDI.STAFF.29.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

GEC INTERROGATORY #1

INTERROGATORY

At Exh B, Tab 1, Sch 1, Enbridge states that "although the Company is submitting a one- year Compliance Plan", it "uses a longer planning horizon when considering financial instrument planning and investments that involve customer and facility abatement."

a. Please provide a summary explanation of how the Company does this.
b. In developing its 2018 Compliance Plan, did the Company assign value to measures or strategies that if implemented in 2018 would provide carbon emission reductions not only in 2018 but in subsequent years as well? In other words, did the Company value a strategy that reduced carbon emissions for 5 years more than one that reduced carbon emissions – or enabled the Company to meet carbon emission obligations, such as through purchase of emission allowances – for only one year?
c. If the answer to part "b" of this question is yes, how was that done? For example, did the Company develop estimates of multi-year streams of costs, carbon emission reductions, and other benefits for each measure or strategy considered for implementation in 2018 and then compare the net present value (NPV) of costs per lifetime ton of carbon emissions avoided or offset? Or did it compute a levelized cost per ton of carbon emissions avoided or offset? If it did neither of these things, what form of analysis did it perform to compare the relative costs of different potential strategies? Please provide copies of all such analyses, in Excel with formulae intact. If parts of any such analyses are deemed confidential, please provide portions that are not confidential, as well as a hypothetical example of how the confidential portions of the analyses were conducted (i.e. absent the confidential assumptions).

RESPONSE

a) It is accurate that Enbridge filed a one-year Compliance Plan for 2018, however, it did not consider the planning process in a silo. The Company incorporated both the Long Term Carbon Price Forecast ("LTCPF") and the Marginal Abatement Cost Curve ("MACC") into its contextual understanding of the market as well as in the

Witnesses: D. Johnson
A. Langstaff
J. Murphy
F. Oliver-Glasford

case of the MACC, cost effective abatement.

b) Enbridge understands that the carbon and natural gas savings for the life of assessed measures were included in the Board's MACC study.

c) Please see response to b). Also for additional discussion please see the response to Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24.

Witnesses: D. Johnson
A. Langstaff
J. Murphy
F. Oliver-Glasford

GEC INTERROGATORY #2

INTERROGATORY

At Exh. C, T 1, S 1, p. 6, Enbridge states that it retained Alpha Inception LLC to develop a “Carbon Market Report” and a “Carbon Strategy Report”. Please provide the scopes for work for these two products.

RESPONSE

In 2016, Enbridge retained the services of Alpha Inception LLC to assist with Enbridge’s preparation for Ontario’s Cap and Trade program and provide the two reports mentioned above.

The Carbon Market report discusses basic program facts and defines the compliance instruments available to Enbridge as a capped participant. The Carbon Strategy Report analyzes Enbridge’s compliance obligation and sets out carbon portfolio recommendations. Both reports contain confidential information, and thus have been filed in redacted form through EB-2016-0300.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

GEC INTERROGATORY #3

INTERROGATORY

At Exh. C, T 1, S 1, p. 7, Enbridge states that "with the Guiding Principal of cost-effectiveness top of mind, Enbridge will aim to minimize the costs of meetings its compliance obligation."

a. What does the Company mean by "cost-effectiveness" in this statement? Please include in the response whether it means lowest lifecycle cost or lowest first year cost per ton of carbon. Please also include in the response whether it means lowest utility cost per ton of carbon (i.e. akin to the utility cost test in DSM terms) or lowest societal cost per ton of carbon (i.e. akin to the TRC or Societal Cost tests in DSM terms).
b. Please explain what analysis the Company performed to compare the costs per ton of carbon of different compliance measures or strategies.
c. Please provide all such analyses in Excel, with formulae intact. If parts of any such analyses are deemed confidential, please provide portions that are not confidential, as well as a hypothetical example of how the confidential portions of the analyses were conducted (i.e. absent the confidential assumptions).

RESPONSE

a) Enbridge contemplated cost effectiveness with several considerations, including: bill impact to the customer in 2018, as well as longer term savings (as was outlined through the MACC).

b) Enbridge used the LTCPF and the MACC as considerations in its comparison of compliance strategies. In addition, please see response to Board Staff Interrogatory #24 filed at Exhibit I.1.STAFF.EGDI.24.

c) Please see b).

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

GEC INTERROGATORY #4

INTERROGATORY

At Exh. C, T2, S 1, p. 1, Enbridge states that it "will only procure compliance instruments that can be used to meet the Company's compliance obligation, are readily available, are a reasonable cost option with a reasonable risk profile…"

a. How does Enbridge define "reasonable cost option" in this statement?
b. Please explain how the Company defines "reasonable risk profile" in this statement?
c. What did the Company do to compare the risk of different potential compliance options, including both the purchase of emission allowances and the pursuit of customer and facility abatement options? Was risk quantified in any way? If so, how?
d. Please provide any analysis of comparative risk of compliance measures that the Company performed.

RESPONSE

a. and b. Enbridge will procure compliance options at reasonable costs and risk profile based on market information available at the time of the transaction. The specific detail regarding the methodology for evaluation of compliance instruments is considered confidential. Enbridge is not permitted to provide this information for reasons of confidentiality as set out in the Climate Change Mitigation and Low-carbon Economy Act, 2016 ("Climate Change Act"), Cap and Trade regulations and the Report of the Board in respect of the Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities (EB-2015-0363) ("Framework"). Enbridge has provided additional details to the Board under confidential cover in response to a confidential interrogatory from Board Staff.

c. and d. The evaluation of risk for potential compliance options will be completed at the time a purchase is contemplated. Specifics of this analysis may be considered confidential, depending on the nature of the option and specific transaction details.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

GEC INTERROGATORY #5

INTERROGATORY

In response to Staff Interrogatory 1(a), which asked the Company to "provide any analysis, with underlying assumptions, that Enbridge Gas has done with respect to the cost-effectiveness of RNG versus other abatement options", the Company provided a short narrative making reference, among other things to the MACC. However, the Company did not provide any specific numerical assumptions, calculations, Excel files or other forms of analysis. Please confirm that this means the Company did not perform any quantitative analysis itself to assess cost-effectiveness and/or to compare the costs per unit of carbon emission reductions that would be provided by different potential abatement options? If not confirmed, please explain what quantitative analysis the Company did perform, and provide the analysis, including all assumptions.

RESPONSE

The volumes of RNG that can be procured will be solved based on the price provided in bids to the intended RFP process and the level of funding received from the Government. As stated in the Company's responses to Board Staff Interrogatory #1, filed at Exhibit I.C.EGDI.STAFF.1, and the Company's response to CCC Interrogatory #10 at filed at Exhibit I.C.EGDI.CCC.10, the Company assumed that it was the cost per tonne of GHG emissions savings net of any government funding that should be applicable to the other abatement options outlined in the MACC.

In addition, the Company has identified that all of the cost effective abatement opportunities (i.e., all of which were energy efficiency related) have been undertaken by the existing DSM programs.

Please also see the response to Board Staff Interrogatory #24 a and b, filed at Exhibit I.1.EGDI.Staff.24.

Witnesses: A. Chagani
D. Johnson
S. McGill
F. Oliver-Glasford

GEC INTERROGATORY #6

INTERROGATORY

Issue 1.4 - Has the gas utility reasonably and appropriately conducted its Compliance Plan option analysis and optimization of decision making?

The MACC results are presented in terms of utility costs rather than societal costs.

a. Does Enbridge agree that "utility cost" is the best cost metric for informing decisions regarding which carbon emission compliance options should be pursued? If not, why not?
b. If the answer to part "a" of this question is yes, does the Company believe that the test Ontario uses to assess cost-effectiveness of energy efficiency be changed to the Utility Cost Test? If not, why should the test used to determine which efficiency resource merit investment be different than the test used to determine which other gas utility resources merit investment?
c. If the answer to part "a" of this question is yes, does the Company agree that any efficiency resource whose utility cost per ton of GHG emission reduction is lower than other alternatives should be procured? If not, why not?

RESPONSE

a) to c)

During the development of the MACC there was some questions and required clarification around what was being used in the analysis and why. Given the current uncertainties in the Ontario marketplace given the level of funding committed by the Government of Ontario to GHG reduction initiatives which makes the current MAAC's results unreliable, the Company believes that this provides the time needed to consider fully the metrics used in the MACC and to propose appropriate refinements, perhaps to the Cap & Trade Working Group, who will be considering enhancements to the Cap & Trade Framework going forward.

Witnesses: D. Johnson
A. Langstaff
S. McGill
J. Murphy
F. Oliver-Glasford

GEC INTERROGATORY #7

INTERROGATORY

At Exh B, T2, S, p. 2, Enbridge states that the "partially effective volumetric reduction" associated with its 2018 DSM plan is 31,139 103m3.

a. Please explain what "partially effective volumetric reduction" is. Is it an estimate of total savings for the year that adjusts for the fact that efficiency measures promoted through the program are installed throughout the year (e.g. some in January, some in July, some in December, etc.), with measures installed earlier in the year providing more savings during the calendar year than those installed at the end of the year? If not, please explain.
b. Please explain how the "partially effective volumetric reduction" is computed? For example, does the Company assuming that 1/12 of measures are installed each month, or does it forecast savings by month to account for historical patterns regarding when measures are installed, or does it do something else?
c. Please provide the specific assumptions and calculations that led to the estimate of 31,139 103m3. Please provide them in Excel, with formulae intact.
d. Please provide a breakdown of the 31,139 103m3 by program.

RESPONSE

a) Please see response to Board Staff Interrogatory #14 part a filed at Exhibit I.1.EGDI.STAFF.14.

b) Please see response to Board Staff Interrogatory #14 part a filed at Exhibit I.1.EGDI.STAFF.14.

c) Please see attachment for details of the calculation of partially effective DSM volumes.

d) Enbridge cannot allocate specific volumes to programs for 2018. However, in an effort to be helpful, the Company has provided the programs offered to Rate 1 and Rate 6 customers consistent with what was in the 2015 to 2020 Multi-Year DSM Plan (EB-2015-0049).

   Rate 1 – Home Energy Conservation, Adaptive Thermostat, Low Income Winter Proofing

   Rate 6 – Commercial & Industrial Custom, Commercial & Industrial Prescriptive, Run it Right, Direct Install, Low-Income MR Affordable Housing

Witnesses: D. Johnson
M. Suarez

2018 OEB DSM Target Volume

Fully Effective @75% (10^3m^3)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Annual DSM Saving @ 100%
Rate 1	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	1,047.3	12,567.7	16,756.9
Rate 6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	2,781.6	33,379.1	44,505.5
Rate 110	440.1	440.1	440.1	440.1	440.1	440.1	440.1	440.1	440.1	440.1	440.1	440.1	5,280.8	7,041.0
Rate 115	351.3	351.3	351.3	351.3	351.3	351.3	351.3	351.3	351.3	351.3	351.3	351.3	4,215.7	5,620.9
Rate 135	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	167.4	223.2
Rate 145	62.6	62.6	62.6	62.6	62.6	62.6	62.6	62.6	62.6	62.6	62.6	62.6	750.9	1,001.2
Rate 170	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	1,125.1	1,500.2
Total Fully Effective Volumes	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**4,790.6**	**57,486.6**	**76,648.8**

Partially Effective Volumes Summary (10^3m^3)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rate 1	87.3	174.6	261.8	349.1	436.4	523.7	610.9	698.2	785.5	872.8	960.0	1,047.3	6,807.5
Rate 6	231.8	463.6	695.4	927.2	1,159.0	1,390.8	1,622.6	1,854.4	2,086.2	2,318.0	2,549.8	2,781.6	18,080.4
Rate 110	36.7	73.3	110.0	146.7	183.4	220.0	256.7	293.4	330.0	366.7	403.4	440.1	2,860.4
Rate 115	29.3	58.6	87.8	117.1	146.4	175.7	204.9	234.2	263.5	292.8	322.0	351.3	2,283.5
Rate 135	1.2	2.3	3.5	4.6	5.8	7.0	8.1	9.3	10.5	11.6	12.8	13.9	90.7
Rate 145	5.2	10.4	15.6	20.9	26.1	31.3	36.5	41.7	46.9	52.1	57.4	62.6	406.8
Rate 170	7.8	15.6	23.4	31.3	39.1	46.9	54.7	62.5	70.3	78.1	85.9	93.8	609.4
Total Partially Effective Volumes	**399.2**	**798.4**	**1,197.6**	**1,596.9**	**1,996.1**	**2,395.3**	**2,794.5**	**3,193.7**	**3,592.9**	**3,992.1**	**4,391.3**	**4,790.6**	**31,138.6**

GEC INTERROGATORY #8

INTERROGATORY

Union Gas notes (at Exhibit 3, Tab 1, Page 9 of 24) that "Union and EGD have developed the AC to support development of new technologies over the long-term, including the pursuit of abatement initiatives that may not be cost-effective and that will require alternative funding models (i.e. CCAP, GreenON, and federal funding) to proceed;"

a. Has Enbridge discussed such options with government entities?
b. Please list all meetings between the company and government entities during 2016 and 2017 where government and/or utility energy efficiency or other (non-RNG) GHG reduction efforts or potential efforts were discussed.
c. Please provide copies of all correspondence sent or received between the company and government entities during 2016 and 2017 where government or utility energy efficiency or other (non-RBG) GHG reduction efforts or potential efforts were discussed.

RESPONSE

a. Yes, Enbridge has discussed funding for abatement initiatives with government entities. In the Company's view, it is the government's mandate to determine which options it wishes to financially support.

b. Over the course of 2016 and 2017 the Company has made numerous presentations and had discussions with government entities about potential GHG reduction initiatives that could be supported by the province through the application of funds collected under the Cap and Trade Program (as contemplated in the CCAP). To the extent these discussions have led to programs that the Company proposes to implement, these programs have been presented as part of Enbridge's 2018 Cap & Trade Compliance Plan. Any further initiatives are at the conceptualize or formulate stages of development. To the extent that any of these initiatives advance to the approval or implementation stage the Company will present the details of these initiatives to the Board in future Cap and Trade Compliance Plans and other required regulatory proceedings. Details pertaining to discussions between the Company and the province concerning RNG were provided in response to Board Staff Interrogatory #5 at Exhibit I.C.EGDI.STAFF.5. With respect to the Company's Geothermal Energy Program please see the attached PowerPoint presentation that

Witnesses: F. Oliver-Glasford
S. McGill

was made to the Minister of Environment and Climate Change and MOECC staff on December 5, 2016.

c. Please see the Company's response to part b. of this question above.

Witnesses: F. Oliver-Glasford
S. McGill

GEC INTERROGATORY #9

INTERROGATORY

At Exh C, T 5, S 1, pp. 4-5, Enbridge states that "abatement programs should be able to draw on a variety of funding sources…" and "where appropriate, an abatement program proposal will be supported by an assessment which may use a range of funding models and appropriate valuations and assumptions."

a. Is Enbridge suggesting that the ability to "draw on a variety of funding sources" presented is a desirable "end" or rather that attempting to leverage other funding sources should be a standard practice to keep ratepayer costs as low as possible (i.e. a "means to an end")? For example, if hypothetical Strategy A had to be paid for entirely by gas ratepayers and cost $10 per ton of carbon emission reduced, would it not be preferable over hypothetical strategy B whose costs would be split 50/50 between gas ratepayers and other sources but had a total cost of $30 (and therefore $15 of ratepayer funds) per ton of carbon emission reduced.
b. When choosing between strategies, does Enbridge believe it is appropriate to consider only the utility cost per unit of carbon emission reduction, or the full societal cost per unit of carbon emission reduction, when determining which strategies are preferable? For example, would hypothetical Strategy A that had to be paid for entire by gas ratepayers and cost $10 per ton of carbon emission reduction be preferable or less desirable than hypothetical Strategy C whose costs would be split 20/80 between gas ratepayers and government and/or other funding sources but had a total cost of $25 (and therefore $5 of ratepayers funds) per ton of carbon reduced. Please explain the Company's rationale.
c. What does the term "assessment" in the cited text mean? Is it a comparative analysis of costs per unit of carbon emission reduction? If not, what is it?
d. Under what conditions does the Company believe that it would be "appropriate" for an abatement program proposal to be supported by an assessment?
e. Please provide copies of all such "assessments" of compliance options conducted by Enbridge for its 2018 Compliance Plan.

RESPONSE

a. Enbridge believes that it is prudent for it to request and leverage other funding sources as a standard practice – especially given the source of the funding has come from ratepayers to a large degree – to be cost effective and help keep ratepayer costs as low as possible (i.e., a "means to an end").

Witnesses: S. McGill
F. Oliver-Glasford

b. While best efforts are made to develop an upfront strategy for meeting our compliance obligations, inputs such as funding that may be available is not always known. It is also the case that different funds have different application or assessment process. As such, Enbridge will not always have perfect certainty on various costs and outcomes that can be derived beyond best available information and assessments. All things being equal though, Enbridge would prefer a strategy where it knew that it could drive the lowest costs for ratepayer, which in the examples presented would be Strategy C.

c. There are a number of considerations within an "assessment". It would include a cost effectiveness analysis as well as contemplation against the criteria and additional considerations outlined in the evidence at Exhibit C, Tab 5 Schedule 1. An assessment of bill impacts is also appropriate.

d. Enbridge would deem it appropriate and necessary to complete an assessment where the Company was in the propose phase of the Initiative Funnel. As well, the Company would contemplate the assessment done by the Board's MACC, and where information warrants, complete assessments to varying degrees during other stages of the Initiative Funnel. Please see Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24.

e. Assessments on RNG procurement have been provided in the 2018 Compliance Plan at Exhibit C, Tab 5, Schedule 2, and assessment of RNG enabling and geothermal have been provided in EB-2017-0319. Assessment of the MACC versus existing DSM programming was provided in the evidence at Exhibit C, Tab 5, Schedule 2, page 26, Table 3.

Witnesses: S. McGill
F. Oliver-Glasford

GEC INTERROGATORY #10

INTERROGATORY

At Ex. C, Tab 5, Sched. 1, pp. 4-5 Enbridge lists attributes of its Abatement Construct, including: "Efficient and rational development: Abatement programs should balance customer cost impacts by leveraging existing infrastructures (particularly utility infrastructure, including physical, brand, billing, program delivery) where appropriate and by not duplicating existing frameworks (e.g. DSM)." Please elaborate on the goal of not duplicating the existing DSM framework. Specifically:

a. Would increasing participation and reducing free ridership by using government program funding to increase customer incentives comply with or conflict with this goal? Please explain the reasoning for the Company's answer.
b. Would increasing financial incentive levels currently paid by the Company (or planned to be paid under its current DSM plan) in order to increase participation, savings and therefore carbon emission reductions from a given measure, set of measures or programs comply with or conflict with this goal? Please explain the reasoning for the Company's answer.
c. Would promoting a new technology or program not currently part of the Company's approved DSM plan in order to generate additional savings and carbon emission reductions comply with or conflict with this goal? Please explain the reasoning for the Company's answer.

RESPONSE

a) Enbridge understands the theory where increased incentives could be one way of driving participation, and perhaps reducing free ridership, although this is not a given. It should be recognized that the relationship between participation and free ridership is not linear and depends on other variables, such as program design. In circumstances where free ridership could decrease, due to enhanced incentives, the challenging question of how to reasonably determine an attribution of results remains. Given that Enbridge does not have attribution policy direction for government programming, the Company is unclear how the Board could treat attribution of results, thus making analysis of this argument difficult to complete at this time. The Company has raised attribution policy and related issues as part of the DSM Mid-Term Review.

b) Depending on the design of the program, additional funding may increase participation; however the Company cannot make definitive determinations as to

Witness: D. Johnson

what extent. At this time, the Board has set clear guidelines on customer cost impacts in the DSM Framework, which the Company is expected to adhere. Additional ratepayer funding may not comply with the goal of balancing customer cost impacts, as outlined in the current DSM Framework (EB-2014-0134). It is appropriate to be mindful of the fact that a customer's allocation of cap and trade compliance costs is based upon actual usage. It is not theoretical usage and thus if the customer does not participate in GHG reduction initiatives and / or DSM programs, they will not realize the benefits of the program savings and will see only the increase in costs due to the programs. The impact on customer bills is a matter that needs to be considered.

c) Currently, Enbridge believes that it considers and includes all cost effective energy efficiency technologies and programs, and continually reviews and evolves its portfolio to include promising new technologies and program design approaches. In fact, the Commercial and Industrial markets, the company has a "custom" program that allows for inclusion of any cost effective natural gas reducing technology to be considered.

Witness: D. Johnson

GEC INTERROGATORY #11

INTERROGATORY

At Ex. C, Tab 5, Sched. 1, pp. 10-11, Enbridge cites the 2017 LTEP as saying that "…we must use (natural gas) as efficiently as possible…" How does Enbridge interpret the statement "as efficiently as possible"? If the Company interprets it as anything other than capturing all efficiency resources that are cost-effective, including the cost of avoided carbon emission compliance costs, please explain why.

RESPONSE

The complete quote from the page 109 of the 2017 LTEP noted at Exhibit C, Tab 5, Schedule 1, page 11 reads: "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]" (emphasis added).

In general, the Company understands this to mean that through the LTEP the government seeks the pursuit of efficiency in the use of natural gas while furthering the application of other "clean" energy technologies. This infers a balancing of the continued efficient use of natural gas and the introduction of other means of meeting the province's energy needs with at lower environmental impact.

Witnesses: S. McGill
F. Oliver-Glasford

GEC INTERROGATORY #12

INTERROGATORY

At Ex. C, Tab 5, Sched. 1, p. 15 Enbridge notes: "As described in Exhibit C, Tab 5, Schedule 2, Enbridge concluded that **additional DSM programs** would not be cost- effective; in some cases the marginal costs of **new programs** may be higher than the cost of compliance instruments." (emphasis added)

a. Is the reference to 'new programs' inclusive of the option of enhancing existing program uptake (e.g. with increased financial incentives, increased marketing and/or other program design changes or enhancements) with or without government support? If not, was that option analysed? If so, please provide any analyses undertaken. If that option was not analysed, please indicate why not.
b. Please explain how Enbridge is defining the term "cost-effective" in the cited statement. Specifically, which of the following potential categories of benefits and costs are included:

   Benefits

   i. Avoided carbon emission permit costs,
   ii. avoided energy costs,
   iii. avoided T&D costs,
   iv. price suppression effects from lower demand,
   v. any other gas utility system cost savings,
   vi. electricity or water cost savings,
   vii. customer non-energy benefits (e.g. improved comfort or improved business productivity)
   viii. societal non-energy benefits (e.g. reduced emissions of pollutants other than greenhouse gases)
   ix. other (please specify)

   Costs

   i. DSM program costs,
   ii. Customer contributions to measure costs (i.e. the portion of measure cost not covered by utility financial incentives)
   iii. Other (please specify)

c. Please explain what is meant by the "marginal costs of new programs". Please give a concrete example to illustrate what is meant.

Witnesses: D. Johnson
F. Oliver-Glasford

d. What is the "cost of compliance instruments" to which Enbridge is referring in this cited statement? Is it the cost of carbon emission allowances? If not, please explain?
e. Which of the costs and benefit categories listed above in part b. does Enbridge understand were captured in the MACC? Which in the CPS?
f. The statement that "in some cases" costs of more DSM may be higher than the cost of compliance instruments would appear to imply that in other cases costs of DSM would be lower. Please indicate which additional DSM resources – either by program or measure – and how much additional DSM resources (in first year m3 saved, lifetime m3 saved and carbon emissions reduced) Enbridge has estimated to be either (1) more expensive or (2) less expensive than the cost of other compliance instruments.
g. Please provide all analysis, including assumptions and the sources of those assumptions, underlying the conclusions that additional DSM programs would not be cost-effective and/or that marginal costs of additional DSM may be higher than the cost of compliance instruments. If any analysis was conducted in Excel, please provide the Excel workbook file(s) in native format with all formulae intact.

RESPONSE

a) to c) and e) to g) Please see the response to Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24.

d) Yes.

Witnesses: D. Johnson
F. Oliver-Glasford

GEC INTERROGATORY #13

INTERROGATORY

At Ex.C, Tab 5, Sched. 2, p.1 Enbridge notes: “Since the Government announced its Climate Change Action Plan (“CCAP”), the Company has been responsive to evolving Government objectives and has made several proposals to advance energy efficiency in the province.” Please provide the details of all such proposals that have been made or are currently under development and provide any materials produced in support of such proposals.

RESPONSE

In addition to the proposals made in this proceeding and in the EB-2017-0319 proceeding, Enbridge has been actively monitoring and bidding on RFPs for delivery of incremental energy efficiency out of Cap and Trade funds (via GreenON Fund).

Witnesses: D. Johnson
F. Oliver-Glasford
S. McGill
J. Tideman

GEC INTERROGATORY #14

INTERROGATORY

At Exh C, T5, S2, p. 10, Enbridge's describes how its proposed RNG procurement model would work. Why is the Company not asking for approval of a similar model for funding additional energy efficiency resources?

RESPONSE

The Company is not in a position to ask for approval of a similar model for other energy efficiency resources or programs as that proposed for RNG, as Climate Change Action Plan funds for other energy efficiency initiatives are not currently being offered or proposed on the same basis.

Witness: D. Johnson

GEC INTERROGATORY #15

INTERROGATORY

At Exh C, Tab 5, Sched 2, p. 16, Enbridge discusses its proposed Geothermal Energy Service program. Under which conditions would the Company believe it to be appropriate to promote geothermal heating and cooling to its customers. For example, if cold climate air source heat pumps would be more economical for any categories of buildings, would the Company promote them instead? If not please explain why not?

RESPONSE

The efficiency of a Geothermal heat pump is greater than a cold climate air sourced heat pump in colder temperatures which makes geothermal heat pumps a more economical and robust solution. Cold climate air source heat pumps have size restrictions and would require a supplemental heat source for Ontario weather.

Enbridge anticipates that there will be some situations in retrofit markets where there are logistical difficulties affecting the installation of ground source loops. A cold climate air source heat pump with supplemental heating may be a viable solution in these cases and the Company would make the customer aware of this option.

Witnesses: P. Datta
S. McGill

GEC INTERROGATORY #16

INTERROGATORY

At Exh C, Tab 5, Sched 2, pp. 19-21, Enbridge discusses the net zero ready (NZR) program.

a. In paragraph 62, it discusses micro generation, using natural gas to produce electricity and heat, as part of the program. Please explain how a building could be net zero energy if it is burning natural gas on-site to meet its energy needs. Why wouldn't the Company instead promote new construction practices that were efficient enough to rely exclusively on the newest generation of very efficient electric heat pumps, with enough on-site renewable energy generation to offset the building's entire electric load?
b. In paragraph 64, the Company explains that a 1.5 kW micro generation unit can produce GHG reductions of 0.7 to 1.0 tCO_2e per year "by operating the unit during peak periods, to offset grid connected gas power generation plants".
    I. Please provide the calculations underpinning this conclusion. Please also provide all key assumptions, including but not limited to assumptions regarding the heat rate (i.e. BTUs in per kWh of output), amount of heat produced per kWh, and annual hours of operation of the micro- generation unit, as well as the heat rate of the gas-fired power plant assumed to be offset.
    II. Would an on-site, natural gas driven micro generation unit produce more GHG reductions than a cold climate air source heat pump or a geothermal heat pump? Please provide assumptions and calculations supporting the Company's response.
    III. What is the cost of a 1.5 kW micro generation unit? Please provide supporting documentation for the Company's response.

RESPONSE

a) Enbridge defines a net-zero home as one that achieves "net zero carbon", which the Company believes is in line with the Province's Climate Change Action Plan ("CCAP"). Although a house may be built with solar PV generating capacity, it may still rely on grid-supplied electricity during times of lower generation, such as during the winter. The use of micro-CHP for highly efficient on-site generation of power and heat when solar production is weak in the winter results in the home's portfolio of on-site generation having a more significant reduction in emissions within the larger energy economy.

Witnesses: S. McGill
R. Sigurdson

b) The numbers provided in Exhibit C, Tab 5, Schedule 2 in respect to potential GHG savings were included to give some context as to why the specific abatement projects are being investigated in the Initiative Funnel. This data is preliminary, based on publicly available information and high level internal calculations. The goal of the Initiative Funnel is to investigate these technologies to determine the GHG savings and costs, which will assist in the evaluation of technologies to be put forward for full scale implementation. At such time as the Company decides to proceed with implementation, a more complete analysis would be provided through the applicable Compliance Plan filing.

Witnesses: S. McGill
R. Sigurdson

GEC INTERROGATORY #17

INTERROGATORY

At Exhibit C, tab 5, Schedule 2, p. 22 Enbridge states that the GHG savings from a residential gas-fired heat pump "could range from 0.8 – 1.5 tCO_2e per year" relative to a new ENERGY STAR rated gas furnace.

a. Please provide the calculations underpinning this conclusion. Please also provide all key assumptions, including but not limited to assumptions regarding the gas heat pump Coefficient of Performance (COP) and assumed building heating load in BTUs per year.
b. What is the basis for the Company's assumption regarding the gas heat pump COP provided in response to part "a" of this question?
c. What is the current cost of a gas-fired heat pump for residential applications?
d. How much more expensive than an Energy Star rated gas furnace is a gas-fired heat pump?

RESPONSE

a) to d) Please refer to the response to GEC Interrogatory #16b, filed at Exhibit I.1.EGDI.GEC.16.

Witnesses: S. McGill
R. Sigurdson

GEC INTERROGATORY #18

INTERROGATORY

At Exhibit C, Tab 5, Schedule 2, pp. 22-23, Enbridge discusses "expanded use of natural gas as a vehicle fuel". Has the Company conducted any comparative analysis of the cost and carbon impacts of switching to electricity instead of to natural gas to run trucks and buses? If so, please provide such analysis.

RESPONSE

Enbridge has not undertaken or sponsored "comparative analysis of the cost and carbon impacts of switching to electricity instead of to natural gas to run trucks or buses". However, the Company supports GHGenius as the 'well-to-wheel' emission modeling tool for Canada. GHGenius is maintained by ("S&T")^2 Consultants Inc. and has been used by NRCan, and other industry stakeholders. Using the current version of GHGenius (V 4.03a), a 13 to 15% well-to-wheel GHG reduction is calculated for the Ontario transportation emission profile. This reduction increases to 89% when CNG is substituted with RNG and delivered using the natural gas distribution network. Although there are electric and hydrogen demonstration heavy duty vehicles currently testing prototype technologies, they are not ready for market deployment.

Witnesses: R. Dysiewicz
S. McGill

GEC INTERROGATORY #19

INTERROGATORY

At Exhibit C, Tab 5, Sched 2, pp. 25-26, Enbridge observes differences between the MACC study results, the Conservation Potential Study results and its own DSM efforts and states that "At a minimum, this analysis serves as a reminder that in designing and deploying DSM to date, Enbridge has been aggressive in its pursuit to reduce volumes and emissions through the most cost-effective opportunities available."

a. Outside of its review of the MACC and Conservation Potential Study, has Enbridge analyzed the extent to which it could increase DSM savings by expanding its own DSM plans, whether through the addition of new measures or programs, through increased financial incentives for measures and programs already part of its DSM portfolio, through increased marketing of its existing DSM programs and/or through other means? If so, please provide the results of that analysis, including the potential increase in savings and spending required to achieve it, as well as all underlying analysis and assumptions.
b. If the Company has not conducted the analysis referenced in part "a" of this question, please provide the Company's qualitative opinion regarding whether it could acquire additional energy savings cost-effectively. Please explain the basis for this opinion, and include in the response how the Company defined cost-effective.
c. If the Company has not conducted the analysis referenced in part "a" of this question, please provided the Company's qualitative opinion regarding whether it could acquire additional energy savings cost-effectively, where cost-effective is defined as having a benefit cost ratio of greater than 1.0 under the Utility Cost Test (UCT), including avoided carbon emission allowance purchases. Please explain the basis for this opinion.
d. Would the Company agree that if it could increase cost-effective DSM savings, that acquisition of such additional savings would impose fewer costs on its ratepayers as a whole than:
    i. carbon emission allowance purchases; or
    ii. any of the abatements strategies included in Stages 1, 2, and 3 of the Company's Cap and Trade plan (see Exh C, Tab 5, Sched 2, Table 1 p. 3)?

    If not, please identify each specific proposed plan strategy that the Company believes would impose lower costs on ratepayers as a whole than additional cost-effective efficiency resource acquisition, provide an explanation for why the Company believes that strategy would impose lower costs on ratepayers as a

whole than additional cost-effective efficiency resource acquisition, and provide all analysis and assumptions (in Excel with formulae intact) that the Company has conducted to support its conclusion.

If the Company's response is different depending on whether cost-effectiveness is defined using the TRC or UCT, please provide the response both ways.

e. If the Company believes that it could increase cost effective DSM savings, please explain why such an increase was not included in its proposed list of abatement measures in its 2018 carbon cap and trade plan.

RESPONSE

a) Please see the company response to Board Staff Interrogatory #24 a and b, filed at I.C.EGDI.STAFF.24.

b) and c) Please see the response to Board Staff Interrogatory #24 a and b, filed at Exhibit I.1.EGDI.STAFF.24. In the context of this Cap and Trade filling, the Company defines cost effective energy efficiency as programs or offers that are lower cost to its customers than the purchase of financial instruments, such as allowances, on a $/t$CO_2$e basis having appropriate regard to appropriate adjustments to estimates to insure that a program does not include unnecessary costs.

c)

i) Please see response to GEC Interrogatory #6, filed at Exhibit I.1.EGDI.GEC.6.

ii) As some of these initiatives are still in the conceptual stage, the company does not yet know the full cost and thus the cost effectiveness of these initiatives.

d) and e)

Please see the response to Board Staff Interrogatory #24a and b, filed at I.1.EGDI.STAFF.24.

Witness: D. Johnson

GEC INTERROGATORY #20

INTERROGATORY

At Exhibit C, Tab 5Schedule 2, p. 25 the company says: "75. An analysis of the MACC study results as compared to the Company's DSM plans shown in Table 3 below indicates that Enbridge's current DSM Plan delivers results for ratepayers that are well in excess of what the MACC study would otherwise indicate is cost-effective under a Mid-Range LTCPF scenario. At present, Enbridge does not have sufficient insight into the underlying analysis of the MACC study to fully understand what is driving the clear differences between the MACC study results, the Conservation Potential Study results and the Utilities' DSM Plans."

a. Why did Enbridge not investigate the reasons for this result? Has the company done so since filing its application (perhaps in preparing its mid-term review filing)? If so, please provide your current understanding. If not, why not?
b. Is it the company's understanding that the MACC includes or excludes the avoided costs of DSM (apart from the avoided C&T compliance costs)?
c. Does the company agree that DSM can be cost effective even though the utility costs of the DSM are higher than the avoided cost of allowances or credits

RESPONSE

a) Enbridge did investigate to some extent but has been unable to resolve all the differences at this time. Enbridge will continue to work towards ensuring appropriate cost-effectiveness review for carbon compliance abatement, and DSM.

b) It is the Company's understanding, as is confirmed in the MACC study itself, that the MACC includes the avoided cost of natural gas for the lifetime of the measure(s) as well as the avoided Cap and Trade compliance costs.

c) Please see response to Board Staff Interrogatory #24 filed at I.1.EGDI.STAFF.24, and response to GEC Interrogatory 24, filed at I.1.EGDI.GEC.24.

Witnesses: D. Johnson
F. Oliver-Glasford

GEC INTERROGATORY #21

INTERROGATORY

At Exhibit C, Tab 5, Schedule 2, Page 26, Enbridge cites the Board's observation that "[the Board] is confident that any potential overlap can be appropriately addressed through the robust Evaluation, Measurement & Verification ("EM&V") process of the DSM Framework." Enbridge then states that it "believes that managing any overlap via the EM&V process will be overly complex and difficult."

a. What are the implications of this perspective? Has this issue limited Enbridge's pursuit of, or proposing of, the enhancement of existing DSM efforts (either with or without government support) to date?
b. Does Enbridge propose to preclude GHG abatement activity that overlaps with DSM programs? If not, how does Enbridge propose to manage overlapping efforts and to evaluate results other than with the EM&V process? In responding to this request please consider the situation where existing DSM program performance is enhanced by way of increased customer incentives funded by a government program as well as the situation where economies of scope or scale are obtained by co-delivering existing DSM program measures with new GHG Abatement efforts (however funded).

RESPONSE

a) Please see the response to Board Staff Interrogatory #24b, filed at Exhibit I.1.EGDI.STAFF.24.

b) Please see the responses to Ontario Sustainable Energy Association Interrogatory #11a, filed at Exhibit I.1.EGDI.OSEA.11 and Board Staff Interrogatory #24b, filed at Exhibit I.1.EGDI.STAFF.24.

Witness: D. Johnson

GEC INTERROGATORY #22

INTERROGATORY

At Exhibit C, Tab 5, Schedule 2, pp. 28-29, the Company discusses its inclusion of the Green Investment Fund (GIF) Residential Energy Efficiency as part of its Cap and Trade Plan. In that discussion, the Company states that the program is "similar to Enbridge's existing DSM offer, the Home Energy Conservation program", and also promotes the deployment of Adaptive Thermostats, which is "consistent with the Company's DSM program".

a. Please explain how the GIF program and the Company's programs promoting the same (or very similar) efficiency measures and services will function in parallel and/or be integrated.
b. How will participants, savings and carbon emission reductions from the GIF program be tracked and evaluated separately from Enbridge's Home Energy Conservation program and its existing DSM efforts to promote Adaptive Thermostats?
c. If the Company can manage to separately track savings and carbon emission reductions from the GIF program and its existing DSM programs, why would separately tracking savings and carbon emission reductions from expansions of its other existing DSM offerings be "overly complex and difficult" (Exh C, T5, S2 p. 26)? What would be different about expanding other programs that would make assessment of additional savings and carbon emission reductions so much more complex and difficult than for expansion of Enbridge's residential retrofit program?

RESPONSE

a) The GIF program leverages the Companies existing HEC program. To the customer, there is only one program marketed as HEC, which is sponsored by both Enbridge and the Ministry of Energy ("MOE"). The program requirements, eligibility rules and incentive amounts are the same; however the GIF program is inclusive of non-gas fuel sources and customers outside of Enbridge's franchise area. Both programs are being delivered in parallel due to the terms of the Transfer Payment Agreement ("TPA") with the MOE that stipulates program operations and attribution of results. Through the attribution policy determined in the TPA, the Company continues to claim gas savings towards DSM, and incremental gas and all non-gas fuel savings are attributed to GIF.

b) Participants are tracked separately based on the agreed to attribution methodology per the TPA. The evaluation of the participants will occur in the same manner as

Witnesses: D. Johnson
J. Tideman

those participating in the DSM program; however, the GIF program is not subject to DSM guidelines and is therefore not subject to free ridership requirements or base case reductions. Reports are provided to the MOE on participation and results.

c) The GIF agreement between the MOE and Enbridge is the result of long and complex negotiations that took a considerable amount of time. Enbridge believes that similar complex discussions would also be required for any incremental ratepayer-funded energy efficiency program(s). To better support negotiations for incremental energy efficiency, the Company believes as part of the DSM Mid-Term Review, the Board should provide additional guidance beyond current language to simplify and improve the compatibility and understanding of how DSM and Cap and Trade customer abatement activities will operate and be measured.

Witnesses: D. Johnson
J. Tideman

GEC INTERROGATORY #23

INTERROGATORY

At Exh C, Tab 5, Sch 2, pp. 27-28, Enbridge summarizes three recommendations it has made for the DSM mid-term review which it believes will achieve better alignment between Cap and Trade and DSM frameworks "and maximize benefits for all parties". The second of those recommendations is to "re-align DSM budgets and targets to recognize the increased need for a robust DSM presence in the energy efficiency market as a result of Cap and Trade". Please clarify what the Company means by this statement.

a. Is the Company suggesting that DSM budgets and targets should be increased? If not, what is the Company suggesting with regards to how DSM budgets and savings targets should change to reflect "the increased need for a robust DSM presence in the energy efficiency market as a result of Cap and Trade"?
b. If the Company is suggesting that DSM budget and targets should be increased, what principles does the Company believe should guide decisions regarding how much they should be increased? For example, does the Company believe that they should be increased to the point where all efficiency resources that are cost-effective (including avoided need to purchase carbon emission allowances) should be acquired? If so, using what definition of cost-effectiveness? If not, why not?

RESPONSE

a) As noted in the Company's submission filed on January 15, 2018 as part of the Mid-Term filing EB-2017-0128, it is proposing either an increase in program budgets (to pay for the unbudgeted increase in customer incentives) or a decrease in targets. This is to ensure the Company has sufficient resources to execute on our programs, which the Company views as important to ensuring a robust DSM presence.

b) The Company is not proposing an increase in DSM targets.

Witness: D. Johnson

GEC INTERROGATORY #24

INTERROGATORY

Regarding the Company's use of the MACC results to determine whether additional efficiency savings could be cost-effectively acquired:

a. Is it accurate to say that the MACC study used efficiency potential identified in the Conservation Potential Study?
b. Is it accurate to say that the Conservation Potential Study (CPS) quantified efficiency that was cost-effective based on the TRC test?
c. Is it accurate to say that the Company is assessing cost-effectiveness of potential carbon abatement strategies using the equivalent of the utility cost test (UCT) – i.e. by comparing only the cost the utilities must incur to reduce or offset carbon emissions, and not including other costs borne by Government and/or other parties for those measures or strategies?
d. If the answers to the three questions above are all "yes", wouldn't the CPS and MACC study understate cost-effective efficiency potential – perhaps even by a very large amount – because it did not consider how much savings could be acquired if cost-effectiveness was based on the UCT (given that utility costs are often much lower than TRC cost)?

RESPONSE

a) Enbridge is not clear as to what GEC means by "efficiency potential". The Conservation Potential Study had three conservation potential scenarios that were developed: the technical potential scenario (which included savings from all technically-feasible measures), the economic potential scenario (a subset of the technical potential that includes only those measures that are cost-effective using the TRC-plus test) and finally, the achievable potential scenario.

b) The CPS ran several different scenarios of efficiency as highlighted in part a) of this question. TRC was a factor in some of those cases.

c) For DSM purposes, the EB-2014-0134, Filing Guidelines to the 2015-2020 DSM Framework directs the natural gas utilities to screen prospective DSM programs using the Total Resource Cost-Plus ("TRC-Plus") test.[1] Further the Board directed the natural gas utilities to also use the Program Administrator Cost ("PAC") test as a

[1] c)b) EB-2014-0134 Filing Guidelines to the 2015-2020 DSM Framework Page 26

Witness: D. Johnson

secondary reference tool to help prioritize programs that deliver the most cost-effective results.[2] The MACC indicates it uses a Utility Cost Test to assess cost effectiveness. When there is clarity on the significant funds entering the market for abatement activities, the Company will be better positioned to run incremental cost effectiveness assessments. In this regard, please see the response to Board Staff Interrogatory #24 filed at I.1.EGDI.STAFF.24. While the Government continues to undertake various GHG emission reduction initiatives with the funding that has been committed, it is the expectation of the company that the anticipated refinements to the MACC and clarity on the appropriate use of its results will be considered by the Cap & Trade working group for review by the Board.

d) See response to parts a through c.

[2] EB-2014-0134 Filing Guidelines to the 2015-2020 DSM Framework Page 26

Witness: D. Johnson

GEC INTERROGATORY #25

INTERROGATORY

In response to Staff Interrogatory 1(c), which asked for all information underlying the Company's conclusion that "additional DSM programs would not be cost-effective; in some cases the marginal costs of new programs may be higher than the cost of compliance instruments", the Company makes reference only to the MACC results and a comparison of those results to the savings estimates currently forecast for its DSM programs as shown in Table 3 of Exh. C, T5, S2 (p. 26). Is the analysis provided in the referenced Table 3 the sole basis for the Company's conclusion? If not, please explain and provide any other analyses conducted.

RESPONSE

Please see the Company's response to Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24.

Witness: D. Johnson

GEC INTERROGATORY #26

INTERROGATORY

In response to Staff Interrogatory 1(d), Enbridge provided a September 2017 presentation. On slide 5 of the presentation there is a statement that suggests that a dual-fuel system that relies on electric air source heat pumps on most days and gas on the coldest days results in a "60% reduction in GHE's" and "less than ½ lifecycle cost of full electric air source heat pump".

a. Please provide the analysis, including all assumptions, underpinning these two statements.
b. What type of air source heat pump was Enbridge assuming to be deployed in this analysis? Was it the cold climate models that can produce heat without electric resistance back-up even at temperatures below -20 C?

RESPONSE

a. The information on slide 5 was obtained from analysis on low-carbon space heating options. It was completed by ICF Consulting, and the findings are included in a December 1, 2016 presentation titled "Electrification and Ontario's Long Term Energy Plan". This presentation is attached to provide the analysis and assumptions.

b. The ICF analysis, referenced above, assumed a higher performance Air Source Heat Pump (ASHP), but it did not specifically assess the cold climate models.

Witnesses: S. McGill
R. Sigurdson
D. Teichroeb

GEC INTERROGATORY #27

INTERROGATORY

Regarding Enbridge's recent energy efficiency program performance, please provide an Excel file with all of the different efficiency measures promoted by the Company, the number of participants by measure and program, both gross and net savings per measure and program, rebate/incentive dollars per measure and program, other costs per program, measure life per measure and program, NPV of the value of savings per measure and program, and NPV of TRC costs per measure and program for all of 2017 and all of 2016 (separately for each year). The information for custom C&I can be provided in aggregate for the program (rather than by measure or project).

RESPONSE

Without acknowledging the appropriateness of this request, Enbridge advises that it is currently in the process of drafting the 2016 clearance of accounts application which will have much of this information available or can be calculated based on this information. This should be available shortly.

For 2017, Enbridge is only beginning to prepare its 2017 DSM Annual report and has not even begun to draft its clearance of accounts application. It will be some time before this information is available.

Witness: D. Johnson

GEC INTERROGATORY #28

INTERROGATORY

At Exhibit C, Tab 5, Schedule 2, pp. 27-28 Enbridge sates “the Company believes the Board has an opportunity to ensure that the existing DSM Framework does all that it can to support a level of abatement activity that produces the best value for ratepayers.“ and goes on to list a number of proposed changes to its DSM plan that it is pursuing in its EB-2017-0128 Mid-Term DSM filing.

Has Enbridge assessed whether there is incremental opportunity for savings due to the C&T obligations and the changing context as part of its Mid-Term DSM filing, and if so, what added savings and carbon abatement has been identified and what added savings and carbon abatement (and related measures, targets and budgets) have been proposed in that filing?

RESPONSE

Please see the response to Board Staff Interrogatory #24b, filed at Exhibit I.1.EGDI.STAFF.24.

Witness: D. Johnson

GEC INTERROGATORY #29

INTERROGATORY

At Exhibit C, Tab 5, Schedule 2, at Page 25 Enbridge states: "At present, Enbridge does not have sufficient insight into the underlying analysis of the MACC study to fully understand what is driving the clear differences between the MACC study results, the Conservation Potential Study results and the Utilities' DSM Plans."

At Page 28 Enbridge states: "In summary, the Company believes that DSM should be considered a vital part of its overall long-term Compliance Plan. This is especially so where the results from incremental conservation and energy efficiency are known to be more cost effective over the long term than the purchase of compliance instruments. Enbridge reviewed the MACC relative to current DSM targets and found that all cost effective savings are already captured."

a. Please reconcile these two statements. Specifically, how did the company conclude (based on the MACC) that all cost effective savings are already captured when it does not fully understand what is driving differing results in the analyses?
b. Since filing the current C&T application, has Enbridge investigated and obtained a full understanding of the MACC study as part of its preparation for the Mid-Term Review? If so, please update the above referenced statements and provide details.
c. If the answer to part b. of this question is 'no', how does Enbridge expect that the Mid-Term Review process will adequately address this issue?

RESPONSE

a) Please refer to the response to Board Staff Interrogatory #24a, filed at Exhibit I.1.EGDI.STAFF.24.

b) No further detail beyond what is provided by the final MACC has been obtained for either the Mid-Term Review or the Compliance Plan proceeding.

c) Enbridge believes that the MACC will not provide the details necessary for either the Compliance Plan or the Mid-Term Review given it does not capture the significant spending from the GreenON Fund around energy conservation into its analysis.

Witnesses: D. Johnson
F. Oliver-Glasford

LIEN INTERROGATORY #1

INTERROGATORY

Exhibit C, Tab 5, Schedule 2, page 28: "…The whole home retrofit program was designed to be similar to Enbridge's existing DSM offer, the Home Energy Conservation program, and is available to all customers regardless of primary fuel type. In addition, the funding was also meant to increase the deployment of the Adaptive Thermostats offer, also consistent with the Company's DSM program, as well as funding to pursue educational and behavioural-based GHG reductions."

a) Please provide a breakdown of Enbridge's plan (including which specific measures will be employed and timing for implementation) for Enbridge's whole home energy efficiency retrofit program through the Green Investment Fund, for 2018 and beyond.
b) Does Enbridge intend to implement social housing retrofits through the Green Investment Fund? If so, please provide a breakdown of Enbridge's plan (including which specific measures will be employed and timing for implementation) for 2018 and beyond.

RESPONSE

a) Effective February 1, 2018, the Home Energy Conservation ("HEC") and Green Investment Fund ("GIF") funded Whole Home Retrofit ("WHR") programs will be delivered as follows:

   The goal of the HEC and WHR program is to provide a holistic energy efficiency program to residential customers which results in an energy rating and prompting customers to upgrade their energy and environmental performance by applying various mechanical and envelope measures

   The HEC program includes a rebate of up to $500 for the costs of home energy audits, not including HST, comprised of:

   $150 instant rebate deducted from the Certified Energy Auditor's invoice for the initial energy audit; and

   $350 reimbursement provided by EGD to the participant in respect of the final energy audit costs if one of the savings targets described below is met.

   A $250 bonus rebate will also be available for each measure installed beyond the first two. The maximum rebate payment is $5,000 per home (this amount

includes rebates for the home energy assessments, measure upgrades, and bonuses.)

A rebate for $500 for air-source heat pumps is also available.

Measure rebates for the WHR programs, which encompasses all fuel types, are found below in Table 1.

Table 1: Measure Rebates for WHR program

Measure	Rebate	Description
Basement Insulation	$1,250	For adding at least R23 to 100% of basement
	$750	For adding at least R12 to 100% of basement
	$1,000	For adding at least R23 to 100% of crawl space wall
	$500	For adding at least R10 to 100% of crawl space wall
	$500	For adding at least R24 to 100% of floor above crawl space
Exterior Wall Insulation	$1,750	Add at least R9 for 100% of building to achieve a minimum of R12
	$1,250	Add at least R3.8 for 100% of building to achieve a minimum of R12
Attic Insulation	$500	For increasing attic insulation from R12 or less to at least R50 from R12 or less
	$250	For increasing attic insulation from R13 to R25 to at least R50
	$500	For increasing cathedral/flat roof insulation by at least R14
Air Sealing	$150	Achieve 10% or more above base target
	$100	Achieve base target
Furnace/Boiler	$1,000	For replacing a: • 94% or less AFUE natural gas, propane, or oil furnace, or; • 89% or less AFUE natural gas, propane, or oil boiler, or; With a: • 95% or higher AFUE condensing natural gas, propane, or oil furnace • 90% or higher AFUE condensing natural gas, propane, or oil boiler
Wood-burning System	$750	For replacing a wood-burning system or appliance with one of the following: • An indoor wood-burning appliance certified to either CAN/CSA-B415.1-M92 or the United States Environmental Protection Agency (EPA) 40 CFR Part 60 wood-burning appliance standard. Appliances exempt from EPA testing are not eligible unless they are B415.1-M92 certified.

Measure	Rebate	Description
		• An indoor pellet-burning appliance (includes stoves, furnaces and boilers that burn wood, corn, grain or cherry pits). • An indoor masonry heater. Or For replacing a solid fuel-fired outdoor boiler with an outdoor wood-burning appliance certified to either CAN/CSA-B415.1 or United States Environmental Protection Agency (EPA) Outdoor Wood-fired Hydronic Heater (OWHH Method 28) Program (Phase 1 and 2). The capacity of the new equipment must be equal to or smaller than the capacity of the boiler being replaced.
Air-source Heat Pump	$500	For installing one of the following ENERGY STAR qualified air-source heat pumps (ASHP) that provide space heating and optional cooling. The ASHP must have an Air-Conditioning, Heating and Refrigeration Institute (AHRI) number meeting the requirements in Table A2: • A central split-system ASHP that is a complete new system or replacement including the matched indoor coil and outdoor unit, as well as a furnace if required to meet ENERGY STAR. • A single package ASHP. • A ductless mini-split ASHP with at least one indoor heat per floor (excluding the basement) that is a complete new system or replacement including indoor head and outdoor unit.
Water Heater	$500	For replacing water heater with ENERGY STAR natural gas water heater with EF of 0.82 or higher
Window/Door/Skylight	$80	For each window, door or skylight replaced with ENERGY STAR-qualified model
Smart Thermostat	$100	For purchase and installation of a wi-fi enabled thermostat with learning capabilities utilizing sensor technology (Stand-alone rebate program)

b) Enbridge was not provided any GIF funds to support social housing retrofits and as a result has no current plans to offer them through this funding avenue. Social housing programs will continue to be offered through DSM for Part 9, Part 3 and new construction.

LIEN INTERROGATORY #2

INTERROGATORY

Reference: Exhibit C, Tab 5

Does Enbridge plan to include any low-income-specific GHG abatement activities/measures in its future GHG abatement offerings (and if so, please describe)?

RESPONSE

Currently, Enbridge has no plans to include any incremental ratepayer funded low-income specific GHG abatement activities/measures beyond its current approved DSM programs. However, Enbridge and Union Gas have partnered in a bid for a low-income energy efficiency RFP put forth by GreenON.

Witness: D. Johnson

LIEN INTERROGATORY #3

INTERROGATORY

Reference: Exhibit E, Tab 1, Schedule 1, Appendix A at page 2 – 4: "Engagement with Low Income Energy Assistance (LEAP) agencies delivering programs to low income customers and representatives such as the Low-Income Energy Network".

a) Please provide specifics about how Enbridge plans to engage with social services agencies to deliver programs to low-income customers and representatives.
b) Please confirm what Enbridge means by "delivering programs". Does this mean delivery of GHG abatement activities/measures to low-income customers? Does it include education as well?
c) Union plans to engage with the United Way to further its customer outreach. Will Enbridge engage with the United Way?
d) How will Enbridge assess whether its communications to low-income customers has been effective?

RESPONSE

a) Enbridge currently offers the Low Income Energy Assistance Program ("LEAP"), delivered by United Way Simcoe Muskoka, to assist customers that are in arrears with their natural gas bill. Through this program, customers can apply for a one-time emergency financial assistance ("EFA") to cover their outstanding energy costs. This program is an opportunity for the Company to simultaneously promote its Low Income Home Winterproofing ("HWP") program to customers. When a customer applies for the LEAP EFA, United Way staff asks the customers if they are interested in participating in the HWP as a way to reduce their energy costs, thus promoting DSM Low Income programs to low income customers.

   Enbridge continues to engage with low income representatives, such as the Low Income Energy Network, bi-annually at in-person meetings and quarterly by email to share information, consult on program design and customer needs. Enbridge also sponsors an annual Low Income conference for stakeholder engagement with low income customer representatives and delivers presentations to attendees about current DSM programming.

b) In the reference provided above, Enbridge intended to refer to the Low Income Energy Assistance Program. Customers eligible for financial assistance through

Witnesses: T. Bruckmueller
D. Johnson

LEAP typically meet the eligibility criteria for the HWP and therefore through cross-promotion Enbridge is able to identify qualified customers who would benefit from the gas savings measures offered through HWP. At this time, the Company does not do additional education, beyond its existing suite of Low Income programming.

c) Currently, both Enbridge and Union Gas work in partnership with the Simcoe-Muskoka chapter of United Way, who is the lead agency delivering LEAP. When a ratepayer applies to LEAP, United Way staff will promote the HWP as another method the client can employ to save on energy costs and improve home comfort.

d) United Way sends a monthly report to Enbridge that details the number of qualified application forms that have been shared with the HWP delivery agents. Through this report, Enbridge is able to quantify how many HWP participants have resulted through the promotional efforts of LEAP agencies.

LIEN INTERROGATORY #3

INTERROGATORY

Please provide the average residential Enbridge natural gas customer's total billed amount for 2017.

RESPONSE

The average residential Enbridge natural gas customer's total billed amount for 2017 was $932.74. This amount does not include Harmonized Sales Tax.

Witnesses: D. McIlwraith
M. Suarez

LIEN INTERROGATORY #5

INTERROGATORY

Please provide the average residential Enbridge natural gas customer's billed amount broken down for each month in 2017.

RESPONSE

The average residential Enbridge natural gas customer's billed amount for each month in 2017 is listed below:

Month	**Billed Amount ($)**
January	137.76
February	127.31
March	123.17
April	94.63
May	68.64
June	46.06
July	37.16
August	38.11
September	40.58
October	40.47
November	71.49
December	107.37

The amounts above do not include Harmonized Sales Tax.

Witnesses: D. McIlwraith
M. Suarez

LIEN INTERROGATORY #6

INTERROGATORY

Has Enbridge considered, and will Enbridge consider, rate mitigation measures (through GHG abatement measures, financial assistance, or other measures), specific to low-income customers to minimize the impact of cap and trade on low-income customers? Please specify which measures Enbridge has considered and will consider

RESPONSE

Enbridge has existing programs in place such as the Low Income Energy Assistance Program ("LEAP") that provides financial relief as well as the Home Winterproofing Program ("HWP") that provides free upgrades to improve energy efficiency and thus lower energy bills.

In addition, Enbridge has partnered with Union Gas in a bid for a low-income energy efficiency RFP put forth by GreenON.

Witness: D. Johnson

NORTHEAST INTERROGATORY #4

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1

Program Overview

a. Please provide a summary of the consultations and public engagement activities leading up to the proposal to create the LCIF, including discussions with specific federal and provincial government departments, universities and research institutes, and Canadian and international companies and industry groups.
b. What are the objectives of the program in terms of GHG reductions, net increase in employment in Ontario, and increased R&D output (i.e., research contracts, patents, licensing, spin-out company formation, teaching)?
c. How does the LCIF plan to leverage existing investments in publicly and privately funded researchers, research centres, industry groups, and federal and provincial programs to better mobilize clean technologies?
d. How would the LCIF be different from the Natural Gas Innovation Fund (NGIF), which was created by the Canadian Gas Association in 2016? Is the LCIF expected to complement or leverage NGIF investments?
e. Please indicate whether only projects that include financial or in-kind contributions from project partners would be funded under the LCIF.
f. Would the LCIF be an autonomous, arm's-length entity with an independent management team and an investment committee that includes qualified non-utility members?

RESPONSE

a. While Enbridge has not directly engaged with stakeholders on the topic of the proposed LCIF, the Company has been actively monitoring and where appropriate pursuing opportunities, and has also been engaged in informal dialogues within industry forums to understand the market landscape and available funds.

b. As indicated in the Company's evidence, the objective of the LCIF is to enable the identification and development of GHG reducing technologies that will evolve into future carbon abatement opportunities. Implicit in this objective is the reduction of GHG emissions. To the extent that the development and adoption of technologies supported by the LCIF takes place in Ontario there could be additional benefits such as increased employment opportunities and or increased R&D output.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

c. The Company expects to work with government agencies, innovation centres and industry groups such as the Canadian Gas Association and the Gas Technology Institute to leverage existing investments.

d. The LCIF is different from the Natural Gas Innovation Fund (NGIF), in that it is managed and administered by Enbridge in order to identify and develop GHG reducing technologies to progress into future abatement opportunities that could benefit Ontario ratepayers. Unlike the NGIF, external parties are not able to apply for funding through the LCIF. Enbridge will continue to work with government agencies and industry groups such as the Canadian Gas Association and the Gas Technology Institute in order to maximize the effectiveness of the LCIF.

e. The Company currently has no plans with respect to require financial or in-kind contributions from potential project partners with respect to LCIF projects.

f. No. Please see response to part (d) above.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

NORTHEAST INTERROGATORY #5

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1

Program Eligibility

a. Would the LCIF be technology agnostic and consider any proposal that meets the program's objectives and key eligibility criteria? Or would the LCIF only consider technologies mentioned in the applications?
b. Please indicate whether any or all of the entities would be eligible for LCIF funding: (1) For-profit organizations such as utilities and private companies; (2) Not-for-profit organization such as industry associations and research groups; (3) Indigenous organizations and groups; (4) Canadian postsecondary institutions and research centres; (5) Community groups; and (6) Municipal governments and their departments and agencies.
c. Can the technology solutions originate from anywhere globally for testing, demonstration, and/or deployment in Ontario?

RESPONSE

a. Yes, the LCIF will be technology agnostic. Enbridge will consider other initiatives beyond those noted in the Company's current applications before the Board where such initiatives meet Company's abatement objectives and key eligibility criteria For a discussion on selection of abatement projects, please refer to the response to Board Staff Interrogatory #23a, filed at Exhibit I.1.EGDI.STAFF.23.

b. To be clear, other entities are not eligible to apply for funding; however, Enbridge would be open to working in partnership with any of the above noted entities, provided the project meets the abatement objectives and key eligibility criteria as discussed in response to part (a) above.

c. Yes, technology solutions that would be supported through the LCIF could originate from anywhere, provided the project meets the abatement objectives and key eligibility criteria as discussed in response to part (a) above.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

NORTHEAST INTERROGATORY #6

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1

Funding Allocation

a. Please indicate how the requested LCIF funding would be allocated to residential, commercial, and industrial sectors.
b. Please indicate how the requested LCIF funding would be allocated to: (1) R&D projects, from applied R&D to pilot projects; and (2) Demonstration projects, including up to first commercial installations.
c. How much would the LCIF expect to contribute per project on a percentage basis? What would be the maximum percentage allocated per project? Would the percentage be different for R&D projects and demonstration projects?
d. How much would the LCIF expect to contribute per project on a dollar amount basis? What would be the maximum dollar amount allocated per project? Would the dollar amount be different for R&D projects and demonstration projects?
e. Would LCIF contributions be non-repayable, conditionally repayable, or something else?

RESPONSE

a. Please refer to 2018 LCIF chart in Board Staff Interrogatory #23b, filed at Exhibit I.1.EGDI.STAFF.23.

b. LCIF funding would be allocated to projects as described at Exhibit C, Tab 5, Schedule 1, paragraph 15. For further discussion on Enbridge's methodology for selecting projects and the allocation of funds in 2018, please refer to the response to Board Staff Interrogatory #23a and b, filed at Exhibit I.1.EGDI.STAFF.23.

c. and d. Please see the response to Energy Probe Interrogatory #18, filed at Exhibit I.1.EGDI.EP.18.

e. As discussed in response to Northeast Interrogatory #5b, filed at Exhibit I.1.EGDI.NORTHEAST.5, other entities are not eligible to apply for LCIF funding. The Company does not anticipate that support provided to project partners would be repayable.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

NORTHEAST INTERROGATORY #7

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1

Submission Process

a. How the LCIF will ensure a consistent, fair, and transparent project selection process in order to identify, select, and approve funding of projects that best fit the program's objectives?
b. Would there be a formal request for proposals? If so, what would be an indicative timeline from the initial call to the selection of projects?

RESPONSE

a. Please see the response to Board Staff Interrogatory #23a, filed at Exhibit I.1.EGDI.STAFF.23.

b. Projects will be identified internally, not through a call for proposals. In cases where the procurement of equipment, services are other resources is required to conduct the development of an LCIF initiative the Company will abide by its normal procurement policies which may in some circumstances call for the conduct of formal RFP processes. Timelines for RFPs related to LCIF projects will be unique to each initiative and vary with the size and complexity of each initiative.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

NORTHEAST INTERROGATORY #8

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1

Evaluation Process

a. How will potential projects be assessed (i.e., design and methodology, project team, uptake potential, environmental impact, economic and social impact)?
b. Will considerations be given to regional diversity and sector distribution (i.e, residential, commercial, industrial)?
c. Will consideration be given to projects that support increased economic development opportunities for rural, northern and Indigenous communities?

RESPONSE

a. For information concerning factors that are considered when evaluating initiatives, please refer to the response to Board Staff Interrogatory #23a, filed at Exhibit I.1.EGDI.STAFF.23.

b. Yes, the Company will give consideration to regional diversity and sector distribution (i.e., residential, commercial, industrial).

c. Yes, the Company will give consideration to projects that support increased economic development opportunities for rural, northern and Indigenous communities.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

NORTHEAST INTERROGATORY #9

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1

Project Monitoring

a. Please indicate how successfully funded projects will be required to report on expected outcomes to ensure that targets and objectives are being met.
b. Since outcomes may only be realized after funding has ended, what provisions would be made for ongoing data collection and assessment for a period of five years following a project's completion date?

RESPONSE

a. The Company has described how it intends to report on LCIF projects as they evolve at paragraphs 17 through 19 of Exhibit C, Tab 5, Schedule 1.

b. Reporting and sustainment requirements will be project or initiative specific and reporting will extend for periods of time relevant to each project or initiative.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigurdson

OSEA INTERROGATORY #3

INTERROGATORY

Reference: Exhibit B, Tab 2, Schedule 1, Page 1 of 8 and Appendix A

Preamble: "The total customer-related obligation was determined by using the 2018 volumetric natural gas forecast for all customers, adjusted for gas-fired generation, Demand Side Management ("DSM"), incremental customer-related abatement, mandatory and voluntary participants, as well as volumes derived from biomass, or consumed outside of Ontario."

a) Is the DSM forecast based on the currently approved DSM Plan? Across Canada and around the world, reductions in GHG emissions have been calculated from a baseline and a forecast of business as usual.

b) Has Enbridge considered fixing the ratepayer funded DSM at current levels for both budget and forecast of results going forward on a basis for GHGs that is consistent with this practice?

RESPONSE

a) Yes, Enbridge's DSM forecast is based on the currently approved DSM Plan.

b) If this question asks whether DSM budget and results should be calculated from a baseline and a forecast of business as usual, the Company notes that this change would require a change in the DSM Framework and related targets and reporting and is more appropriate for the DSM Mid-Term review and not this compliance proceeding.

Witness: D. Johnson

OSEA INTERROGATORY #4

INTERROGATORY

Reference: Exhibit A, Tab 1, Schedule 2, Page 2 of 4

a) The OEB Cap and Trade Framework contemplated a longer-term time horizon for each compliance plan. Has Enbridge considered using a longer time horizon, designating the degree to which planning assumptions are likely to change in the near term and then only submitting an update to those assumptions and the impact of the updates to the Plan as a variance report?

RESPONSE

a) With the significant changes in the carbon market, it was prudent for Enbridge to develop two one-year Compliance Plans for 2017 and 2018 followed by one two-year Compliance Plan for 2019 and 2020. Variance reporting could be considered as part of the Board's next Cap and Trade framework. Please refer to the response to BOMA Interrogatory #5, filed at Exhibit I.1.EGDI.BOMA.5.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

OSEA INTERROGATORY #5

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1, Page 7 of 15

a) Does Enbridge intend to establish a standard format and content for developing and getting approval for its Compliance Plan options and analysis? Will the risk management analysis also be standardized?

RESPONSE

a) Enbridge has developed a robust approach to its Compliance Plans that has been relatively consistent over the first two plans. Given the Company's commitment to continuous improvement it is anticipated that where warranted, updates to Enbridge's approach may be required.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

OSEA INTERROGATORY #6

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1, Page 12 of 15

Preamble: "In order to have confidence that the costs associated with implementing and advancing the Abatement Construct are recoverable, Enbridge is requesting approval (or a finding of reasonableness) of… available funding of up to $2 million for 2018 through the LCIF to pursue abatement initiatives."

a) Union is also requesting $2 million in funding for 2018 through the LCIF to pursue abatement initiatives. If each utility's funding is approved and the amalgamation of Union and Enbridge is approved, will the amalgamated utility have access to a combined $4 million in funding through the LCIF, funded by ratepayers, to investigate, conduct studies and pilot projects, and otherwise pursue abatement initiatives?
b) Does Enbridge anticipate that a merger with Union will generate cost-efficiencies, reduce duplication in terms of investigating and testing abatement initiatives and technologies, and increase capacity for proceeding with abatement initiatives? If so, does how does this affect Enbridge's timeline for realizing abatement initiatives? If not, why not?

RESPONSE

a) Please see response to CCC Interrogatory #25 filed at Exhibit I.1.EGDI.CCC.25.

b) Please see response to Board Staff Interrogatory #16a) filed at Exhibit I.1.EGDI.STAFF.16.

Witnesses: S. McGill
F. Oliver-Glasford

OSEA INTERROGATORY #7

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 1, Page 15 of 15

Preamble: "Enbridge made specific use of the Board's MACC study in the following ways: Enbridge considered the guidance and information in the MACC study about energy efficiency programs to assess whether it should be expanding DSM programs…Enbridge concluded that additional DSM programs would not be cost-effective; in some cases the marginal costs of new programs may be higher than the cost of compliance instruments…Enbridge used the information about RNG found in the MACC to consider and develop its proposal for RNG procurement."

a) Please explain Enbridge's rationale for proceeding with RNG compared to other potential customer abatement measures given that the Board's 2017 MACC study identified RNG as one of the few abatement measures that was not cost effective under the different long term carbon price scenarios.

b) Please provide Enbridge's calculations demonstrating that additional DSM programs would not be cost-effective.

c) Has Enbridge considered using the Total Resource Cost net benefits used in DSM in its analysis of the cost-effectiveness of abatement measures in Cap and Trade? If no, why not?

RESPONSE

a) Enbridge notes that the MACC study only includes natural gas substitution and that other benefits of RNG are not captured in the MACC analysis, such as any value from generating offset credits, which would make RNG a cost effective abatement measure. Importantly though, Enbridge's proposal for procuring RNG is contingent on available provincial funding, thereby resulting in a net cost of GHG abatement to ratepayers equivalent to that of the purchase of carbon allowances. For further details please see the responses to Board Staff Interrogatory #1a, filed at Exhibit I.C.EGDI.STAFF.1, Consumers Council of Canada Interrogatory #10, filed at Exhibit I.C.EGDI.CCC.10 and Board Staff Interrogatory #24b, filed at I.1.EGDI.STAFF.24.

b) Please see the response to Board Staff Interrogatory #24a at I.1.EGDI.STAFF.24.

c) Enbridge is not of the opinion that using TRC for the purposes of carbon planning is appropriate at this time. Please refer to the response to Green Energy Coalition Interrogatory #24c, filed at I.1.EGDI.GEC.24.

Witnesses: D. Johnson
S. McGill
F. Oliver-Glasford

OSEA INTERROGATORY #8

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 2, Page 3 of 29

a) Please provide any calculations or analysis prepared by Enbridge of the initiatives that it selected in its Initiative Funnel Stage to explain how it selected these particular initiatives including how the the screening criteria Enbridge developed were considered such as (i) potential GHG volume abatement forecast, (ii) potential costs and cost effectiveness, (iii) potential government funding available, (iv) market size, (v) potential market acceptance, and (vi) potential timelines for introduction into the market.
b) Has Enbridge considered other abatement initiatives not listed in Table 1? If so, please provide Enbridge's rationale and its analysis for excluding those abatement initiatives from consideration.
c) Given that the feasibility of RNG is heavily dependent on securing funding from the provincial government, has Enbridge considered prioritizing other abatement initiatives that do not rely on government funding? What abatement measures selected by Enbridge in its Initiative Funnel Stage are feasible without government funding?

RESPONSE

a) For clarity, the screening criteria and additional considerations are listed in the evidence at Exhibit C, Tab 5, Schedule 1 pages 4 to 6 and do not perfectly reflect the criteria OSEA has listed in this question. The initiatives identified in the Initiative Funnel are those that the Company believes present viable carbon abatement opportunities at the current time. These initiatives represent a starting point, and are expected to evolve over time as additional opportunities are added to the Funnel. Enbridge has provided submissions on RNG procurement, RNG Enabling and geothermal in this 2018 Cap and Trade Compliance Plan (for the RNG procurement) and EB-2017-0319 (for RNG enabling and geothermal). In future Compliance Plans and associated applications, the Company will provide detailed analysis in support of any other initiatives that advance to the "Propose" stage of the Initiative Funnel. For further discussion, please see response to GEC Interrogatory #8b found at Exhibit I.1.EGDI.GEC.8. And for more detail on the projects within the stages of the Initiative Funnel please see the response to SEC Interrogatory #15 found at Exhibit I.1.EGDI.SEC.15.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigudson

b) Enbridge has considered other possible abatement initiatives not listed in Table 1, most notably energy efficiency programming through active participation in GreenON RFPs. Enbridge has been actively involved in bidding on and proactively discussing options for incremental energy efficiency with GreenON. The Company's Initiative Funnel provides a starting point for low carbon activities. Activities not included were determined to have low priority based on preliminary reviews or were being pursued by a separate process (i.e. the GreenON RFPs).

c) One of the key determinants of the Company's evaluation of any potential GHG abatement initiative is economic feasibility (from the perspective of the Company and its ratepayers). This takes into account subsidies that are known or expected. As such, the evaluation process will prioritize initiatives that require no or lesser incremental subsidy amounts (beyond what is currently available or expected). Subsidy amounts have been identified as being required and available for both the Company's RNG procurement proposal and its proposed Geothermal Energy Service. To the extent that other initiatives require subsidies in order to be viable the Company will identify the incremental subsidies required as part of its future submissions to the Board for the approval of these initiatives.

Witnesses: S. McGill
F. Oliver-Glasford
R. Sigudson

OSEA INTERROGATORY #9

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 2, Page 12 of 29

Preamble: "With respect to the advancement of 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 the injection and transportation of this gas to market. To that end, Enbridge is proposing the "RNG Enabling Program"

a) OSEA's experience in the development of the FIT program indicated that both the Ontario Power Authority and Hydro One lacked interest in assisting project developers and customers to break new ground on renewable energy. How will Enbridge avoid this pitfall through the enabling program?

RESPONSE

Enbridge has advocated and supported RNG development efforts in the past. This current application further signals Enbridge's commitment to support RNG producers and customers in developing their RNG projects. Through the provision of fair, transparent and equitable rates and processes to inject RNG and upgrade biogas into RNG for all parties, Enbridge will avoid pitfalls in its' enabling program. For further details as to how Enbridge intends to support the development of RNG production facilities in Ontario please see the Company's RNG Enabling Program evidence under the Board's Docket Number EB-2017-0319.

Witnesses: A. Chagani
S. McGill

OSEA INTERROGATORY #10

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 2, Page 17 of 29

Preamble: "The Company's 10 year customer forecast was based on several factors including expected demand for geothermal systems (which will be driven in part by a Green Ontario 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 2018 and over a period of 10 years a total of about 18,000 customers."

a) Please provide Enbridge's calculations/analysis for its 10 year customer forecast.
b) Please describe how Enbridge can overcome the potential barriers to increase the market penetration of geothermal systems.

RESPONSE

a) The customer add forecast was estimated based on the Green Ontario Fund program announcement which included the number of existing dwellings in Ontario and the forecast for new construction homes. The estimate was also driven by supply of qualified drilling and geothermal contractors available in Ontario. The Company also solicited input from the Ontario Geothermal Association ("OGA") for these estimates.

b) The adoption of geothermal technology has been hampered by high initial cost and inconsistent deployment and installation practices. Enbridge has been working with the OGA, the Ministry of Environment and Climate Change ("MOECC"), and the Ministry of Energy ("MOE") to find solutions to overcome the barriers faced by the geothermal industry and further the adoption of ground source heating and cooling systems. The solution that Enbridge has developed, as discussed further in the EB-2017-0319 filing, 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.

c) The Company will ensure uniform standards are applied to the safety, design, and installation of geothermal systems to achieve a high level of quality assurance and consistent operating and economic performance. Enbridge can provide this service through its ownership and maintenance of geothermal loops for the residential market.

Witnesses: A. Chagani
P. Datta
S. McGill

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 heat pump systems as those used to install gas distribution piping and services today.

Witnesses: A. Chagani
P. Datta
S. McGill

OSEA INTERROGATORY #11

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 2, Page 26 of 29

Preamble: "In the Framework, the Board also acknowledges that offering customer abatement programs "creates the potential for significant overlap between existing DSM programs and future Compliance Plans… [However the Board] is confident that any potential overlap can be appropriately address through the robust Evaluation, Measurement and Verification (EM&V) process of the DSM Framework."

a) How does Enbridge think the potential overlap between its DSM programs and its Compliance Plans should be dealt with? Is it Enbridge's position that all customer abatement should be done through the DSM framework?

RESPONSE

a) Enbridge believes that determining energy efficiency goals, budgets and targets is central to the DSM Framework, and related planning. Enbridge is of the opinion that all ratepayer funded energy efficiency customer abatement should be done under the guidance of the DSM framework to avoid potential confusion around treatment of results as well as to avoid possible programmatic overlap which would result in inefficient use of ratepayer funds.

   With respect to non-ratepayer funded energy efficiency customer abatement, such as programs though the Climate Change Action Plan funding, these will be dealt with on a case-by-case basis and be subject to the review of the DSM audit process as well as via the Cap and Trade Compliance Plan annual results review. For additional information please see the response to Board Staff Interrogatory #24b, filed at I.1.EGDI.STAFF.24.

Witnesses: D. Johnson
F. Oliver-Glasford

OSEA INTERROGATORY #12

INTERROGATORY

Reference: Exhibit C, Tab 5, Schedule 2, Page 27 of 29

Preamble: "As indicated in the Company's DSM Mid-Term submission (EB-2017-0127/0128), the Company believes the Board has an opportunity to ensure that the existing DSM Framework does all that it can to support a level of abatement activity that produces the best value for ratepayers. Enbridge believes that in light of the new policy environment, certain features of the DSM Framework should be enhanced to ensure that DSM activity is maximized to meet the needs of ratepayers moving forward."

a) Please explain how Enbridge proposes that the DSM Framework should be enhanced. Is Enbridge in support of expanding custom programs to more customer segments?

RESPONSE

a) Enbridge filed evidence with its views on the DSM Framework through the DSM Mid-term process and in particular the evidence filed on Jananuary 15, 2018 (EB-2017-0127). Please also refer to Board Staff Interrogatory #24 filed at Exhibit I.1.EGDI.STAFF.24.

Witness: D. Johnson

SEC INTERROGATORY #8

INTERROGATORY

With respect to Union and Enbridge:

a. Please confirm that Enbridge and Union are affiliates.
b. If (a) is confirmed, please explain why Enbridge and Union require separate cap and trade groups within their companies considering they are now affiliates.
c. Please confirm that subsection 65(3) and (4) of O.Reg 144/16 has been revoked.
d. If (c) is confirmed, please explain any changes in how Enbridge and Union plan to participate in allowances auctions compared to 2017 when the provisions were in force.

RESPONSE

a. Confirmed.

b. Although Enbridge and Union are affiliates under the Cap and Trade regulation, the companies are still operating as separate entities. Once the decision on the amalgamation of the Utilities is confirmed, a go forward plan can be developed/implemented.

c. Confirmed.

d. Until the amalgamation between Enbridge and Union is approved by the Board, the companies continue to keep their procurement strategies separate. Please see response to Board Staff Interrogatory #16a found at Exhibit I.1.EGDI.STAFF.16.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

SEC INTERROGATORY #9

INTERROGATORY

[C-1-1, p.10] Please provide the internal memorandum, guide, and/or other document that sets out in detail the Abatement Construct.

RESPONSE

The details related to the Abatement Construct are outlined in evidence found at Exhibit C, Tab 5, Schedule 2. There is no further internal guide detailing the Abatement Construct.

Witness: F. Oliver-Glasford

SEC INTERROGATORY #10

INTERROGATORY

[C-1-1, p.10] Please provide the internal memorandum, guide, and/or other document that sets out in detail the Abatement Construct.

RESPONSE

Please see the response to School Energy Coalition Interrogatory #9, filed at Exhibit I.1.EGDI.SEC.9.

Witness: F. Oliver-Glasford

SEC INTERROGATORY #11

INTERROGATORY

[C-1-1, p.10] Please provide the internal memorandum, guide, and/or other document that sets out in detail the Abatement Construct.

RESPONSE

Please see the response to School Energy Coalition Interrogatory #9, filed at Exhibit I.1.EGDI.SEC.9.

Witness: F. Oliver-Glasford

SEC INTERROGATORY #12

INTERROGATORY

[C-1-1, p.11] Please discuss what Enbridge has learned regarding its governance and accountability measures that it had in place in 2017. What improvements is it making going forward?

RESPONSE

Please refer to the response to Board Staff Interrogatory #15, filed at Exhibit I.1.EGDI.STAFF.15.

Witness: F. Oliver-Glasford

SEC INTERROGATORY #13

INTERROGATORY

[C-1-1, p.13] Please provide a copy of Enbridge's Carbon Emissions Trading Agreement.

RESPONSE

Enbridge's Emissions Trading Agreement ("Agreement") is attached to this Exhibit. Please note that this Agreement is proprietary to Enbridge and is in a generic form that would be subject to negotiation with counter-parties.

Witnesses: A. Langstaff
F. Oliver-Glasford

EMISSIONS TRADING MASTER AGREEMENT FOR LINKED JURISDICTIONS

dated as of

[INSERT DATE]

by

ENBRIDGE GAS DISTRIBUTION INC.
("Party A")

and

……

("Party B")

EMISSIONS TRADING MASTER AGREEMENT

This EMISSIONS TRADING MASTER AGREEMENT FOR LINKED JURISDICTIONS ("**Master Agreement**") is made and entered into as of _____ (the "**Effective Date**") by and between Enbridge Gas Distribution Inc., a corporation continued under the laws of Ontario, and ___ _____ a **[corporation incorporated]** under the laws of [●], each individually referred to as a "**Party**", and jointly referred to as the "**Parties**".

RECITALS

WHEREAS, the Parties have entered into or anticipate entering into one or more Transactions for the purchase, sale and Transfer of GHG emission Allowances and/or Offsets that will be governed in accordance with the terms and conditions of this Master Agreement;

NOW THEREFORE, in consideration of the mutual covenants set forth herein, and for such other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, and intending to be legally bound, the Parties agree as follows:

ARTICLE 1
SUBJECT OF AGREEMENT

1.1 This Master Agreement and each Confirmation entered into pursuant hereto (including any and all Schedules, Appendices, Parts, Exhibits and written supplements referred to herein) shall govern all agreements between the Parties to undertake one or more Transactions.

1.2 All Transactions are entered into in reliance on the mutual agreement of the Parties that the Master Agreement, any Schedule(s) and all Confirmations evidencing individual Transactions together form a single agreement, and the Parties acknowledge and agree that they would not otherwise enter into any Transactions.

ARTICLE 2
DEFINITIONS, INTERPRETATION AND TERM

2.1 Definitions. Capitalized terms shall have the meanings assigned to them in this Master Agreement, including in Schedule 1 and in the applicable Confirmation.

2.2 Interpretation. The following interpretive provisions apply to this Master Agreement.

(a) Subject to sections 8.4 (*Illegality*) and 8.5 (*Change in Law*), reference to any law, statute or regulation includes any amendment or modification to, consolidation, reenactment or replacement of such law, statute or regulation.

(b) References in the singular include the plural and vice versa, pronouns having masculine or feminine gender include the other, and words denoting persons include natural persons, partnerships, firms, companies, corporations, joint ventures, trusts, associations, organizations or other entities, whether or not having separate legal personality. Other grammatical forms of defined words or phrases have corresponding meanings.

(c) "Include" or "including" means "including without limitation".

(d) In relation to a given Transaction, references to "this Agreement" or "the Agreement" shall refer to this Master Agreement, together with the terms of that Transaction, as evidenced by the relevant Confirmation or Confirmations that evidence the Transaction.

(e) If there is any conflict between the provisions of this Master Agreement, any Schedule, and/or any Confirmation for a Transaction, the following provisions shall prevail (in the following order): (i) the terms of the Confirmation for such Transaction; (ii) the terms of Schedule 1; and (iii) the remaining terms of this Master Agreement.

(f) Any reference to "time" is to Eastern Time.

(g) Where anything is to be done under this Master Agreement with reference to a particular Business Day or period of Business Days, a Business Day shall begin at 9:00 a.m. and run until 5:00 pm. An obligation to be performed on or by a given Business Day must be performed by 5:00 p.m. on that day or shall be treated as having been done on the next following Business Day.

2.3 Term. Without prejudice to Article 11 (*Events of Default and Termination*), this Master Agreement shall remain in force from the Effective Date until terminated by written notice by either Party provided always that no such termination may take effect prior to, the later of, twenty (20) Business Days following the date of such notice or the date both Parties have fulfilled all of their obligations with respect to all Transactions entered into prior to the notice of termination delivered under this section 2.3 (*Term)*.

ARTICLE 3
CONFIRMATION PROCEDURE

3.1 Agreement of a Transaction. The Parties intend that they shall be legally bound by the terms of each Transaction in accordance with section 3.2 (*Exchange of Confirmations*).

3.2 Exchange of Confirmations.

(a) Subject to section 3.2(b)

(i) to agree to a Transaction, the Delivering Party shall send to the Receiving Party by facsimile or e-mail a Confirmation materially in the relevant form set out in Exhibit A with respect to Allowances or Exhibit B with respect to Offsets, or in a form otherwise agreed between the Parties, signed and dated, setting out the details of the Transaction;

(ii) if the Receiving Party is satisfied that the Confirmation accurately reflects the terms of the Transaction, it shall countersign and return the Confirmation to the Delivering Party by facsimile or e-mail within three (3) Business Days of receipt of the Confirmation; or, the Receiving Party shall inform the Delivering Party in writing as to any objections or inaccuracies within three (3) Business Days of receipt of the Confirmation and if the Delivering Party agrees with the objections or inaccuracies, it shall send a new Confirmation within three (3) Business Days of agreement and the provisions of this section 3.2 (*Exchange of Confirmations*) shall apply again. If the objection is not resolved between the Parties, the Confirmation shall not be effective. If the Receiving Party fails to countersign and return the Confirmation to the Delivering Party within three (3) Business Days of receipt, the Confirmation shall not be effective;

(iii) if the Receiving Party has not received a Confirmation within three (3) Business Days of the terms of a Transaction having been agreed, it may send a Confirmation to the Delivering Party and sections 3.2(a)(i) and 3.2(a)(ii) (*Exchange of Confirmations*) shall apply *mutatis mutandis* in relation to any such

Confirmation except that all references to the Receiving Party shall refer to the Delivering Party and vice versa;

(iv) Party B acknowledges and agrees that Party A shall not be bound by the terms of a Confirmation and a Confirmation shall not be effective unless signed by two (2) authorised persons representing Party A.

(b) If the Parties have elected in Schedule 2 to permit oral transactions, section 3.2(a) (*Exchange of Confirmations*) shall not apply and this section 3.2(b) (*Exchange of Confirmations*) shall apply to this Master Agreement, failing which this section 3.2(b) (*Exchange of Confirmations*) shall have no force end effect:

(i) within three (3) Business Days of a Transaction having been entered into, the Delivering Party shall send to the Receiving Party by facsimile and e-mail a Confirmation materially in the relevant form set out in Exhibit A with respect to Allowances or Exhibit B with respect to Offsets, or in a form otherwise agreed between the Parties, signed and dated, recording the details of the Transaction;

(ii) if the Receiving Party is satisfied that the Confirmation accurately reflects the terms of the Transaction, it shall countersign and return the Confirmation to the Delivering Party by facsimile or e-mail within three (3) Business Days of receipt of the Confirmation; or, the Receiving Party shall inform the Delivering Party in writing as to any objections or inaccuracies within three (3) Business Days of receipt of the Confirmation and if the Delivering Party agrees with the objections or inaccuracies, it shall send a new Confirmation within three (3) Business Days of agreement and the provisions of this section 3.2 (*Exchange of Confirmations*) shall apply again. If the objection is not resolved between the Parties, the Confirmation shall not be effective. If the Receiving Party fails to (i) countersign and return the Confirmation to the Delivering Party or (ii) inform the Delivering Party of any objections or inaccuracies within three (3) Business Days of receipt, the Confirmation shall be deemed to be accepted by the Receiving Party;

(iii) if the Receiving Party has not received a Confirmation within three (3) Business Days of a Transaction having been entered into, it may send a Confirmation to the Delivering Party. Sections 3.2(b)(i) and 3.2(b)(ii) (*Exchange of Confirmations*) shall apply *mutatis mutandis* in relation to any such Confirmation except that all references to the Receiving Party shall refer to the Delivering Party and vice versa;

(iv) failure by either Party to send, return or execute a Confirmation does not (i) affect the validity or enforceability of any Transaction, or (ii) constitute a failure to perform a material obligation under this Master Agreement as contemplated in section 11.1(d) (*Material Obligations*);

(v) each Party consents to the creation of a tape or electronic recording ("**Recording**") of all telephone conversations between the Parties relating in whole or part to this Master Agreement, and agrees that any such Recording will be retained in confidence, secured from improper access, and may be submitted in evidence in any proceeding or action relating to this Master Agreement. Each Party waives any further notice of such Recording, and agrees to notify its officers and employees of such Recording and to obtain any necessary consent of such officers and employees. Any Recordings shall be the controlling evidence of the

Parties' agreement with respect to a particular Transaction in the event a Confirmation is not fully executed (or deemed accepted) by both Parties and the Parties' agreement so evidenced shall be deemed for all purposes of this Master Agreement to be the Confirmation of such Transaction, subject to section 3.2(b)(ii) (*Exchange of Confirmations*). Each Party agrees not to contest, or assert any defense to, the validity or enforceability of any Transaction entered into in accordance with this Master Agreement (i) based on any law requiring agreements to be in writing or to be signed by the Parties, or (ii) based on any lack of authority of the Party or any lack of authority of any employee of the Party to enter into a Transaction;

(vi) upon full execution (or deemed acceptance) of a Confirmation, such Confirmation shall, except in the case of manifest error, prevail in the event of any conflict with the terms of a Recording or other evidence, whether written or oral.

ARTICLE 4
PRODUCT TRANSFERS

4.1 Primary Obligation.

(a) In relation to a Transaction, the Delivering Party shall sell in accordance with Article 10 (*Covenants*) *and* Deliver (or cause the Delivery of), and the Receiving Party shall purchase and Accept (or cause the Acceptance of), the Quantity of the Product, and the Receiving Party shall pay the Delivering Party the Contract Amount with respect to the Transferred Product, subject to and in accordance with this Master Agreement and the Program Rules.

(b) Separate Transactions shall be deemed to exist under a single Confirmation when more than one Delivery Date is specified and, with respect to each such Delivery Date, the following terms are specified or are otherwise capable of being determined with certainty: (i) Product; (ii) Product Unit Price; (iii) Quantity; (iv) Specified Period; and (v) Payment Due Date. The terms of each such deemed Transaction, other than in relation to the Delivery Date and items (i) – (v) listed above, shall be the same, unless otherwise specified in the Confirmation.

4.2 Delivery. For the purposes of section 4.1(a) (*Primary Obligation*) in relation to a Quantity of Product to which a Transaction applies, on or before each Delivery Date the Delivering Party shall cause two (2) of its Account Representatives to submit and confirm a Transfer Request in CITSS to Transfer the Quantity from Delivering Party's Holding Account to Receiving Party's Holding Account and take any other action as may be required from a transferor under the Program Rules to Transfer Product (a "**Transfer Request Initiation**"). The Delivering Party shall cause each such Account Representative to execute such Transfer Request Initiation during a single day.

4.3 Acceptance.

(a) To Accept a Quantity of Product to which a Transaction applies in accordance with section 4.1(a) (*Primary Obligation*), the Receiving Party shall cause one (1) of its Account Representatives to confirm in CITSS the Transfer Request Initiation and take any other action as may be required from a transferee under the Program Rules to Transfer Product (a "**Transfer Request Confirmation**"). The Receiving Party shall execute a Transfer Request Confirmation on the earlier of (i) the first Business Day following receipt of notice

of such Transfer Request Initiation or (ii) the third day after receipt of notice of such Transfer Request Initiation.

(b) Delayed Transfer. If, through no fault of either Party, a Transfer does not occur in accordance with this section 4.3 (*Acceptance*), the Parties shall re-initiate the process for Delivery and Acceptance as set out in this Article 4 (*Product Transfers*). If Parties are unable to complete a Transfer after three attempts, the Transaction shall be terminated as an FM Affected Transaction and section 8.2 (*Force Majeure Transaction Termination*) shall apply, except that the Delivering Party shall return to the Receiving Party any payment already made for any Product not Transferred within three (3) Business Days of the termination of the Transaction;

4.4 Transfer Request Deficiencies. Upon issuance of a TRD by a Relevant Authority with respect to a Transaction:

(a) the Parties shall promptly confer and use commercially reasonable efforts to respond to any request made by the Relevant Authority and to cure the facts, conditions or circumstances alleged to form the basis of the TRD;

(b) if a TRD Determination is issued and is attributed by the Relevant Authority to the Delivering Party, the Transaction relating to the TRD Determination shall be deemed to have been terminated to the extent of the TRD Determination and the Receiving Party may provide an invoice to the Delivering Party within thirty (30) days of the TRD Determination for the Receiving Party's Replacement Cost and the Delivering Party shall pay the invoice within three (3) Business Days of receipt;

(c) if a TRD Determination is issued and is attributed by the Relevant Authority to the Receiving Party, the Transaction relating to the TRD Determination shall be deemed to have been terminated to the extent of the TRD Determination and the Delivering Party may provide an invoice to the Receiving Party for the Delivering Party's Replacement Cost within thirty (30) days of the TRD Determination and the Receiving Party shall pay the invoice within three (3) Business Days of receipt, *provided, however*, that if Receiving Party has made a payment for Product that was not Transferred, Delivering Party shall return such payment within three (3) Business Days of the TRD Determination;

(d) if the TRD Determination is not attributed by the Relevant Authority to either Party or is equally attributed to both Parties, the Parties shall re-initiate the process for Delivery and Acceptance. If Parties are unable to complete a Transfer after three attempts, the Transaction shall be terminated as an FM Affected Transaction and section 8.2 (*Force Majeure Transaction Termination*) shall apply, except that the Delivering Party shall return to the Receiving Party any payment already made for any Product not Transferred within three (3) Business Days of the termination of the Transaction;

(e) if a TRD Determination is issued and is attributed primarily to one Party, such Party shall reimburse the other Party any fines and penalties imposed by a Governmental Authority in connection with such TRD Determination; and

(f) a TRD or TRD Determination shall not be an Event of Default, but the failure of the Delivering Party or the Receiving Party to pay, when due, any amount referred to in this section 4.4 (*Transfer Request Deficiencies*) is an Event of Default.

4.5 Transfer Further Assurances. Each Party shall provide to the other Party any reasonably requested information or documentation required to effect a Transfer, cooperate to cause a Transfer to occur, and comply with and do all such things under any and all applicable procedures and requirements of Applicable Law, including the Program Rules, or a Relevant Authority (within the time periods stipulated) relating to the Transfer of Product, in each case, to establish the title of the Receiving Party to any Product that is the subject of a Transaction.

ARTICLE 5
BILLING AND PAYMENT

5.1 Payment Due Date. Payment for each Transaction shall be due on the later of: (i) the tenth (10^{th}) Business Day of the month in which a Statement is received by the Receiving Party; and (ii) the fifth (5^{th}) Business Day after receipt of such Statement (the "**Payment Due Date**").

5.2 Monthly Billing Statement.

(a) On or before the tenth (10^{th}) Business Day of each month following each Transfer Date, the Delivering Party shall send to the Receiving Party a written statement (the "**Statement**") showing for each such Transaction:

(i) the Quantity, Product Unit Price and Contract Amount;

(ii) the volume of Transferred Product and the dates of the relevant Transfers;

(iii) any amount owing from one Party to the other, including any amount owing by reason of Article 7 (*Failure to Deliver, Failure to Accept and Invalidation*) or section 5.4 (*Disputed Payments*), stating any part of that amount or any other amount that has already been paid or set off under section 5.6 (*Payment Netting*);

(iv) the net amount payable from one Party to the other after taking into account the items provided above; and

(v) Sales Tax on the Contract Amount, if any, and any other amount payable under Article 6 (*Taxes*),

and each Party shall promptly provide to the other Party further information as may reasonably be requested by the other Party to substantiate the information contained in any Statement issued pursuant to this section 5.2 (*Monthly Billing Statement*).

(b) For the avoidance of doubt, only one consolidated Statement needs to be issued for each calendar month, such to be issued as soon as practicable, but not later than ten (10) Business Days after the end of that calendar month with respect to all Transfers effected within that calendar month. Each consolidated Statement shall specify (i) each of the items listed in sections 5.2(a)(i) - (v) (*Monthly Billing Statement*) with respect to each individual Transaction to which it pertains and (ii) aggregate totals for each of those items with respect to all Transactions to which it pertains.

(c) If the Delivering Party fails to issue a Statement in accordance with this section 5.2 (*Monthly Billing Statement*), then the Receiving Party may issue that Statement to the Delivering Party and, once issued, that Statement shall be treated as a Statement issued by the Delivering Party for the purposes of this Master Agreement. Failure to issue a Statement does not affect the rights and obligations of the Parties under this Master

Agreement and does not constitute a failure to perform a material obligation under this Master Agreement as contemplated in section 11.1(c) (*Events of Default*).

5.3 Payment Mechanics.

(a) By no later than the Payment Due Date, the Receiving Party or the Delivering Party, as the case may be, shall pay the amount owing to the other Party on such Payment Due Date.

(b) Payments due hereunder shall be made in USD or CAD Dollars, as specified in the Confirmation. For the purpose of calculating currency conversions between Canadian and United States currency, currency conversions shall be made using the month average of the WM/Reuters 12 Noon EST Intraday Spot Rate as quoted for the calendar month prior to the Payment Due Date.

(c) Payment due hereunder shall be made by direct bank transfer or equivalent transfer of immediately available funds to the credit of the account specified by the Party to whom such payment is due to the following accounts:

Party A: **Enbridge Gas Distribution Inc.**

US Dollars:

Correspondent Bank:

(FFC) Beneficiary Bank:

Beneficiary:

CAD Dollars:

Party B: _____

_____

_____

_____

5.4 Disputed Payments.

(a) If a Party disputes, in good faith, any sum set out in a Statement as payable by that Party under this Master Agreement, it shall give notice to the other Party of the amount in dispute and the reasons for the dispute but shall pay the undisputed amount invoiced by no later than the Payment Due Date.

(b) The Parties shall seek to settle any disputed amount notified under section 5.4(a) (*Disputed Payments*) as soon as reasonably possible. Any adjustment payment required to be made in accordance with the resolution of such dispute shall be made, with interest

payable in accordance with section 5.5(b) (*Interest*), within three (3) Business Days of that resolution.

(c) All Statements are conclusively presumed final and accurate unless objected to in writing, with adequate explanation and documentation, within twenty-four (24) months after the month the Statement was received, or should have been received, by the Receiving Party.

5.5 Interest.

(a) If a Party fails to pay to the other Party any amount due under this Master Agreement, interest shall be payable on that amount at an annual rate equal to the Interest Rate calculated daily plus three percentage (3%) points and compounded monthly from and including the due date for the payment or the last day on which payment can be timely made but excluding the date payment is made.

(b) If, following the resolution of a dispute or otherwise to correct any mistaken overpayment or underpayment made in good faith, one Party is required to pay an amount to the other Party, interest shall be payable on that amount at an annual rate equal to the Interest Rate calculated daily and compounded monthly from the date when the amount would have been paid or not paid (as applicable) if the dispute, overpayment or underpayment had not occurred to but excluding the date payment is made.

(c) If the Interest Rate ceases temporarily or permanently to be published then the Party owed money may substitute a published lending rate that it considers in good faith to be the equivalent of that rate.

(d) If interest is payable in accordance with this section 5.5 (*Interest*), payment shall be due within three (3) Business Days following notice from a Party to the other Party that such interest is due.

5.6 Payment Netting. If on any date amounts would otherwise be payable by each Party to the other, whether under one or more Transactions, then, on that date, each Party's obligation to pay any such amount shall be automatically satisfied and discharged and replaced by an obligation upon the Party owing the greater aggregate payment in connection with such amounts (if any) to pay the other Party the net difference owed by such Party on that date.

5.7 Performance Assurance. If at any time during the Term:

(a) the creditworthiness or financial condition of a Party or its Credit Support Provider becomes impaired or unsatisfactory to the other Party acting reasonably and without limiting the generality of the foregoing it shall be reasonable for a Party to consider the financial condition or the creditworthiness of the other Party or its Credit Support Provider to be impaired or unsatisfactory where the relevant party's debt rating falls below investment grade according to a nationally recognized rating agency or it ceases to be rated by a nationally recognized rating agency; or

(b) a Party fails to pay an invoice issued by the other Party in accordance with this Article 5 (*Billing and Payment*),

in each case such "other Party" being referred to herein as the "**Requesting Party**," the Requesting Party may, upon notice request performance assurance in the form of a Credit Support Document from the other Party (the "Providing Party") which shall be in form and

substance and for a term that is acceptable to the Requesting Party, acting reasonably. The Providing Party will, or will cause its Credit Support Provider to, within 5 Business Days of receipt of a request, provide the Credit Support Document to secure the Providing Party's obligations under this Master Agreement. Upon requesting a Credit Support Document pursuant to this section 5.7 (*Performance Assurance*), the Requesting Party may immediately after the request was delivered, or at any time thereafter without notice to the Providing Party, suspend performance of any or all of the Requesting Party's obligations hereunder until such Credit Support Document has been received. Once a Providing Party has provided a Credit Support Document pursuant to this section 5.7 (*Performance Assurance*) it shall maintain or cause the maintenance of such Credit Support Document for as long thereafter as any obligations of the Providing Party under this Master Agreement remain outstanding, provided, however, Providing Party shall not be required to maintain a Credit Support Document in excess of the Requesting Party's Market Exposure. Notwithstanding the suspension rights contained herein, if the required Credit Support Document is not received within five (5) Business Days of being requested then an Event of Default will be deemed to have occurred with respect to the Providing Party and the Requesting Party will be entitled to the remedies set forth in Article 7 (*Failure to Deliver, Failure to Accept and Invalidation*).

ARTICLE 6
TAXES

6.1 Sales Taxes. All amounts referred to in this Master Agreement are exclusive of any applicable Sales Tax chargeable on the supply or supplies for which such amounts form the whole or part of the consideration for Sales Tax purposes. The Sales Tax treatment of any Transfer under a Transaction shall be determined pursuant to the Sales Tax law of the jurisdiction where a taxable transaction for Sales Tax purposes is deemed to take place. If Sales Tax is properly chargeable on any such supply or supplies, the Receiving Party shall pay to the Delivering Party an amount equal to the Sales Tax, if any, chargeable in the Delivering Party's jurisdiction, *provided, however*, that (a) such amount shall only be required to be paid once the Delivering Party provides the Receiving Party with a valid Sales Tax invoice in relation to that amount and (b) the Receiving Party shall be under no obligation to make any payment to the Delivering Party with respect to Sales Tax which the Receiving Party must self-assess under the reverse charge rule or any similar system in the Receiving Party's jurisdiction. Each Party shall to the extent permitted by Applicable Law provide the other with any additional valid Sales Tax invoices and any supporting documentation as required for the purposes of this Master Agreement and, to the extent required by Applicable Law, shall correctly account for any Sales Tax properly due in its jurisdiction.

6.2 Other Taxes. Subject to each Party's obligations relating to Sales Taxes, each Party shall cause all royalties, taxes, duties and other sums (including any stamp duty, other documentary taxes, climate change levy or other environmental tax or levy) legally payable by that Party arising in connection with this Master Agreement to be paid. In the event that the Delivering Party pays any tax which is properly for the account of the Receiving Party, the Receiving Party shall promptly indemnify or reimburse the Delivering Party with respect to such tax. In the event that the Receiving Party pays any tax which is properly for the account of the Delivering Party, the Receiving Party may deduct the amount of any such tax from the sums due to the Delivering Party under this Master Agreement and the Delivering Party shall promptly indemnify or reimburse the Receiving Party with respect to any such tax not so deducted.

6.3 Minimization of Taxes. Both Parties shall use reasonable efforts to administer this Master Agreement and to implement its provisions in accordance with the intent to minimize, where reasonable and possible, any potential tax payment collection or remittance obligations.

6.4 GST Registration. Each Party represents and warrants it is registered for the purposes of the Excise Tax Act (Canada) and agrees to provide any documentary evidence required by each Party in order to claim input credits/reimbursements in respect of any amounts payable for federal goods and services tax, the Quebec sales tax and any fully harmonized federal/provincial sales tax (collectively, "GST"), and all invoices, statements of account or any similar documents rendered by the Party shall contain such information as is required by, or prescribed under, the Excise Tax Act (Canada) or any similar or replacement value added or sales or use tax enacted under successor legislation. Each Party's GST registration number is:

Party A: [●];
Party B: [●].

6.5 Deeming Rule. Any payments payable under this Agreement that are otherwise subject to the deeming rule in section 182 of the Excise Tax Act (Canada) shall be increased by an amount equal to the amount determined by multiplying any such payments by the applicable rate of GST.

ARTICLE 7
FAILURE TO DELIVER, FAILURE TO ACCEPT AND INVALIDATION

7.1 Failure to Deliver. Except to the extent caused by the Receiving Party's non-performance under this Master Agreement or by a Force Majeure, Program Abandonment, Illegality or Change in Law under Article 8 (*Force Majeure, Program Abandonment, Illegality and Change in Law*), if the Delivering Party fails to Deliver a Quantity (whether in whole or in part) to the Receiving Party by a Delivery Date, such failure shall not constitute an Event of Default but the Transaction relating to such failure to Deliver shall be deemed to have been terminated to the extent of such failure and the Receiving Party may provide an invoice to the Delivering Party for the Receiving Party's Replacement Cost and the Delivering Party shall pay the invoice within three (3) Business Days of receipt.

7.2 Failure to Accept. Except to the extent caused by the Delivering Party's non-performance under this Master Agreement or by a Force Majeure, Program Abandonment, Illegality or Change in Law under Article 8 (*Force Majeure, Program Abandonment, Illegality and Change in Law*), if the Receiving Party fails to Accept a Quantity (whether tendered in whole or in part) in accordance with its obligations under section 4.3 (*Acceptance*), or if it specifies an incorrect Holding Account and does not provide the correct Holding Account within twenty-four (24) hours of notice from the Receiving Party, then such failure shall not constitute an Event of Default but the Transaction relating to such failure to Deliver shall be deemed to have been terminated to the extent of such failure and the Delivering Party may provide an invoice to the Receiving Party for the Delivering Party's Replacement Cost and the Receiving Party shall pay the invoice within three (3) Business Days of receipt.

7.3 Invalidation.

(a) If a Relevant Authority makes an Initial Invalidation Determination with respect to any Offsets that were Transferred pursuant to a Transaction, the Parties shall promptly confer and use best efforts to respond to any request made by the Relevant Authority (within the time periods stipulated) and to do all such things to cure the facts, circumstances or conditions in its control that are alleged to be the basis of the Initial Invalidation Determination.

(b) If a Relevant Authority makes a Final Invalidation Determination with respect to any Offsets that were Transferred pursuant to a Transaction (each, an "**Invalidated Offset**") with the effect that the Invalidated Offset is invalid for compliance purposes under all

Linked Programs, such determination shall not be an Event of Default but the Receiving Party may notify the Delivering Party that:

(i) it requests Qualified Replacement Offsets to be Delivered in which case, within ten (10) Business Days of such notice, the Delivering Party shall, at its sole cost and expense Deliver to the Receiving Party Qualified Replacement Offsets in a quantity equal to the quantity of the Invalidated Offsets in which case the provisions of the Master Agreement relating to Delivery and Transfer of Product, including Article 4 (*Product Transfers*) and this Article 7 (*Failure to Deliver, Failure to Accept and Invalidation*) shall apply to such Delivery; and

(ii) in case of a failure of the Delivering Party to Deliver as required under paragraph 7.3(b)(i) (*Invalidation*), then it will treat the Final Invalidation Determination as a Failure to Deliver in which case the Delivering Party shall be deemed to have failed to Deliver the Invalidated Offsets and the provisions of section 7.1 (*Failure to Deliver*) shall apply accordingly to such Invalidated Offsets.

(c) In the event any Qualified Replacement Offsets Transferred to the Receiving Party pursuant to paragraph 7.3(b)(i) (*Invalidation*) are or become Invalid, such Offsets shall be treated as Invalidated Offsets and the Receiving Party shall be entitled to exercise the rights set forth in this section 7.3 (*Invalidation*) with respect to such Invalidated Offsets.

(d) If an Offset Transferred to the Receiving Party, which has been submitted for compliance purposes, subsequently becomes an Invalidated Offset, the Delivering Party shall be liable for any monetary administrative penalty charged by the Relevant Authority incurred by the Receiving Party resulting from the Delivering Party's failure under paragraph 7.3(b)(ii) but only if, and to the extent that, the Receiving Party could not reasonably have avoided such monetary administrative penalties.

ARTICLE 8
FORCE MAJEURE, PROGRAM ABANDONMENT, ILLEGALITY AND CHANGE IN LAW

8.1 Force Majeure.

(a) Upon the occurrence of a Force Majeure, either Party may notify the other Party in writing of the commencement of the Force Majeure. Where the notification is from the Party affected by the Force Majeure (the "**FM Affected Party**"), to the extent available to such Party, it shall also provide details of the Force Majeure and a good faith, non-binding estimate of the extent and the expected duration of its inability to perform any of its obligations due to the Force Majeure.

(b) The obligations of both Parties under this Master Agreement with respect to the Transaction(s) affected by the Force Majeure (the "**FM Affected Transactions**") shall be suspended for the duration of the Force Majeure from the date of the notification given pursuant to section 8.1(a) (*Force Majeure*). During the continuation of the Force Majeure, the FM Affected Party shall use all reasonable efforts to overcome and mitigate the effects of the Force Majeure. Upon the Force Majeure being overcome or it ceasing to exist, both Parties shall resume full performance of their obligations under this Master Agreement with respect to the FM Affected Transactions (including, for the avoidance of doubt, any suspended obligations) as soon as reasonably practicable thereafter provided always that any Delivery Date delayed by Force Majeure shall not be deemed to be extended to a date that is later than the day that is five (5) Business Days prior to a

Compliance Deadline (the "**Delayed Delivery Date**"). For the avoidance of doubt, where a Delivery Date is adjusted in accordance with this section 8.1(b) (*Force Majeure*), then the use of the term "Delivery Date" elsewhere in this Master Agreement shall be construed to be a reference to the Delayed Delivery Date.

(c) Where a Force Majeure continues for a period of forty (40) Business Days, either Party may, by written notice to the other Party, terminate all (but not less than all) FM Affected Transactions.

8.2 Force Majeure Transaction Termination. If an FM Affected Transaction is terminated in accordance with section 8.1 (*Force Majeure*), the Parties' corresponding Delivery and Acceptance obligations shall be released and discharged without any liability, *provided, however*, that the obligation to pay any Unpaid Amounts shall survive the termination of the FM Affected Transaction.

8.3 Program Abandonment.

(a) Program Abandonment. If, at any time, a Program Abandonment occurs, all outstanding Transactions between the Parties under this Master Agreement shall be terminated from the effective date of such Program Abandonment as FM Affected Transactions and section 8.2 (*Force Majeure Transaction Termination*) shall apply.

(b) Unpaid Amounts. No Party shall be relieved from any obligations to provide any notice or pay any Unpaid Amounts during or following a Program Abandonment.

8.4 Illegality. If, at any time after a Transaction is entered into (i) any new Applicable Law is adopted or enacted or any existing Applicable Law is amended or (ii) there is any promulgation of, or any change in, the interpretation by any Governmental Authority of any Applicable Law, pursuant to which it becomes unlawful (other than as a result of a Program Abandonment) for a Party (the "**Affected Party**"):

(a) to perform any absolute or contingent obligation to make or receive a payment or Deliver or Accept Product with respect to that Transaction or to comply with any other material provision of this Master Agreement relating to that Transaction; or

(b) to perform, or for any Credit Support Provider of that Party to perform, any contingent or other obligation that the Party (or that Credit Support Provider) has under any Credit Support Document relating to that Transaction,

(in either case, an "**Illegality**"), then, unless the Parties otherwise agree in writing, either Party may elect to terminate that Transaction in accordance with sections 11.3 (*Early Termination Date*) and 11.4 (*Termination Payments*), except that, for the purposes of section 11.3 (*Early Termination Date*), either Party may designate an Early Termination Date and, for the purposes of section 11.4 (*Termination Payments*), references to the Defaulting Party are to be read as references to the Affected Party, references to the Non-Defaulting Party are to be read as references to the Party that is not the Affected Party, and references to "all Transactions" are to be read as references to only those Transactions affected by the Illegality ("**Illegality Affected Transactions**"). However, if both Parties are Affected Parties, then each Party shall determine its Market Loss with respect to the Illegality Affected Transaction and the Party with the lower Market Loss shall pay the Party with the higher Market Loss one half of the net difference between the Parties' respective Losses.

8.5 Change in Law.

(a) Upon the occurrence of a Change in Law, the Party affected by the Change in Law may notify the other Party of such occurrence. The notice shall identify the Transactions

affected by the Change in Law and describe in reasonable detail the Change in Law and the terms and conditions upon which the Affected Party is willing to continue to perform its obligations relating to such Transaction(s).

(b) Upon notice of a Change in Law, the obligations of both Parties under this Master Agreement with respect to the Transactions affected by the Change in Law shall be suspended and the Parties shall renegotiate in good faith the material terms or conditions so affected in order to appropriately pass through or otherwise address or reflect the effects of the Change in Law.

(c) If the Parties are unable to agree on revised material terms or conditions within twenty (20) Business Days following the notice of a Change in Law, the Party affected by the Change in Law may terminate the Transactions as FM Affected Transactions and section 8.2 (*Force Majeure Transaction Termination*) shall apply.

8.6 Program Abandonment, Illegality, Change in Law, Force Majeure and Event of Default. If an event or circumstance would, in the absence of this section 8.6 (*Program Abandonment, Illegality, Change in Law, Force Majeure and Event of Default*), constitute or give rise to more than one of the following events, it shall be treated solely as the first of the following listed applicable events: (i) a Program Abandonment; (ii) an Illegality; (iii) Change in Law; (iv) a Force Majeure; or (v) an Event of Default.

ARTICLE 9
REPRESENTATIONS AND WARRANTIES

9.1 Mutual Representations and Warranties. Each Party hereby represents and warrants to the other Party (which representations and warranties shall be deemed to be repeated by each Party on each date on which a Transaction is entered into) that:

(a) Status. It is duly organized and validly existing under the laws of the jurisdiction of its organization or incorporation (and, if relevant under those laws, is in good standing).

(b) Power. It has the power to:

(i) execute this Master Agreement and any other documentation relating to this Master Agreement to which it is a party;

(ii) deliver this Master Agreement and any other documentation required hereunder; and

(iii) perform its obligations under this Master Agreement and any obligations it has under any Credit Support Document to which it is a party,

and it has taken, or obtained, as the case may be, all approvals, consents, resolutions or other actions that are legally required in the relevant jurisdiction(s) to authorize such execution, delivery and performance.

(c) No Violation or Conflict. The execution, delivery and performance referred to in section 9.1(b) (*Power*) do not violate or conflict with Applicable Law, any provision of its constitutional documents, or any contractual restriction binding on or affecting it or any of its assets.

(d) Required Authorizations. Required authorizations, including all governmental and other licenses, authorizations, permits, consents, contracts and other approvals (if any) that are required to enable the Party to fulfill any of its obligations under this Master Agreement have been obtained and are in full force and effect, and all conditions of such required authorizations have been complied with.

(e) Physical Settlement. It enters into each Transaction hereunder with the intention that it shall be physically settled through Delivery of Product and shall not be financially settled or otherwise constitute a "swap" within the meaning of the *Commodity Exchange Act*, 7 U.S.C. 1a(47)(A);

(f) Obligations Binding. Its obligations under this Master Agreement or any Credit Support Document to which it is a party constitute its legal, valid and binding obligations, enforceable in accordance with their respective terms subject to applicable bankruptcy, reorganization, insolvency, moratorium or similar laws affecting creditors' rights generally and to equitable principles of general application.

(g) No Event of Default. No Event of Default has occurred with respect to it and no such event would occur as a result of its entering into or performing its obligations under this Master Agreement or any Credit Support Document to which it is a party.

(h) No Litigation. No litigation, arbitration or administrative suit or proceeding at law or in equity or before any court, tribunal, governmental body, agency, official or arbitrator is pending or, so far as it is aware, threatened against it or, if applicable, any Credit Support Provider that would, if adversely determined, be likely to affect the legality, validity or enforceability against it of this Master Agreement or that Credit Support Document or its ability to perform its obligations under this Master Agreement or that Credit Support Document.

(i) No Reliance. It is not relying upon any representations of the other Party other than those expressly set out in this Master Agreement or any Credit Support Document to which it is a party.

(j) Principal. It has negotiated, entered into and executed this Master Agreement and any Credit Support Document to which it is a party as principal (and not as agent or in any other capacity, fiduciary or otherwise).

(k) Risk Assumption. It has entered into this Master Agreement and any Credit Support Document to which it is a party after a full opportunity to review their terms and conditions, has a full understanding of those terms and conditions and of their risks, and is capable of assuming those risks.

(l) Accurate Information. All applicable information that is furnished in writing by or on behalf of it to the other Party and is identified as being subject to or connected to this Master Agreement is, as of the date it is furnished to the other Party, true, accurate and complete in every material respect.

(m) Compliance with Laws. It is currently in compliance with all Applicable Laws relevant to the Transaction(s).

9.2 Representation of Delivering Party. The Delivering Party represents and warrants on each Transfer Date that each Product the subject of a Transfer is in full force and effect and to its best

information, knowledge and belief, no circumstances exist under which any Relevant Authority could revoke any such Product.

ARTICLE 10
COVENANTS

10.1 No Encumbrances. The Delivering Party covenants to the Receiving Party that it shall convey to the Receiving Party full legal and beneficial title to the Transferred Product (whether or not such Product constitutes property) free and clear of any liens, taxes, claims, demands, security interests or other encumbrances or any interest in or right to use the Transferred Product by any other Entity and the Delivering Party shall indemnify and hold the Receiving Party harmless for any such adverse claims with respect to the Transferred Product.

10.2 Holding Accounts and Registries. So long as either Party has any Delivery or Acceptance obligation under a Transaction, each Party covenants to the other Party that:

(a) it shall ensure that it has a Holding Account registered in accordance with the Program Rules in the Relevant Registry specified in the related Confirmation, which Holding Account shall be (i) capable of Delivering or Accepting (as applicable) the relevant Product for each Transaction; (ii) in good status; and (iii) held by the Party or an Affiliate of the Party; and

(b) it shall notify the other Party of such Holding Account and all necessary Holding Account information no later than ten (10) Business Days prior to the Delivery Date.

ARTICLE 11
EVENTS OF DEFAULT AND TERMINATION

11.1 Events of Default. Subject to Article 7 (*Failure to Deliver, Failure to Accept and Invalidation*) and section 8.6 (*Program Abandonment, Illegality, Change in Law, Force Majeure and Event of Default*), an "**Event of Default**" means the occurrence of any of the following events:

(a) Non-payment. The Party fails to pay any amount when due under this Master Agreement, and that failure is not remedied on or before the tenth (10^{th}) Business Day after the Non-Defaulting Party gives the Defaulting Party notice of that failure.

(b) Delivery or Acceptance. A Party fails to complete Delivery or Acceptance, which is not excused by Force Majeure, more than twice in any 12-month period.

(c) Representation or Warranty. Any material representation or warranty made, or deemed to have been made, by the Party or any Credit Support Provider of that Party in this Master Agreement or any Credit Support Document proves to have been false or misleading in a material way at the time it was made or was deemed to have been made.

(d) Material Obligations. The Party fails to perform a material obligation under this Master Agreement (other than an obligation referred to in sections 11.1(a) (*Non-payment*), 11.1(c) (*Representation or Warranty*), 7.1 (*Failure to Deliver*) and 7.2 (*Failure to Accept*)) and that failure is not remedied within five (5) Business Days of the Non-Defaulting Party giving the Defaulting Party notice of that failure.

(e) Insolvency. The Party or any Credit Support Provider of the Party becomes Bankrupt:

(f) Credit Support.

(i) the Party or any Credit Support Provider of the Party fails to comply with or perform any agreement or obligation to be complied with or performed by it in accordance with any Credit Support Document if that failure is not remedied within three (3) Business Days of notification;

(ii) any Credit Support Document expires or terminates, is due to expire or terminate within thirty (30) days or fails or ceases to be in full force and effect for the purpose of this Master Agreement (in each case other than in accordance with its terms) prior to the satisfaction of all obligations of the Party under each Transaction to which that Credit Support Document relates without the written consent of the other Party and such expiration or termination is not remedied within three (3) Business Days of notification; or

(iii) the Party or any Credit Support Provider of that Party disaffirms, disclaims, repudiates or rejects, in whole or in part, or challenges the validity of, that Credit Support Document or otherwise fails to comply with or perform its obligations under or with respect to a Credit Support Document and that failure is continuing after any applicable grace or cure period.

(g) Performance Assurance. The Party fails to provide Performance Assurance in accordance with section 5.7 (*Performance Assurance*).

(h) Merger Without Consent. The Party or any Credit Support Provider of the Party undergoes a Change of Control, consolidates or amalgamates with, or merges with or into, or transfers all or substantially all its assets to, or reorganizes, incorporates, reincorporates or reconstitutes into or as another Entity, or another Entity transfers all or substantially all its assets to, or reorganizes, incorporates, reincorporates or reconstitutes into or as such Party or any Credit Support Provider of the Party, and:

(i) that Party or Credit Support Provider fails to obtain the consent of the other Party prior to such consolidation, amalgamation, merger, transfer, reorganization, reincorporation or reconstitution; or

(ii) the benefits of any Credit Support Document cease or fail to extend (without the consent of the other Party) to the performance by such resulting surviving transferee or successor Entity of its obligations under this Master Agreement at the time of such consolidation, amalgamation, merger, transfer, reorganization, reincorporation or reconstitution.

(i) Repudiation of Agreement. The Party disaffirms, disclaims, repudiates or rejects, in whole or in part, or challenges the validity of this Master Agreement or any Confirmation executed and delivered by that Party or any Transaction evidenced by such a Confirmation (or such action is taken by any person or Entity appointed or empowered to operate it or act on its behalf).

11.2 Suspension Following Event of Default. Notwithstanding any other provision of this Master Agreement, after the occurrence of an Event of Default, the Non-Defaulting Party may:

(a) withhold or suspend payments under this Master Agreement; or

(b) suspend its compliance with Article 4 (*Product Transfers*).

11.3 Early Termination Date. If, at any time, an Event of Default has occurred and is continuing, the Non-Defaulting Party may designate a date (the "**Early Termination Date**") on which this Master Agreement and all Transactions shall terminate (even if the Event of Default is then no longer continuing) and on which date all outstanding Transactions shall liquidate and accelerate and the Non-Defaulting Party shall calculate its Market Loss. Upon the effective designation or occurrence of an Early Termination Date: (a) no further payments or compliance with Article 4 (*Product Transfers*) is required with respect to any Transaction, and (b) the amount, if any, payable with respect to an Early Termination Date shall be determined pursuant to section 11.4 (*Termination Payments*). The Early Termination Date shall not be earlier than the date of the Non-Defaulting Party's notice to the other Party and not later than fifteen (15) Business Days after the date of such notice. Such notice must specify and describe in reasonable detail the applicable Event of Default. The rights under this section 11.3 (*Early Termination Date*) are in addition to any other remedies available under this Master Agreement or at law.

11.4 Termination Payments.

(a) On, or as soon as reasonably practicable after, the Early Termination Date, the Non-Defaulting Party shall liquidate each terminated Transaction in good faith calculating the termination payment (the "**Termination Payment**"), which is an amount equal to:

(i) the Non-Defaulting Party's Market Loss (whether positive or negative) for all Transactions; plus

(ii) all Unpaid Amounts owing to the Non-Defaulting Party; less

(iii) any Unpaid Amounts owing to the Defaulting Party.

(b) The Non-Defaulting Party shall notify the Defaulting Party of the Termination Payment including detailed support for the Termination Payment calculation.

(c) A Party is not required to enter into replacement transactions in order to determine the Termination Payment.

(d) If the Termination Payment is a positive number, the Defaulting Party shall pay the Termination Payment to the Non-Defaulting Party within three (3) Business Days of invoice or notification of the Termination Payment amount (the "**Termination Payment Date**").

(e) If the Termination Payment is a negative number, the Non-Defaulting Party shall pay an amount equal to the absolute value of the Termination Payment to the Defaulting Party within thirty (30) Business Days of the Termination Payment Date.

(f) Disputed amounts under this section 11.4 (*Termination Payments*) are to be paid by the Defaulting Party subject to refund with interest calculated in accordance with section 5.5(b) (*Interest*) if the dispute is resolved in favour of the Defaulting Party.

11.5 Survival of Obligations. Any obligation of a Party that would have become due under a Transaction but for section 11.2 (*Suspension Following Event of Default*) shall, notwithstanding the occurrence of the last scheduled due date for performance by that Party under that Transaction, become due on the date that the relevant Event of Default ceases to subsist if an Early Termination Date has not been designated.

ARTICLE 12
CONFIDENTIALITY

12.1 The Parties shall treat the existence and terms of this Master Agreement and all information provided under or in connection with it, including the existence and terms of any Transaction (collectively, "**Confidential Information**") as confidential and may not either disclose Confidential Information or use it other than for bona fide purposes connected with this Master Agreement without the prior written consent of the other Party, except that consent is not required for disclosure to:

(a) directors, employees or Affiliates of a Party, as long as they need to know the Confidential Information for the purposes of such Party's performance of this Master Agreement and in turn are required by that Party to treat the Confidential Information as confidential in favour of the other Party on terms substantially the same as those set out in this Article 12 (*Confidentiality*);

(b) persons professionally engaged by a Party, as long as they need to know the Confidential Information for the purposes of such Party's performance of this Master Agreement and in turn are required by that Party to treat the Confidential Information as confidential in favour of the other Party on terms substantially the same as those set out in this Article 12 (*Confidentiality*);

(c) the extent required by any Governmental Authority having competent jurisdiction over that Party;

(d) any bank, other financial institution or rating agency to the extent required in relation to the financing of a Party's business activities, as long as the bank or other financial institution or rating agency, as the case may be, is required by that Party to treat the Confidential Information as confidential in favour of the other Party on terms substantially the same as those set out in this Article 12 (*Confidentiality*);

(e) the extent required by any applicable laws, judicial process or the rules and regulations of any regulated market or recognized stock exchange;

(f) any permitted assignee of the rights and interests of a Party under this Master Agreement or under a Transaction or to a person intending to acquire an interest in a Party or that Party's Affiliate as long as such assignee or acquirer in turn is required by that Party to treat the Confidential Information as confidential in favour of the other Party on terms substantially the same as those set out in this Article 12 (*Confidentiality*); or

(g) the extent that the Confidential Information is in or lawfully comes into the public domain other than by breach of this Article 12 (*Confidentiality*).

12.2 For each Transaction, the obligations under this Article 12 (*Confidentiality*) shall survive termination of this Master Agreement for a period of two (2) years after the final day of the compliance period of the Program during which the Transaction occurred.

ARTICLE 13
ASSIGNMENT

13.1 Prohibition of Assignment. Subject to section 13.2 (*Assignment of Termination Payments*), neither Party may assign or transfer to any person any of its rights or obligations with respect to this Master Agreement without the written consent of the other Party (which consent shall not be unreasonably withheld or delayed); except that either Party may, without the other Party's consent (i)

transfer, sell, pledge, encumber or assign this Master Agreement or the accounts, revenues or proceeds hereof in connection with any financing or other financial arrangements; (ii) transfer or assign this Master Agreement to an Affiliate, or to any Person succeeding to all or substantially all of the assets or business of assignor and whose creditworthiness (or the creditworthiness of such proposed assignee's proposed Credit Support Provider, if any) is equal to or higher than that of assignor (or of assignor's Credit Support Provider, if any) as at the effective date of the proposed assignment, and such Affiliate or Person provides, or causes to be provided, Performance Assurance; provided, however, that in any such case, such assignee shall agree in writing to be bound by the terms and conditions of this Master Agreement. Any assignment by a Party in violation of this provision is voidable at the other Party's option. By consenting to one assignment a Party will not be deemed to have consented to a subsequent assignment.

13.2 Assignment of Termination Payments. Notwithstanding section 13.1 (*Prohibition of Assignment*), a Party may assign all or any part of its interest in any Termination Payment payable to it by a Defaulting Party under section 11.4 (*Termination Payments*) together with any amounts payable on or with respect to that interest pursuant to section 5.5 (*Interest*) without the consent of the other Party.

ARTICLE 14
LIABILITIES

14.1 No Consequential Loss. Except to the extent included in any payment made in accordance with Article 7 (*Failure to Deliver, Failure to Accept and Invalidation*) or sections 4.4 (*Transfer Request Deficiencies*), 11.4 (*Termination Payments*) or 8.4 (*Illegality*), neither Party is liable to the other, whether in contract, tort (including negligence and breach of duty) or otherwise at law, for any business interruption or loss of use, profits, contracts, production, or revenue or for any consequential or indirect loss or damage of any kind however arising.

14.2 Breach of Warranty or Covenant. Neither Party shall be liable with respect to any breach of warranty under Article 9 (*Representations and Warranties*) or covenant under Article 10 (*Covenants*) in relation to any Transaction for any greater sum than it would be liable for under Article 11 (*Events of Default and Termination*) in relation to such Transaction for any breach of Article 4 (*Product Transfers*).

14.3 Unlimited Liability. Notwithstanding anything to the contrary contained in this Master Agreement, the liability of a Party to the other Party for:

(a) death or personal injury resulting from negligence of the Party liable, its employees, agents and contractors; or

(b) fraud or fraudulent misrepresentation

is unlimited save that nothing in this section 14.3 (*Unlimited Liability*) confers a right or remedy upon the other Party to which that Party would not otherwise have been entitled.

14.4 Reasonable Pre-estimate and Maximum Liability. Each Party acknowledges that the payment obligations in Articles 4 (*Product Transfers*), 7 (*Failure to Deliver, Failure to Accept and Invalidation*), 8 (*Force Majeure, Program Abandonment, Illegality and Change in Law*) and 11 (*Events of Default and Termination*) are a reasonable pre-estimate of loss in the light of the anticipated harm and the difficulty of estimation or calculation of actual damages. Each Party waives the right to contest those payments as an unreasonable penalty. Each Party further acknowledges that the payment obligation in Article 11 (*Events of Default and Termination*) shall constitute the maximum liability in the event of termination of this Master Agreement.

ARTICLE 15
MISCELLANEOUS

15.1 Waiver. No waiver by either Party of any breach by the other of this Master Agreement operates unless expressly made in writing, and any such waiver is not to be construed as a waiver of any other breach.

15.2 Amendment. No amendment to the provisions of this Master Agreement is valid unless it is in writing and signed by each Party.

15.3 Entire Agreement. This Master Agreement and each Confirmation entered into shall constitute the entire agreement and understanding of the Parties with respect to its subject matter and shall supersede and extinguish any representations previously given or made with respect to its subject matter and neither Party is relying on any such representation and warranty other than those given or made in this Master Agreement, but nothing in this section 15.3 (*Entire Agreement*) limits or excludes any liability for fraud.

15.4 Severability. If any provision or part of a provision of this Master Agreement is found by a court, arbitrator or other authority of competent jurisdiction to be void or unenforceable, that provision or part of a provision is to be deemed deleted from this Master Agreement and the remaining provisions to continue in full force and effect. The Parties shall in this event seek to agree upon a valid and enforceable provision or part of a provision to replace the provision or part of a provision found to be void and unenforceable.

15.5 Notices. Any notice or other communication to be given or made with respect to this Master Agreement by one Party to the other is to be given or made in writing to the other at the address or contact number or in accordance with the electronic messaging system or e-mail details provided in sections 15.5(b) and 15.5(c) (*Notices*).

(a) A written notice is deemed to have been received:

(i) if sent by e-mail, on the Business Day the e-mail is sent or on the first (1st) Business Day after the date the e-mail is sent if sent on a day other than a Business Day, unless the sender receives an automatically generated response indicating that the e-mail address specified in sections 15.5(b) and 15(c) (*Notices*) are not valid.

(ii) if delivered by hand, on the Business Day of delivery or on the first (1st) Business Day after the date of delivery if delivered on a day other than a Business Day;

(iii) if sent by registered mail, on the Business Day of delivery or on the first (1st) Business Day after the date of delivery if delivered on a day other than a Business Day; or

(iv) if sent by facsimile transmission and a valid transmission report confirming good receipt is generated, on the day of transmission if transmitted before 5:00 p.m. on a Business Day or otherwise at 9:00 a.m. on the first Business Day after transmission.

(b) Address for notices or communications to Party A:

Any notices or communications to Party A relating to a Confirmation are to be given to it at the following address or to be sent by email to the email address set out below:

Address: Enbridge Gas Distribution Inc.
c/o Enbridge Inc.
Suite 200, Fifth Avenue Place
425 - 1st Street S.W.
Calgary, Alberta T2P 3L8

Email: EnbridgeConfirmations@enbridge.com

Any notices or communications to Party A relating to Article 4 (*Product Transfers*) are to be sent by email to **both** of the email addresses set out below:

Email:

Email:

All other notices or communications to Party A are to be given to it at the following address or to be sent by email to the email address set out below:

Address: Enbridge Gas Distribution Inc.
c/o Enbridge Inc.
Suite 200, Fifth Avenue Place
425 - 1st Street S.W.
Calgary, Alberta T2P 3L8

Attention: Vice President and Treasurer

Facsimile No.: (403) 767-4549

Specific Instructions: With a Copy to: Vice President, Legal – Calgary
Email: LegalNotices@Enbridge.com

(c) Address for notices or communications to Party B:

Address:

Attention:

Facsimile No.: Telephone No.:

E-mail:

Specific Instructions:

15.6 Third Party Rights. Subject to the rights that may accrue to any successor or permitted assignees of the Parties, no provision of this Master Agreement is be construed as creating any rights enforceable by a third party, and all third party rights implied by law are, to the extent permissible by law, excluded from this Master Agreement.

15.7 Governing Law and Disputes. This Master Agreement and the rights and duties of the Parties hereunder shall be governed by and construed, enforced and performed in accordance with the laws of the Province of Ontario and all Federal laws applicable therein. The Parties submit to the exclusive

jurisdiction of the Courts of Ontario and all Courts of Appeal having jurisdiction for the purposes of any dispute under or in connection with this Master Agreement and any obligations arising out of or in connection with it. Notwithstanding the foregoing, the creation, issuance, transfer, tracking and retirement of Product shall be governed by the Applicable Law having jurisdiction over the Product.

15.8 Bankruptcy-related Acknowledgments. The Parties hereto intend for:

(a) The Transactions hereunder and this Master Agreement each to be:

(i) "eligible financial contracts" by virtue of being a "master agreement", "spot, future, forward or other commodity contracts" or otherwise as an "eligible financial contract" within the meaning of the BIA, including, without limitation, Can. Reg. 2007-256 - Eligible Financial Contract General Rules (BIA), made under the BIA, SOR/2007-256, the CCAA, including, without limitation, Can. Reg. 2007-57 - Eligible Financial Contract Regulations (CCAA) made under the CCAA, SOR/2007-257, as amended and SOR/2009-223, the WRA, including, without limitation, Eligible Financial Contract Regulations (WRA), SOR/2007-258, or any other applicable Canadian insolvency legislation; and

(ii) a "forward contract" within the meaning of the *Bankruptcy Code* (United States), 11 U.S.C. §§ 101 *et seq*., including without limitation as such term is used in Sections 101, 362 and 555 thereof;

(b) This Master Agreement to be a "master netting agreement" as defined in the *Bankruptcy and Insolvency Act* (Canada), the *Companies' Creditors Arrangement Act* (Canada), the *Winding-Up and Restructuring Act* (Canada) and in Section 101(38A) of the *Bankruptcy Code* (United States);

(c) A Party's right to liquidate, terminate or accelerate any Transaction, to offset, net or net out termination values, payment amounts or other Transfer obligations, and to exercise any other remedies upon the occurrence of any Event of Default under this Master Agreement or any Transaction thereunder with respect to the other Party that results in the termination or cancellation of this Master Agreement or any Transaction hereunder to constitute a "contractual right" within the meaning of Sections 560 and 561 of the *Bankruptcy Code* (United States);

(d) Any cash, securities or other property provided as performance assurance, credit support or collateral with respect to this Master Agreement or any Transaction hereunder to constitute:

(i) "financial collateral", in each case, within the meaning of the *Bankruptcy and Insolvency Act* (Canada), the *Companies' Creditors Arrangement Act* (Canada), the *Winding-Up and Restructuring Act* (Canada); and

(ii) "margin payments" and "transfers" "under" or "in connection with" this Master Agreement and each Transaction hereunder, and in each case within the meaning of the *Bankruptcy Code* (United States);

(e) All payments or deliveries for, under or in connection with this Master Agreement or each Transaction hereunder, all payments for any securities or other assets and the transfer of such securities or other assets to constitute "settlement payments" and "transfers" "under"

or "in connection with" this Master Agreement and each Transaction hereunder, and in each case within the meaning of the *Bankruptcy Code* (United States).

15.9 Counterparts. This Master Agreement (including any Confirmations) may be executed in any volume of counterparts and by different Parties in separate counterparts, any of which when so executed shall be deemed to be an original and all of which when taken together shall constitute the one and same Master Agreement.

15.10 Statute of Frauds. The Parties hereto intend for the Transactions hereunder and this Master Agreement (including any Confirmations) each to be a "qualified financial contract" within the meaning of New York General Obligations Law § 5-701(b) and California Civil Code § 1624(b)(2), respectively.

15.11 Audit. Each Party and its duly authorized representatives shall have access to and be provided with copies of the accounting records and other documents maintained by the other Party which relate to the Product being Transferred under this Master Agreement or which otherwise must be maintained by the other Party under the Program Rules in relation to Product Transferred. Each Party shall have the right to audit such records once a year at any reasonable time or times within sixty (60) months of the rendition of any statement or invoice forming the basis of such audit request.

15.12 Conflict of Interest. Except as otherwise expressly provided herein, no director, employee or agent of either Party, its subcontractors or vendors, shall give or receive from any director, employee or agent of the other Party or any Affiliate any commission, fee, rebate, gift or entertainment of significant cost or value in connection with this Master Agreement. In addition, no director, employee or agent of either Party, its subcontractors or vendors, shall enter into any business arrangement with any director, employee or agent of the other Party or any Affiliate who is not acting as a representative of such Party or its Affiliate without prior written notification thereof. Any representative(s) authorized by either Party may audit the applicable records of the last three (3) years of the other Party for the sole purpose of determining whether there has been compliance with section 15.11 (*Audit*). All financial settlements, reports, and billings rendered to a Party are to properly reflect the facts about all activities and transactions.

15.13 Own Account. Each Party is entering into this Master Agreement, and any Transactions pursuant to this Master Agreement, for its own account and not on behalf of any other party. Each Party has undertaken entry into this Master Agreement, and any Transactions pursuant to this Master Agreement, pursuant to its own market analysis and neither party has acted or will act as a Commodity Trading Advisor or advisor in any other capacity to the other Party with respect to this Master Agreement or any Transactions pursuant to this Master Agreement. This Master Agreement provides for the purchase and sale of Product. This Master Agreement is not a service agreement and no Party is authorized to act on behalf of the other as agent or otherwise. Seller may fulfill its obligations to Deliver the Product using Product that it holds in its Holding Account, by purchasing Product on the secondary market, by purchasing Product in an auction, or by any other means that it elects in its discretion. Under no circumstances shall the Parties share between themselves, either directly or indirectly, any information relating to their participation in any auction held pursuant to the Cap and Trade Regulations, including any information in connection with the following: (a) their identity; (b) their bidding strategy; (c) the amount of their bids and the quantity of emission units concerned; and (d) the financial information submitted to Administrator.

IN WITNESS WHEREOF the Parties have duly executed and delivered this Master Agreement with effect from the Effective Date.

ENBRIDGE GAS DISTRIBUTION INC.	
(**Party A**)	**(Party B)**
By:	By: .....
Name: Title:	Name: Title:
By:	By: .....
Name: Title:	Name: Title:

SCHEDULE 1
DEFINITIONS

The following words or phrases, where they appear in this Master Agreement, have the following respective meanings:

"**Accept**" means the completion by the Receiving Party of a Transfer Request Confirmation in accordance with section 4.3 (*Acceptance*), and "**Acceptance**" and "**Accepted**" shall be construed accordingly.

"**Account Representative**" means either a Primary Account Representative or an Alternate Account Representative, each term having the meaning given to it in the Cap and Trade Regulations.

"**Act**" means the *Climate Change Mitigation and Low-carbon Economy Act,* SO 2016, c 7, as amended from time to time.

"**Affected Party**" has the meaning given in section 8.4 (*Illegality*).

"**Affiliate**" means, with respect to any Entity, any other Entity that directly or indirectly through one or more intermediaries Controls or is Controlled by or is under common Control with the Entity.

"**Allowance**" means

(a) the limited authorization to emit up to one metric ton of carbon dioxide equivalent issued in accordance with section 30 of the Act;

(b) an authorization to emit up to one metric ton of carbon dioxide equivalent issued by the Relevant Authority of a Linked Program that is recognized for use in the Program pursuant to section 38 of the Act; or

(c) to the extent the Relevant Registry does not permit the Parties to identify whether a specific authorization was issued by the Relevant Authority or by an external GHG emissions trading system approved for linkage under the Cap and Trade Regulations, any other authorization to emit issued by such linked system that may be used to emit up to one (1) metric ton of carbon dioxide equivalent under the Cap and Trade Regulations; and,

for the avoidance of doubt, excludes Offsets and Early Action Offset Credits.

"**Applicable Law**" means any applicable international, federal, provincial, state, local or municipal statute, law, constitution, treaty, rule, by-law, regulation, ordinance, code, permit, enactment, injunction, order, writ, decision, interpretation, advice letter, authorization, resolution, judgment, decree or other legal or regulatory determination or restriction by any Governmental Authority, court or arbitrator of competent jurisdiction that apply to the Program Rules, any Linked Program, or any one or both of the Parties (or any of their assets) or the terms hereof; and any binding interpretation of the foregoing.

"**Auction Reserve Price**" means the minimum price of an Allowance established in accordance with the Cap and Trade Regulations.

"**Bankrupt**" means, with respect to a Party or Credit Support Provider, that such Party or Credit Support Provider: (i) is dissolved (other than pursuant to a consolidation, amalgamation or merger

or the admission or withdrawal of a partner); (ii) becomes insolvent or is unable to pay its debts or fails (or admits in writing its inability) generally to pay its debts as they become due; (iii) makes a general assignment, arrangement or composition with or for the benefit of its creditors; (iv) has instituted against it a proceeding seeking a judgment of insolvency or bankruptcy or any other relief under any bankruptcy or insolvency law or other similar law affecting creditor's rights, or a petition is presented for its winding-up, reorganization or liquidation; (v) commences a voluntary proceeding seeking a judgment of insolvency or bankruptcy or any other relief under any bankruptcy or insolvency law or other similar law affecting creditors' rights; (vi) seeks or consents to the appointment of an administrator, provisional liquidator, conservator, receiver, trustee, custodian or other similar official for it or for all or substantially all of its assets; (vii) has a secured party take possession of all or substantially all of its assets, or has a distress, execution, attachment, sequestration or other legal process levied, enforced or sued on or against all or substantially all of its assets; (viii) causes or is subject to any event with respect to it which, under the applicable laws of any jurisdiction, has an analogous effect to any of the events specified in clauses (i) to (vii) inclusive; or (ix) takes any action in furtherance of, or indicating its consent to, approval of, or acquiescence in, any of the foregoing acts.

"**BIA**" means the *Bankruptcy and Insolvency Act*, R.S.C. 1985, c.B-3, as amended from time to time.

"**Business Day**" means any day other than a Saturday, Sunday, or public holiday as defined in *Employment Standards Act, 2000*, S.O. 2000, c. 41, as amended from time to time.

"**Calculation Date**" has the meaning specified in the relevant Confirmation.

"**Cap and Trade Regulations**" means the Act and the regulations made thereunder, all as amended from time to time.

"**CCAA**" means the *Companies' Creditors Arrangement Act*, R.S.C. 1985, c.C-36, as amended from time to time

"**Change in Law**" means the adoption, enactment or promulgation of any new Applicable Laws or the amendment, modification, revision or repeal of any existing Applicable Laws, or the issuance by a Governmental Authority of an order, decision or interpretation of any existing Applicable Laws as a result of which, on a Delivery Date: (i) the Receiving Party that was a covered Entity under the Program Rules as of the Trade Date is no longer a covered Entity under or is no longer obligated to comply with the Program Rules; (ii) the Receiving Party is no longer permitted to use the Product to satisfy its compliance obligations under the Program Rules; (iii) the Receiving Party's covered emissions under the Program Rules are materially lower than what they were scheduled to be under the Program Rules in effect at the Trade Date; or (iv) the Relevant Authority is unable to implement or enforce the Program Rules.

"**Change of Control**" means in relation to an Entity, any other Entity acquiring Control, directly or indirectly of such first Entity except where such acquisition is of securities listed on a stock exchange.

"**CITSS**" means the Compliance Instrument Tracking System Service authorized by the Cap and Trade Regulations in accordance with the Program Rules and administered by the Western Climate Initiative, Inc., or any successor system thereto.

"**Compliance Deadline**" means the last date by which an Entity may surrender Allowances or Offsets to the Relevant Authority to meet the applicable compliance obligation, as defined under the Program Rules.

"**Compliance Registry**" means the CITSS, or another system mutually agreed to by the Parties to ensure the accurate accounting of the issuance, holding, Transfer, surrender (for compliance or otherwise), and cancellation of Allowances or Offsets.

"**Confidential Information**" has the meaning given in Article 12 (*Confidentiality*).

"**Confirmation**" means a confirmation of a Transaction substantially in the form set out in Exhibit A with respect to Allowances or Exhibit B with respect to Offsets, or in a form otherwise agreed between the Parties.

"**Contract Amount**" means, for each Transaction, the amount calculated by multiplying the Product Unit Price by the Quantity for that Transaction.

"**Control**" means the possession, directly or indirectly through one or more intermediaries, of more than fifty percent (50%) of the outstanding voting securities, equity or other ownership interests of an Entity, or the power to direct or cause the direction of the management policies of, any Entity, whether through ownership of securities, equity or other ownership interests, as a general partner or trustee, by contract or otherwise and "**Controls**" and "**Controlled**" shall be construed accordingly.

"**Credit Support Document**" means, a letter of credit, a guarantee, or other security acceptable to a Requesting Party.

"**Credit Support Provider**" means an Affiliate of a Party who has issued a Credit Support Document in relation to the performance of the obligations of such Party under this Master Agreement.

"**Defaulting Party**" has the meaning given in section 11.1 (*Events of Default*).

"**Delayed Delivery Date**" has the meaning given in section 8.1(b) (*Force Majeure*).

"**Deliver**" means the completion by the Delivering Party of the Transfer Request Initiation in accordance with section 4.2 (*Delivery*), and "**Delivery**" and "**Delivered**" shall be construed accordingly.

"**Delivering Party**" means the Party to the Transaction, as specified in the Confirmation, who is to Deliver the Product to the Receiving Party.

"**Delivering Party's Holding Account**" means the Holding Account(s), specified by the Delivering Party in the Confirmation to a Transaction (including any additional account specified by the Delivering Party in accordance with Article 4 (*Product Transfers*)). Where the Delivering Party has specified a Registry only without specifying the Holding Account details in the Confirmation, "Delivering Party's Holding Account" includes any Holding Account notified by the Delivering Party to the Receiving Party under Article 4 (*Product Transfers*) and/or section 10.2 (*Holding Accounts and Registries*).

"**Delivering Party's Replacement Cost**" means with respect to a failure to Accept (or cause the Acceptance of) a Delivery of a volume of Product pursuant to section 7.2 (*Failure to Accept*) or pursuant to section 4.4 (*Transfer Request Deficiencies*), in either case, the "**Rejected Product**":

(a) any positive difference between (i) the Product Unit Price multiplied by the volume of Rejected Product, and (ii) the price the Delivering Party, acting in a commercially reasonable manner, does or would receive in an arm's length transaction for an equivalent volume of like Product; plus

(b) interest on the amount calculated in accordance with paragraph (a) above for the period from (and including) the Delivery Date to (but excluding) the date of termination at the rate specified in section 5.5(a) (*Interest*); plus

(c) the amount of such reasonable costs and expenses which the Delivering Party incurs with respect to the Rejected Product (including, without limitation, broker fees, commissions and legal fees).

"**Delivery Date**" means, in relation to a Transaction, the Business Day agreed between the Parties as the date by which the relevant Transfer Request Initiation is to be initiated.

"**Early Action Offset Credit**" means an "early reduction credit" as defined in the Cap and Trade Regulations.

"**Early Termination Date**" has the meaning given in section 11.3 (*Early Termination Date*).

"**Eastern Time**" means Eastern Standard Time or Eastern Daylight Time, as applicable.

"**Effective Date**" means the date set out on the first page of this document.

"**Entity**" means an individual, government or state or division of it, government or state agency, corporation, partnership or such other entity as the context may require.

"**Event of Default**" has the meaning given in section 11.1 (*Events of Default*).

"**Final Invalidation Determination**" means a notice from a Relevant Authority of the Invalidation of a specified quantity of Offsets.

"**FM Affected Party**" has the meaning given in section 8.1 (*Force Majeure*).

"**FM Affected Transaction**" has the meaning given in section 8.1 (*Force Majeure*).

"**Force Majeure**" means an event or circumstance which materially and adversely affects the ability of a Party to perform its obligations under this Master Agreement, including its obligations to Transfer or Accept the relevant Product, and which is not within the reasonable control of, or the result of the negligence of, the Party claiming Force Majeure, and which the claiming Party is unable to overcome or avoid or cause to be avoided by the exercise of reasonable care. For the avoidance of doubt, Force Majeure includes Registry Failure but does not include: (i) the Delivering Party's ability to sell the Product to another buyer at a price greater than the Unit Price; (ii) the Receiving Party's inability to economically use or resell the Product, which expressly includes if the Receiving Party or a third party is no longer permitted to use Offsets to satisfy its compliance obligations; (iii) the Receiving Party's ability to purchase Product at a price less than the Product Unit Price; (iv) a freeze, suspension, termination or other action related to a Party's Holding Account or eligibility to participate in Program, which includes the Receiving Party's inability to Accept the Product due to the Receiving Party exceeding its Holding Limit; (v) changes

in the market price of the Product, including a change in or elimination of the Auction Reserve Price; (vi) economic hardship suffered by a Party; (vii) changes to the number of Allowances or Offsets allocated to, or that may be purchased or retired by Receiving Party or other regulated or non-regulated Entities; or (viii) decisions or interpretations of the Cap and Trade Regulations or the equivalent regulations governing a Linked Program which make transacting in the Product less financially attractive.

"**GHG**" or "**Greenhouse Gas**" has the meaning given in the Cap and Trade Regulations.

"**GST**" has the meaning given in section 6.4 (*GST Registration*).

"**Governmental Authority**" means any international, national, federal, provincial, state, regional, municipal, county or local government, administrative, judicial or regulatory Entity operating under any Applicable Law and includes any court, administrative agency, board, bureau, commission, department or regulatory body of any government.

"**Holding Account**" means the account in the Relevant Registry that an Entity receives when it registers with a Relevant Authority or the Relevant Registry, as applicable, pursuant to the Program Rules, that will be used to record the Transfer of Product.

"**Holding Limit**" means the maximum quantity of Product that may be held by an Entity (or jointly held by a group of Entities with a direct corporate association) in accordance with the Program Rules.

"**Illegality**" has the meaning given to it in section 8.4 (*Illegality*).

"**Illegality Affected Transactions**" has the meaning given in section 8.4 (*Illegality*).

"**Initial Invalidation Determination**" means a notice from a Relevant Authority of any initial determination by the Relevant Authority that grounds exist for the Invalidation of any Offset.

"**Interest Rate**" means the per annum rate of interest identified from time to time as the prime lending rate for commercial loans by the Toronto-Dominion Bank.

"**Invalidation**" means the invalidation, rescission or termination of a specified volume of Offsets by the Relevant Registry or by a Relevant Authority in accordance with Applicable Law. "**Invalid**," "**Invalidated**" and cognate expressions shall be construed accordingly.

"**Invalidated Offset**" has the meaning given in section 7.3 (*Invalidation*).

"**Linked Program**" means a cap and trade program in another jurisdiction which is approved for integration and harmonization with the Program pursuant to the Act.

"**Market Exposure**" means, as reasonably calculated and substantiated upon request, the product of: (i) the difference between the Product Unit Price and the Market Price for the undelivered Quantity, and (ii) the undelivered Quantity.

"**Market Loss**" means, for the purposes of section 11.4 (*Termination Payments*):

(a) If the Delivering Party is the Defaulting Party, then the Delivering Party's total liability to the Receiving Party shall be an amount equal to the positive difference, if any, obtained by subtracting the Product Unit Price from the Market Price; and multiplying the difference by the undelivered Quantity.

(b) If the Receiving Party is the Defaulting Party, then the Receiving Party's total liability to the Delivering Party shall be the sum of the following:

(i) for any Product Delivered but not paid for, the greater of the Product Unit Price or Market Price for such Product, multiplied by the Quantity of Product Delivered but not paid for; and

(ii) for any Product not Delivered, the positive difference, if any, obtained by subtracting the Market Price from the Product Unit Price, multiplied by the Quantity of Product not Delivered.

"**Market Price**" means the per Allowance or Offset market price determined based on the average of prices quoted by four (4) independent third party leading market brokers/dealers in North America after excluding the highest and lowest quotes, with Delivering Party and Receiving Party each selecting in good faith two (2) independent market brokers/dealers to provide quotes; provided, that if the Defaulting Party has not selected and informed the Non-Defaulting Party of its chosen two (2) independent market brokers/dealers within four (4) Business Days of a written request therefor by the Non-Defaulting Party (following an Event of Default), then the Non-Defaulting Party shall proceed to select such independent market brokers/dealers not selected by the Defaulting Party on behalf of the Defaulting Party, and the Non-Defaulting Party shall proceed in a commercially reasonable manner to obtain one quote from each of the independent market brokers/dealers selected and shall promptly notify the Defaulting Party in writing of each quote obtained; if less than four (4) quotes are received, then the Parties shall proceed as follows: (x) if only three (3) quotes are obtained, the highest and lowest quotes shall be excluded and the remaining quote shall be the Market Price; (y) if only two (2) quotes are obtained, the arithmetic mean of the quotes shall be the Market Price; (z) if only one quote is obtained, that quote shall be the Market Price. It is expressly agreed that Parties shall not be required to enter into a replacement transactions in order to determine the Market Price.

"**Non-Defaulting Party**" means the Party that is not the Defaulting Party.

"**Offset**" means (a) an Ontario offset credit created and issued pursuant to sections 35 and 36 of the Act and any applicable Protocols or (b) an offset credit issued under a Linked Program that is recognized for use in the Program pursuant to section 38 of the Act, and excludes Allowances and Early Action Offset Credits.

"**Party**" and "**Parties**" has the meaning given in the preamble.

"**Payment Due Date**" has the meaning given in section 5.1 (*Payment Due Date*), subject to the provisions of Article 7 (*Failure to Deliver, Failure to Accept and Invalidation*).

"**Price Source**" means an institution publishing prices for Allowances or Offsets including exchanges trading in any relevant future contracts or commodities such as the Intercontinental Exchange, as agreed to in the relevant Confirmation.

"**Product**" means the Allowances, Offsets or both and the applicable Vintage(s) specified in the relevant Confirmation as that which the Parties wish to trade for the purposes of the relevant Transaction.

"**Product Unit Price**" means, for a particular Quantity, Specified Period and Transaction, the amount agreed to be the price for that Quantity (per Product), excluding any applicable taxes as agreed to in the Confirmation.

"**Program**" means the program created under the Program Rules.

"**Program Abandonment**" means a Governmental Authority has permanently discontinued the effective application of the Program Rules and such Government Authority action is final and non-appealable, and such circumstance is not within the reasonable control of, or the result of the negligence of, either Party.

"**Program Rules**" means the Cap and Trade Regulations, the Registry Rules and applicable Protocols, as amended from time to time.

"**Protocol**" means any protocol relating to the creation of Offsets, including registration of Offset initiatives, pursuant to the Cap and Trade Regulations.

"**Quantity**" means the aggregate quantity of Product that the Parties have agreed to Deliver and Accept for that Transaction as specified in the relevant Confirmation.

"**Qualified Replacement Offsets**" means Offsets which may be submitted for compliance purposes under the Cap and Trade Regulations to the same extent as the Invalidated Offsets.

"**Receiving Party**" means the Party to the Transaction, as specified in the Confirmation, who shall Accept the Quantity of Product from the Delivering Party.

"**Receiving Party's Holding Account**" means the Holding Account(s) specified by the Receiving Party in the Confirmation to a Transaction (including any additional account agreed by the Parties in accordance with Article 4 (*Product Transfers*). Where the Receiving Party has specified a Registry only without specifying the Holding Account details in the Confirmation, "Receiving Party's Holding Account" includes any Holding Account notified by the Receiving Party to the Delivering Party under Article 4 (*Product Transfers*) and/or section 10.2 (*Holding Accounts and Registries*).

"**Receiving Party's Replacement Cost**" means, with respect to a failure to Deliver a volume of Product pursuant to section 7.1 (*Failure to Deliver*) or pursuant to section 4.4 (*Transfer Request Deficiencies*), in either case, the "**Undelivered Product**":

(a) any amount previously paid by the Receiving Party to the Delivering Party for the Undelivered Product; plus, the positive difference, if any, between (A) the price the Receiving Party, acting in a commercially reasonable manner, does or would pay to replace the Undelivered Product in an arm's length transaction for an equivalent quantity of like Product (including, where the Undelivered Product is Offsets, comparable Offsets that may be submitted for compliance purposes to the same extent as the Undelivered Product) and (B) the Product Unit Price multiplied by the volume of Undelivered Product; plus

(b) interest on the amount calculated in accordance with paragraph (a) above for the period from (and including) the Delivery Date to (but excluding) the date of termination at the rate specified in section 5.5(a) (*Interest*); plus

(c) the amount of reasonable costs and expenses that the Receiving Party incurs with respect to the Undelivered Product (including, without limitation, broker fees, commissions and legal fees).

"**Registry Failure**" means a disruption in the ability of either Party to Deliver or Accept Product, as applicable, caused solely by the Relevant Registry that (i) is not specific to either Party's

Holding Account, (ii) is not subject to section 8.4 (*Illegality*), and (iii) is not within the control of, or the result of the negligence of, such Party and which could not have been avoided by the exercise of reasonable due diligence.

"**Registry Rules**" means all policies, procedures and requirements adopted by the Relevant Registry in connection with the management of its registry program, including, but not limited to, operating procedures, terms of use, program manual(s), and all applicable Protocols.

"**Rejected Product**" is defined in the definition of Delivering Party's Replacement Cost.

"**Relevant Authority**" means the Governmental Authority or any other body (or its affiliated agencies) that administer(s) the Program or a Linked Program.

"**Relevant Registry**" means the Compliance Registry specified in the Confirmation through which a Party is obligated to perform a Delivery or Acceptance obligation under and in accordance with a Transaction.

"**Requesting Party**" has the meaning given to it in section 5.7 (*Performance Assurance*).

"**Sales Tax**" means, to the extent this definition is not amended or restated in the Confirmation to a Transaction, any tax charged on the supply of goods or services including, by way of example only and without limitation, (a) any value added tax imposed by any government, (b) any replacement or other tax levied by reference to value added to a transaction, or (c) any goods and services tax, but not including any corporate tax on the net profits of a Party.

"**Schedule**" means each of Schedules 1 and 2 to the Master Agreement.

"**Specified Period**" means, in relation to a Transaction and a Quantity, the relevant specified time period of issuance of Product as agreed between the Parties at the time of entering into the Transaction as specified in the relevant Confirmation.

"**Statement**" means, for a Transaction, the statement referred to in section 5.2 (*Monthly Billing Statement*) for such Transaction.

"**Term**" has the meaning given to it in section 2.3 (*Term*).

"**Termination Payment**" has the meaning given in section 11.4(a) (*Termination Payments*).

"**Termination Payment Date**" has the meaning given in section 11.4(d) (*Termination Payments*).

"**Trade Date**" means the date a Transaction is agreed as specified in the Confirmation for the Transaction.

"**Transaction**" means an agreement between the Parties to undertake one or more physically settled transactions involving Transfers of Product pursuant to the terms of this Master Agreement, as documented by a Confirmation or its equivalent as described in section 3.2 (*Exchange of Confirmations*).

"**Transfer**" means (whether used as a verb or a noun) with respect to a Transaction, the irrevocable, unqualified and absolute transfer of ownership, receipt and deposit of Product from the Delivering Party's Holding Account to the Receiving Party's Holding Account in accordance with the Program Rules, and "**Transferred**" and "**Transferable**" are to be construed accordingly.

"**Transfer Date**" means, in relation to a Transaction, the date on which Transfer occurs.

"**Transfer Request**" means a request made or any necessary procedures or actions to be taken by the Delivering Party in accordance with the Program Rules to effect a Transfer.

"**Transfer Request Confirmation**" has the meaning given in section 4.3 (*Acceptance*).

"**Transfer Request Deficiency**" or "**TRD**" means a deficiency in a completed Transfer Request in the Relevant Registry for which a Relevant Authority has grounds to impose the penalties set forth in Applicable Law, including monetary penalties, the reversal of a deficient Transfer, or the removal of compliance instruments from an Entity's Holding Account, as applicable. For the avoidance of doubt, the violation or prospective violation of the Holding Limit in connection with a Transaction constitutes a TRD.

"**Transfer Request Initiation**" has the meaning given in section 4.2 (*Delivery*).

"**TRD Determination**" means a finding or determination by the Relevant Authority that a TRD has occurred with respect to the Transfer of Product that is the subject of a Transaction.

"**Undelivered Product**" is defined in the definition of Receiving Party's Replacement Cost.

"**Unpaid Amounts**" owing to any Party means

(a) any amount that became payable to that Party or that relates to obligations performed by the Party prior to the first day of the period for which the obligations of the Parties are suspended or terminated under Article 8 (*Force Majeure, Program Abandonment, Illegality and Change in Law*) which remains unpaid; or

(b) any amount that became payable to that Party on or prior to an Early Termination Date under Article 11 (*Events of Default and Termination*) which remains unpaid.

"**Vintage**" is the year an Allowance was created under the Program Rules.

SCHEDULE 2

ELECTION FOR SECTION 3.2 EXCHANGE OF CONFIRMATIONS

The Parties elect the following with respect to transaction confirmation procedures pursuant to section 3.2 (*Exchange of Confirmations*) of this Master Agreement:

[ ] Written confirmations are required in accordance with section 3.2(a); or

[ ] Oral transactions are permitted in accordance with section 3.2(b).

EXHIBIT A

FORM OF CONFIRMATION FOR ALLOWANCE TRANSACTIONS

This Confirmation confirms a Transaction under the Master Agreement by and between [_____] (the "**Receiving Party**") and [_____] (the "Delivering Party"), dated _____ (the "**Master Agreement**") pursuant to which the Receiving Party shall purchase and the Delivering Party shall sell Product to the Receiving Party on the Transfer Dates on the terms set forth in the Master Agreement, Credit Support Document and this Confirmation.

PART A: TERMS

Trade Date: _____

Receiving Party: _____

Delivering Party: _____

Relevant Registry: CITSS

Receiving Party's Holding Account: _____

Delivering Party's Holding Account: _____

Product and Vintage: Allowances

Product Unit Price:

Fixed Price: _____; or

Floating Product Unit Price

Price Source: _____

Calculation Date: _____

Calculation Method: _____

Final Floating Product Unit Price: _____

Product Unit Price Currency: _____

Quantity: _____

Contract Amount (Product Unit Price x Quantity): _____

Specified Period: _____

Delivery Date(s): _____

Payment Due Date:

PART B: ADDITIONAL TERMS

1. Confirmation Effective Date. This Confirmation Effective Date shall occur on the Trade Date and this Confirmation shall remain effective until all Transactions hereunder have been completed.

2. Definitions. All capitalized terms are defined in the Master Agreement or the Schedules thereto, the Credit Support Document, and if not therein, in the Program Rules.

3. Counterparts. This Confirmation may be executed and delivered in counterparts with the same effect as if both Parties had executed and delivered the same copy, and when each Party has signed and delivered a counterpart, all counterparts together constitute one agreement that evidences the Transaction under the Master Agreement. Delivery of a copy of this Confirmation by facsimile is good and sufficient delivery.

4. Authority. Each Party executing this Confirmation represents that the execution, delivery and performance of this Confirmation have been duly authorized by all necessary action and that the person(s) executing this Confirmation each has the authority to execute and deliver it on behalf of such Party.

If this Confirmation correctly sets out the terms of our agreement, please sign and return a copy of this Confirmation within three (3) Business Days from receipt of this Confirmation. If you believe that this Confirmation does not correctly set out the terms of our agreement, send a response within three (3) Business Days from receipt of this Confirmation that sets out in detail the alleged inaccuracy. If your response contains additional or different terms from those set out in this Confirmation or this Master Agreement, they only become part of the Transaction if we expressly agree to them in a supplemental written confirmation.

Receiving Party		**Delivering Party**	
Signature:	_____	Signature:	_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____
Signature:	_____	Signature:	_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____

EXHIBIT B

FORM OF CONFIRMATION FOR OFFSET TRANSACTIONS

This Confirmation confirms a Transaction under the Master Agreement by and between [_____] (the "**Receiving Party**") and [_____] (the "**Delivering Party**"), dated _____ (the "**Master Agreement**") pursuant to which the Receiving Party shall purchase and the Delivering Party shall sell Product to the Receiving Party on the Transfer Dates on the terms set forth in the Master Agreement, Credit Support Document and this Confirmation.

PART A: TERMS

Trade Date: _____

Receiving Party: _____

Delivering Party: _____

Relevant Registry: CITSS

Receiving Party's Holding Account: _____

Delivering Party's Holding Account: _____

Product: Offsets

Relevant Authority: _____

Product Unit Price: _____

Fixed Price: _____; or

Floating Product Unit Price

Price Source: _____

Calculation Date: _____

Calculation Method: _____

Final Floating Product Unit Price: _____

Product Unit Price Currency: _____

Quantity: _____

Contract Amount (Product Unit Price x Quantity): _____

Specified Period: _____

Delivery Date(s): _____

Payment Due Date:

Invalidation Security: _____

Product Issuance Date: _____

PART B: ADDITIONAL TERMS

1. Confirmation Effective Date. This Confirmation Effective Date shall occur on the Trade Date and this Confirmation shall remain effective until all Transactions hereunder have been completed.

2. Definitions. All capitalized terms are defined in the Master Agreement or the Schedules thereto, the Credit Support Document, the Special Provisions on Invalidation Risk, and if not therein, in the Program Rules.

3. Counterparts. This Confirmation may be executed and delivered in counterparts with the same effect as if both Parties had executed and delivered the same copy, and when each Party has signed and delivered a counterpart, all counterparts together constitute one agreement that evidences the Transaction under the Master Agreement. Delivery of a copy of this Confirmation by facsimile is good and sufficient delivery.

4. Authority. Each Party executing this Confirmation represents that the execution, delivery and performance of this Confirmation have been duly authorized by all necessary action and that the person(s) executing this Confirmation each has the authority to execute and deliver it on behalf of such Party.

If this Confirmation correctly sets out the terms of our agreement, please sign and return a copy of this Confirmation within three (3) Business Days from receipt of this Confirmation. If you believe that this Confirmation does not correctly set out the terms of our agreement, send a response within three (3) Business Days from receipt of this Confirmation that sets out in detail the alleged inaccuracy. If your response contains additional or different terms from those set out in this Confirmation or this Master Agreement, they only become part of the Transaction if we expressly agree to them in a supplemental written confirmation.

Receiving Party		**Delivering Party**	
Signature:	_____	Signature:	_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____
Signature:	_____	Signature:	_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____

SEC INTERROGATORY #14

INTERROGATORY

[C-2-1] Please describe all changes that Enbridge has made to its compliance plan strategy as compared to its previous compliance plan.

RESPONSE

Enbridge has used learnings from implementing the Company's 2017 Compliance Plan as a foundational input to the 2018 Compliance Plan and these changes are noted in the plan as filed. Some of these changes include:

1) Development of a Cap and Trade working group, which is discussed further in response to Board Staff Interrogatory #15, filed at Exhibit I.1.EGDI.STAFF.15;
2) Development of an Abatement Construct and Initiative Funnel in order to start to formalize thinking around abatement opportunities, as outlined in Exhibit C, Tab 5, Schedule 1;
3) More focus and subject matter expertise development amongst staffing resources; and
4) More fulsome offset procurement strategy.

Additional learnings from procurement implementation in 2017 have been applied in the development of the 2018 procurement strategy. Enbridge is not permitted to provide this information for reasons of confidentiality as set out in the Climate Change Mitigation and Low-carbon Economy Act, 2016 ("Climate Change Act"), Cap and Trade regulations and the Report of the Board in respect of the Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities (EB-2015-0363) ("Framework"). Enbridge has provided details on specific changes to its compliance strategy as compared to its previous compliance strategy to the Board under confidential cover in response to Board Staff Interrogatory #51d, filed at Exhibit I.1.EGDI.STAFF.51.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

SEC INTERROGATORY #15

INTERROGATORY

[C-2-2, p.3] With respect to the proposed Low Carbon Initiative Fund:

a. Please provide a breakdown of the proposed $2M in 2018.
b. Union has proposed a similar fund. Please explain what type of coordination will be undertaken regarding the use of each utility's fund.
c. Please discuss Enbridge positon regarding a potential condition of approval that all research activities undertaken using these ratepayer funds should be made available to the public.
d. Please confirm that there would be no subsequent review for prudence of the amount spent up to $2M.

RESPONSE

a) Please refer to the response to Board Staff Interrogatory #23b, filed at Exhibit I.1.EGDI.STAFF.23.

b) Please see the responses to Board Staff Interrogatory #16a, filed at I.1.EGDI.STAFF.16 and APPRO Interrogatory #4b filed at Exhibit I.1.EGDI.APPRO.4.

c) Enbridge is supportive of making final report findings available to the public.

d) LCIF amounts will be recorded in the 2018 GGEIDA. LCIF amounts recorded in the 2018 GGEIDA will be brought forward for clearance in future proceedings.

Witnesses: S. McGill
R. Sigurdson

SEC INTERROGATORY #16

INTERROGATORY

[C-5-2] Has Enbridge developed any formal or informal marginal abatement cost curve or similar tool to use in conjunction with the Abatement Construct, or for any other reason? If so, please provide a copy. If not, please explain why it has not.

RESPONSE

Enbridge has not developed an alternate formal marginal abatement cost curve ("MACC") to that completed by the Board. MACCs studies are typically expensive and capture a specific point in time with respect to activity (technology, funding and policy) in the market. Enbridge noted that with so many unknowns related to CCAP funding and offset valuation that there was not significant incremental value to be derived from completing another study outside of the MACC study completed for the Board at this time. This being said, the cost per tonne of carbon abatement is considered by the Company in its evaluation of all proposed potential carbon abatement initiatives.

Witness: F. Oliver-Glasford

SEC INTERROGATORY #17

INTERROGATORY

[C-5-2] With respect to the Stage 2 of the Abatement Construct:

a. Please provide a work plan for 2018 regarding each of the listed initiatives.
b. For each listed initiative, please provide a copy of any memorandum, concept outline, and/or other internal document describing in full the potential initiative, costs, benefits and work that should be undertaken before it can be considered for Stage 3.

RESPONSE

a. and b. An outline of the activities associated with each of the listed initiatives is set out in response to Board Staff Interrogatory #23b, filed at I.1.EGDI.STAFF.23. Detailed work plans for each of these initiatives will be developed by the incremental FTEs requested in this proceeding “to support investigation, planning and project management activities” (Exhibit C, Tab 5, Schedule 2, page 3, Table 1).

Witness: R. Sigurdson

SEC INTERROGATORY #18

INTERROGATORY

[C-6-1] Considering there is a provincial election scheduled for spring 2018, please discuss how Enbridge is mitigating the risk of a change in policy regarding the current Cap & Trade program.

RESPONSE

Enbridge is monitoring the carbon file as it evolves in the run up to the provincial election, noting the Company cannot speculate on the outcome. Enbridge will consider and respond as appropriate to changes in government policy and related compliance obligations if and when they are announced. The Company believes it is premature to propose any action until any potential changes in carbon policy are known.

Witnesses: A. Langstaff
J. Murphy
F. Oliver-Glasford

SEC INTERROGATORY #19

INTERROGATORY

[[D-1-1, p.5] With respect to the proposed FTEs:

a. Please provide a breakdown of the staffing costs into the following categories: i) total salary, ii) total benefits, iii) total compensation, and iv) total overhead.
b. Do the 8 listed FTEs include 2 proposed to be included as part of the Low Carbon Initiative Fund (see for example C-5-1, p.11)? If not, please provide another version of the requested breakdown in part (a) to include those positions.

RESPONSE

a. Enbridge provides the following breakdown between i) total salary, ii) total benefits, iii) total compensation, and iv) total overhead. Please note that these allocations are approximate and based on the most current information available.

Total Salary	$1,027,397
Total Benefits	$472,603
Total Compensation	$1,500,000
Total Overhead	$0

b. Yes, the eight FTEs include the two proposed FTEs to administer the abatement projects in the Low Carbon Initiative Fund.

Witnesses: A. Langstaff
F. Oliver-Glasford