Asha Patel
Technical Manager, Regulatory Applications
Regulatory Affairs

Tel: 416-495-5642
Email: Asha.Patel@enbridge.com
EGIRegulatoryProceedings@enbridge.com

Enbridge Gas Inc.
500 Consumers Road
North York, Ontario
M2J 1P8

VIA RESS and EMAIL

March 16, 2022

Nancy Marconi
Registrar
Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, Ontario M4P 1E4

Dear Ms. Marconi:

Re: Enbridge Gas Inc. (Enbridge Gas)
Ontario Energy Board (OEB) File No.: EB-2021-0002
Multi-Year Demand Side Management Plan (2022 to 2027)
Technical Conference Undertaking Responses

In accordance with the OEB's Procedural Order #6 enclosed please find Enbridge Gas's responses to the undertakings from the Technical Conference.

Enbridge Gas notes that in preparing the undertakings it has taken the opportunity to correct for an interrogatory response in Exhibit I.10h.EGI.STAFF.77. The undertaking response and correction are included in Exhibit JT1.21.

Should you have any questions on this matter please contact the undersigned at 416-495-5642.

Sincerely,

Asha Patel
Digitally signed by Asha Patel
Date: 2022.03.16 17:47:47 -04'00'

Asha Patel
Technical Manager, Regulatory Applications

cc: D. O'Leary, Aird & Berlis
EB-2021-0002 Intervenors

ENBRIDGE GAS INC.

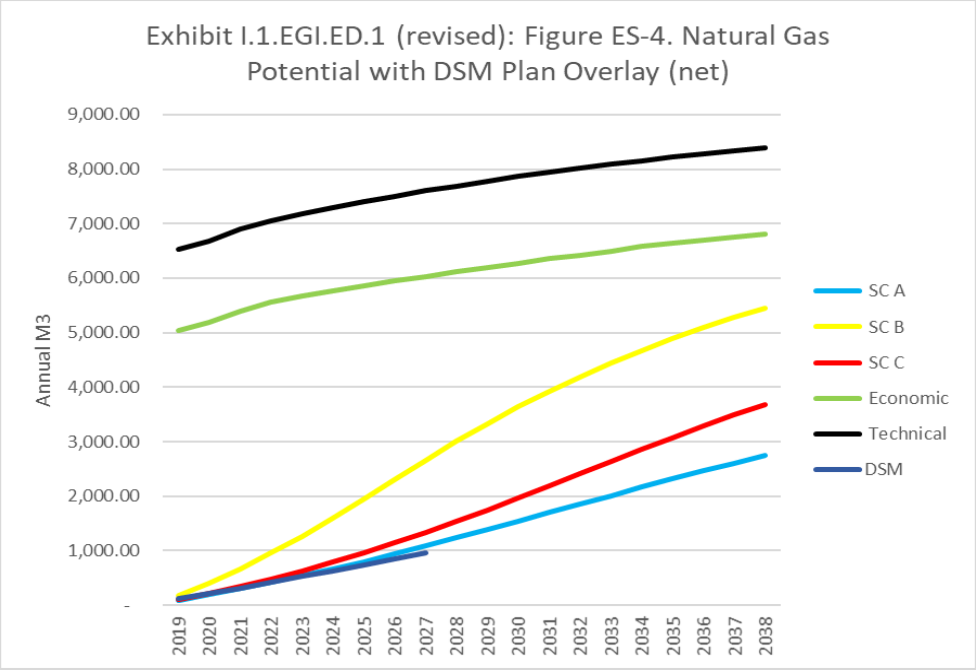
Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 8

Request for a colour version of Figure ES-4 from IRR.ED.1(a) comparison between APS and DSM plan savings chart.

Response:



Caveats:

- 2019 values actual post audit net annual m3
- 2020 values actual pre audit net annual m3
- 2021 values represent a forecasted CCM value provided to the OEB in a July 2021 updated, divided by the 2020 average measure life to get to net annual m3
- 2022 values represent application of the TAM at 100% achievement of forecast 2021 results divided by 2020 average measure life to get to net annual m3
- Enbridge Gas will not show beyond 2027 because this is beyond the proposed DSM Plan term.
- Enbridge Gas notes that the APS uses a fixed assumption for net to gross values that is substantially different from the DSM Plan values utilized which would have a material effect on the comparison of the DSM Plan values to any APS scenario

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 16

ED.1(a) – to reproduce the chart such that the potential study values and the DSM plan values are as comparable as possible, and particularly with respect to the caveat in the final bullet relating to net to gross values.

Response:

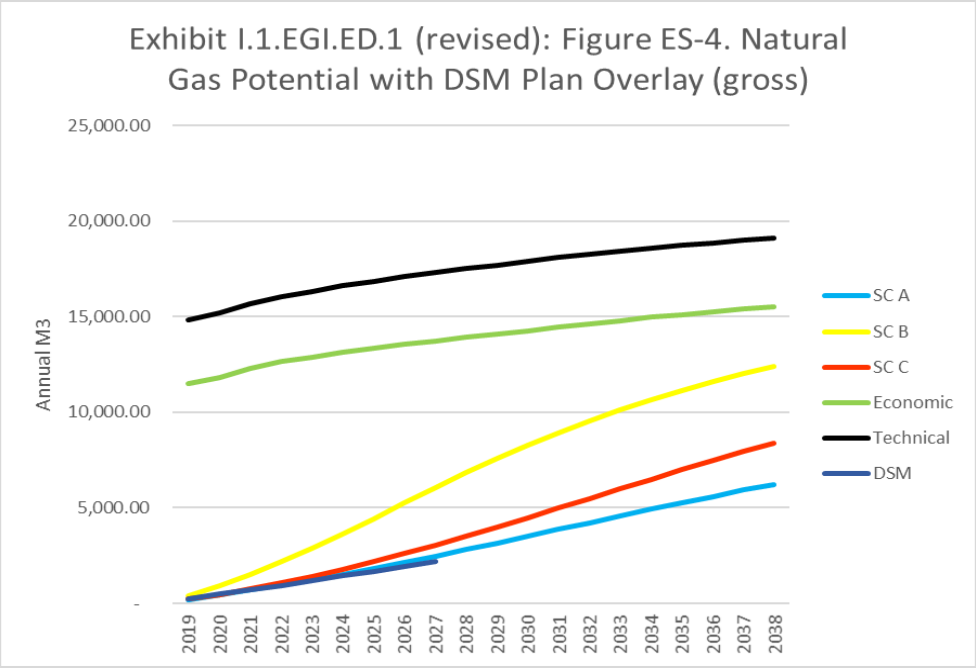
In Exhibit E, Tab 4, Schedule 7 and the Posterity Group (Posterity) report included as Attachment 1 of its evidence, Enbridge Gas clearly outlines the efforts undertaken in collaboration with Posterity to better understand the 2019 APS, and in following the OEB's direction, to consider the 2019 APS as one of many inputs that could inform the development of Enbridge Gas's plan. The inability to arrive at an outcome where the Mirror Model could be used to support planning efforts was also reiterated in Exhibit I.9.EGI.STAFF.24.

To understand the challenge presented by this undertaking request, please consider the work that was completed by Enbridge Gas and Posterity in efforts to be responsive to the OEB's direction.

- Through Posterity's efforts, a model was created to mimic the 2019 APS as closely as possible
- As outlined in the report, Exhibit E, Tab 4, Schedule 7, Attachment 1, a large number of issues were identified and documented through the joint analysis of Posterity and Enbridge Gas
- As a result of this analysis modifications were made to attempt to address some of the deficiencies identified.
- Through an iterative process, a Mirror Model was created which reflected the impacts of the recommended modifications that had been made to the original model.
- Despite repeated efforts, the outputs from the Mirror Model remained unusable. It was determined that further time and effort spent on the Mirror model would not yield the desired outcomes, however through their experience working together Enbridge Gas and Posterity did agree that an APS could be informative to program design, budget and target setting efforts if it was developed with those specific use cases in mind.

Understanding the level of complexity, time and effort that it took Enbridge Gas and Posterity to arrive at the Mirror model, it should be understandable that Enbridge Gas cannot develop a chart that aligns the APS to its plan.

However, Enbridge Gas has reproduced the table from Exhibit I.1.EGI.ED.1 part a applying a 0.44 NTG value at the portfolio level which can be derived through looking at Total Gross Annual and Total Net Annual m3 in Attachment 1 of Exhibit I.5.EGI.GEC.7.



Caveats:

- 2019 values actual post audit net annual m3
- 2020 values actual pre audit net annual m3
- 2021 values represent a forecasted CCM value provided to the OEB in a July 2021 updated, divided by the 2020 average measure life to get to net annual m3
- 2022 values represent application of the TAM at 100% achievement of forecast 2021 results divided by 2020 average measure life to get to net annual m3
- Enbridge Gas will not show beyond 2027 because this is beyond the proposed DSM Plan term.
- Enbridge Gas notes that the APS uses a fixed assumption for net to gross values that is substantially different from the DSM Plan values utilized which would have a material effect on the comparison of the DSM Plan values to any APS scenario

Enbridge Gas felt it would be useful to, in addition to providing grossed up savings values outlined in the chart above, gross up the budgets requried to achieve these savings as well, to provide additional context through which to consider these APS Scenarios.

Net Budgets/Annual Savings	A		C		B	
	M3 (millions)	$	M3 (millions)	$	M3 (millions)	$
2023	121	$ 79,233,428	146	$ 175,419,343	311	$ 548,334,885
2024	126	$ 72,920,614	161	$ 198,249,156	336	$ 611,393,864
2025	132	$ 75,222,022	172	$ 215,782,560	348	$ 657,088,699
2026	141	$ 79,997,683	186	$ 240,282,131	358	$ 704,517,499
2027	145	$ 82,615,655	194	$ 255,285,168	350	$ 723,763,439
2028	150	$ 82,601,780	204	$ 275,429,234	342	$ 745,944,789
2029	152	$ 77,002,464	212	$ 293,324,601	327	$ 753,711,536
2030	154	$ 79,486,368	217	$ 308,994,909	307	$ 749,295,140

Gross Budgets/Annual Savings	A		C		B	
	M3 (millions)	$	M3 (millions)	$	M3 (millions)	$
2023	275	$ 198,435,972	332	$ 417,040,324	707	$ 1,264,575,648
2024	287	$ 184,088,667	366	$ 468,926,264	764	$ 1,407,891,508
2025	300	$ 189,319,141	390	$ 508,774,909	790	$ 1,511,743,408
2026	320	$ 200,172,917	424	$ 564,455,753	814	$ 1,619,536,133
2027	330	$ 206,122,852	441	$ 598,553,563	796	$ 1,663,276,907
2028	340	$ 206,091,318	464	$ 644,335,533	778	$ 1,713,689,065
2029	345	$ 193,365,599	481	$ 685,006,820	744	$ 1,731,340,764
2030	350	$ 199,010,837	494	$ 720,621,157	698	$ 1,721,303,500

These numbers were derived from following the approach outlined in the recommended approach to determine gross budgets outlined in the 2019 Integrated Ontario Electricity and Natural Gas Achievable Potential Study on page 116:

Equation 7-2. Calculating Gross Budget from Net Program Cost Values

$$A.\ Annual\ Program\ Budget\ for\ Future\ DSM\ Portfolio = \frac{Net\ Program\ Administrator\ Cost\ from\ APS\ Study}{Estimated\ NTG\ Ratio} + Overhead$$

$$B.\ \frac{\$80M}{75\%} + \$10M = \$117M$$

For the sake of these calculations, the NTG ratio used was the same as that used to update the chart above, 0.44, and the overhead cost was fixed using the 2023 Portfolio Subtotal budget of $18,360,000 as outlined in Exhibit D, Tab 1, Schedule 1, Table 1 page 9.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 23

Add a row to this table ED.8(b), p. 4 – for each year from 2018 to 2027, show annual DSM plan savings that persist in 2030.

Response:

The response to Exhibit I.2.EGI.ED.8 has been updated to show annual DSM plan savings that persist in 2030.

a) Please see the following table.

DSM Savings Historic and Targeted										
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Net Annual Gas Savings (per plan / 100% target), m3 [1] [4]	113,028,464	104,131,044	108,561,473	101,411,656	102,220,650	105,558,506	107,738,318	110,015,584	111,960,896	114,200,114
Net Annual Gas Savings (audited results), m3 [2]	108,402,303	115,690,827	96,238,682	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Net Cumulative Gas Savings (per plan / 100% target), m3 [3]	2,014,441,008	1,868,442,370	1,841,221,139	1,719,959,014	1,733,679,692	1,732,912,070	1,768,066,432	1,804,652,760	1,838,195,816	1,874,959,732
Net Cumulative Gas Savings (audited results), m3 [2]	1,931,991,621	2,075,861,664	1,632,224,492	N/A	N/A	N/A	N/A	N/A	N/A	N/A

1. The 2015-2020 DSM Plan (extended to 2022) does not have net annual 100% savings targets. For illustrative purposes, net annual saving targets are derived from the net cumulative 100% saving targets using the respective year's audited results as a proxy. 2021-2022 use 2020's audited results as a proxy.
2. 2020 are draft audit results.
3. 2022 net cumulative gas saving targets based on 100% target calculation using the 2021 results and spend as detailed in interrogatory response to I.6.EGI.STAFF.13 a, Attachment 1
4. 2023-2027 values have been revised to account for updated evidence filed on February 18, 2022.

b) Please see the following table.

DSM Savings Persisting in 2030										
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
DSM Savings Persisting in 2030 (m3) – According to Plan/Budget [1 2 3 5]	113,028,464	217,159,508	325,720,981	427,132,637	529,353,287	634,911,793	742,650,110	852,665,694	964,626,590	1,078,826,704
Weighted DSM Savings Persisting in 2030 (m3) – According to Plan/Budget [1 2 3 5 6]	92,683,340	180,153,417	276,773,129	368,043,619	460,042,204	555,044,859	654,164,111	759,779,072	867,261,532	979,177,643
DSM Savings Persisting in 2030 (m3) – Based on Audited Results [4]	108,402,303	224,093,130	320,331,812	320,331,812	320,331,812	320,331,812	320,331,812	320,331,812	320,331,812	320,331,812

1. The 2015-2020 DSM Plan (extended to 2022) does not have first year savings targets. For illustrative purposes, first year saving targets are derived from the net cumulative gas saving targets using the respective year's audited results as a proxy. 2021-2022 use 2020's audited results as a proxy.
2. 2022 net cumulative gas saving targets based on 100% target calculation using the 2021 results and spend as detailed in interrogatory response to I.6.EGI.STAFF.13 a, Attachment 1
3. 2021 net cumulative gas saving results as detailed in interrogatory response to I.6.EGI.STAFF.13 a, Attachment 1. However the numbers may vary due to rounding adjustments.
4. 2020 are draft audit results.
5. 2023-2027 values have been revised to account for updated evidence filed on February 18, 2022.
6. Net annual gas saving weighted EUL (estimated useful life) profiles from 2020 audit results applied to each year to estimate the amount of savings persisting in 2030. Using 2018 as an example, 82% of 2018 savings are modelled to persist in 2030 based on 2020 results as that percentage of 2020 savings had an EUL of 12 years or longer.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 25

ED.11 - To clarify the comparison in ED 10 for proposed gas savings in the current DSM plan with the amounts of savings in the environment plan relating to natural gas.

Response:

Enbridge Gas confirms that the interrogatory response provided in Exhibit I.2.EGI.ED.10 provides the best comparison between the proposed gas savings in its DSM plan with amounts referenced in the Environment Plan.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 29

ED.12 – Provide mix between residential, commercial and industrial from 2014 vs 2023 ratio of spending for each sector.

Response:

Program Budgets by Sector as a Percentage of Total Program Budgets [1]	**2014 Budget**	**2016 Budget**	**2023 Proposed Budget**
Residential	9%	25%	35%
Commercial	27%	42%	19%
Industrial [2]	24%		15%
Low Income [3]	27%	24%	21%
Other Programs [4]	13%	9%	10%
Total Program (%)	**100%**	**100%**	**100%**
Total Program ($)	**$48,354,309**	**$81,959,096**	**$112,099,380**

1. Program administration and evaluation costs are not included
2. Industrial includes Large Volume
3. Low Income includes the Affordable Housing Savings By Design offering
4. Other programs consists of Market Transformation, Building Beyond Code (2023), Low Carbon (2023), Energy Performance (2023) programs

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 31

Referring to the Table at ED 12 showing annual gas costs: (a) to add to the table the volumes of gas that would not be applicable for Enbridge's carbon costs, and an estimate of those carbon costs; (b) to ensure that all of the upstream costs are included, and advise, on a best efforts basis; (c) to add to the table Ontario gas consumption in EGI'S franchise area; (d) to include any other costs for gas that are missing

Response:

a) Please refer to Attachments 1 and 2 to this undertaking response for the volumes of gas that are not subject to the Federal Carbon Charge. These attachments are the tables provided in Exhibit 1.5.EGI.ED.12 part g and h respectively with an added row to include the volume of gas not subject to the Federal Carbon Charge.

   Enbridge Gas is unable to provide an estimate of the carbon costs associated with the volumes of gas not subject to the Federal Carbon Charge. Facilities that are covered under the Federal Output Based Pricing System or Ontario Emission Performance Standard are exempt from paying the Federal Carbon Charge on their natural gas bills and are instead responsible for satisfying their own compliance obligation directly with the government (federal government up to and including 2021, provincial government for 2022 onwards). The amount that is paid under both pricing systems is not made publicly available and is calculated based on data that is also not publicly available. Additionally, facilities may be able to reduce their carbon costs by using lower cost compliance instruments. It would therefore be difficult to estimate these carbon costs; however, as both programs are intended to provide price relief to the facilities that are covered, Enbridge Gas understands the amount paid would be significantly lower than the Federal Carbon Charge.

b) The annual distribution cost in Attachments 2 and 3 at Exhibit I.5.EGI.ED.12 includes all the upstream cost that would be paid by Enbridge Gas customers

c) Please refer to Table 1 in Exhibit I.5.EGI.GEC.3 Attachment 1 for the total volume forecast in EGI's franchise area. The volumes data provided in this exhibit are weather normalized volumes based on the 2022 budget degree days.

d) The annual other gas related costs in Attachments 2 and 3 at Exhibit I.5.EGI.ED.12 includes all other costs (pre-tax) which include the load balancing costs and the storage costs that would be paid by Enbridge Gas customers.

Enbridge Gas Inc. - Annual Gas Cost

	2015	2016	2017	2018	2019	2020
Total Ontario gas consumption (10^6m^3)[1]	25,702	24,564	24,533	26,088	26,704	25,065
Total Ontario gas customers[2]	3,540,089	3,598,700	3,653,986	3,701,403	3,717,399	3,740,847
Total Ontario gas consumption for which Enbridge has commodity price data (10^6m^3)	12,102	11,249	12,066	13,460	13,753	12,441
Average annual commodity price (for gas that Enbridge has data for) ($/m^3$)	$ 0.138	$ 0.106	$ 0.125	$ 0.111	$ 0.119	$ 0.100
Annual commodity costs (for gas that Enbridge has data for) ($000)	$ 1,673,729	$ 1,196,865	$ 1,514,111	$ 1,490,445	$ 1,640,834	$ 1,245,103
Annual commodity costs (estimate other customers)[3]	$ 1,873,562	$ 1,319,030	$ 1,740,315	$ 1,556,562	$ 1,633,807	$ 1,243,629
Annual distribution costs ($000)[4]	$ 1,972,233	$ 1,982,456	$ 2,074,811	$ 2,274,557	$ 2,350,719	$ 2,314,764
Annual carbon costs ($000)[5]	$ -	$ -	N/A	N/A	$ 347,142	$ 809,072
Annual other gas related costs ($000)[6]	$ 949,082	$ 870,798	$ 783,655	$ 823,991	$ 703,701	$ 604,447
Total annual gas costs (for gas that Enbridge has data for) – ($000)	**$ 4,595,044**	**$ 4,050,119**	**$ 4,372,577**	**$ 4,588,992**	**$ 5,042,397**	**$ 4,973,387**
Total gas consumption not applicable to the Federal Carbon Charge (10^6m^3)[7]	N/A	N/A	N/A	N/A	5,858	8,781

[1] Annual gas volumes include quantities of gas sold to system gas customers and quantities of gas delivered to direct purchase customers. Source: OEB Natural gas distributor yearbooks

[2] Total customers include system gas customers and direct purchase customers of gas marketers licensed by the OEB. Source: OEB Natural gas distributor yearbooks

[3] Estimate is calculated using direct purchase customer volumes and apply to the commodity prices equal to Enbridge system gas customers

[4] Fixed and Variable, please refer to Exhibit I.GEC.4 for the breakdown by rate class

[5] 2017 & 2018: These costs were filed as strictly confidential in EB-2018-0331; 2019: Refer to EB-2019-0247, EGI Updated Federal Carbon Pricing Program Application (May 14, 2020), Exhibit C, p.11-12

[6] Other costs include transportation cost, load balancing & storage costs. Please refer to Exhibit I.GEC.4 for the breakdown by rate class

[7] Totals include exempt volumes delivered to downstream distributors, mandatory and voluntary participants in the Output-Based Pricing System, volumes qualifying for exemption for non-covered activities and partial relief (80%) for greenhouse operators. For 2019, the volumes only represent April-December 2019 as the Federal Carbon Charge was not implemented until April 1, 2019.

Enbridge Gas Inc. - Annual Gas Cost

	2023	2024	2025	2026	2027
Total Ontario gas consumption (10^6m^3)[1]	N/A				
Total Ontario gas customers[2]	N/A				
Total Ontario gas consumption for which Enbridge has commodity price data (10^6m^3)	14,457	14,504	14,554	14,610	14,665
Average annual commodity price (for gas that Enbridge has data for) ($/m^3$) [3]	$ 0.122	$ 0.122	$ 0.122	$ 0.122	$ 0.123
Annual commodity costs (for gas that Enbridge has data for) ($000)	$ 1,762,818	$ 1,774,854	$ 1,779,680	$ 1,788,883	$ 1,797,650
Annual commodity costs (estimate other customers)[4]	$ 1,462,000	$ 1,472,479	$ 1,469,958	$ 1,473,729	$ 1,477,049
Annual distribution costs ($000)[5]	$ 2,193,449	$ 2,208,275	$ 2,271,351	$ 2,422,542	$ 2,451,582
Annual carbon costs ($000)[6]	$ 2,202,930	$ 2,724,157	$ 3,242,034	$ 3,777,393	$ 4,308,557
Annual other gas related costs ($000)[7]	$ 804,052	$ 711,318	$ 754,775	$ 807,502	$ 697,397
Total annual gas costs (for gas that Enbridge has data for) ($000)	**$ 6,963,249**	**$ 7,418,604**	**$ 8,047,840**	**$ 8,796,321**	**$ 9,255,187**
Total gas consumption not applicable to the Federal Carbon Charge (10^6m^3)[8]	9,346	9,447	9,491	9,510	9,569

[1]Annual gas volumes forecast for the province of Ontario is not available. Please refer to Exhibit I.GEC.3 for the total volume forecast for Enbridge Gas

[2]Total customers forecast for the province of Ontario is not available. Please refer to Exhibit I.GEC.3 for the total customer forecast for Enbridge Gas

[3]Estimate commodity prices are based on the Board-Approved April 2021 QRAM

[4]Estimate is calculated using direct purchase customer volumes and apply to the commodity prices equal to Enbridge system gas customers

[5]Fixed and Variable, please refer to Exhibit I.GEC.4 for the breakdown by rate class. The estimated gas cost are calculated based on the current rates and rate class structures which may change as a result of the rate harmonization effort that is currently ongoing in anticipation of filing the Rebasing application at the end of 2022.

[6]This forecast only represents customer related carbon costs as Enbridge Gas does not complete long-range volume forecasts related to our facility operations beyond 2022. Please refer to Exhibit I.Anwaatin.2 for more information on these forecasts.

[7]Other costs include transportation cost, load balancing & storage costs. Please refer to Exhibit I.GEC.4 for the breakdown by rate class

[8] Forecast includes exempt volumes delivered to downstream distributors, mandatory and voluntary participants in the Emissions Performance Standards, volumes qualifying for exemption for non-covered activities and partial relief (80%) for greenhouse operators.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 47

To provide additional information on the calculation and forecasting of avoided electricity costs.

Response:

There is no further information beyond the evidence filed at the following references. The methodology has been used by both legacy utilities since at least the beginning of the 2012-2014 DSM Framework.

- Exhibit E, Tab 5, Schedule 1, page 5, Paragraph 14.
- Exhibit E, Tab 5, Schedule 1, Attachment 3, page 2.
- Exhibit E, Tab 5, Schedule 1, Attachment 3, page 4.
- Exhibit I.5.EGI.ED.16, part (f).
- Exhibit I.5.EGI.ED.16, Attachment 1, page 9.
- Exhibit I.5.EGI.ED.16, Attachment 2, page 9.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 48

Data tables from IESO planning outlook, weighted average marginal cost forecast – why would Enbridge propose to use total wholesale cost instead of marginal cost published by the IESO.

Response:

Enbridge Gas's electricity avoided cost methodology (based on the IESO's wholesale weighted average rate) is a simplified approach that has been in place since at least the beginning of the 2012-2014 DSM Framework. For references related to the methodology, see response to Exhibit JT1.7.

Enbridge Gas does not have comprehensive knowledge of the IESO's electricity avoided cost methodology used for CDM programs, nor does Enbridge Gas have expertise in electricity system costs. Enbridge Gas is aware of the IESO's cost-effectiveness tool available at the following link: https://www.ieso.ca/en/Sector-Participants/Energy-Efficiency/Evaluation-Measurement-and-Verification. The tool is a MS Excel workbook which includes a tab titled "Avoided Cost Table", which provides some information on the IESO's electricity avoided costs.

Based on a review of this tab, and some brief questions posed to IESO staff, Table 1 provides Enbridge Gas's understanding of the differences between Enbridge Gas's electricity avoided cost methodology for DSM and the IESO's electricity avoided cost methodology for CDM.

Table 1

Enbridge Gas's electricity avoided cost methodology for DSM	**Enbridge Gas's understanding of IESO's avoided cost methodology for CDM**
• One rate for all electricity avoided costs ($/kWh), based on the IESO's wholesale weighted average rate including HOEP, Global adjustment, Wholesale transmission, etc.	• Eight rates for avoided electricity costs ($/kWh) based on time-of-use periods: o Winter On-Peak o Winter Mid-Peak o Winter Off-Peak o Summer On-Peak o Summer Mid-Peak o Summer Off-Peak o Should Mid-Peak o Shoulder Off-Peak • Three rates for avoided electricity capacity costs ($/kW-yr): o Generation o Transmission o Distribution • Eight rates for avoided GHG savings ($/kWh), based on time-of-use periods: o Winter On-Peak o Winter Mid-Peak o Winter Off-Peak o Summer On-Peak o Summer Mid-Peak o Summer Off-Peak o Should Mid-Peak o Shoulder Off-Peak

While it can be expected that IESO's methodology would provide a more accurate representation of the electricity avoided costs from DSM programs, electricity avoided costs is estimated to represent only 5-10% of Enbridge Gas's total DSM TRC-Plus benefits. The remaining TRC-Plus benefits are driven by natural gas avoided costs, carbon avoided costs, water avoided costs, and non-energy benefits.

It should be noted that, besides requiring the need for Enbridge Gas to more comprehensively understand IESO's electricity avoided cost methodology, implementing the methodology would not be as simple as adopting the IESO's electricity avoided cost table. At a minimum, Enbridge Gas would also need to develop electricity load profiles for each measure/project to align with the 8 time-of-use periods indicated in Table 1 above, develop capacity savings input assumptions (i.e. kW-year) for each measure/project, and include these components within tracking and reporting

systems. The OEB's TRM would likely require updating for all prescriptive measures to include at minimum an electricity capacity savings input assumption.

Given the low impact electricity avoided costs have on DSM TRC-Plus benefits, and the significant efforts required to implement IESO's electricity avoided cost methodology, Enbridge Gas submits it is not appropriate to adopt the IESO's electricity avoided costs methodology for DSM at this time. Enbridge Gas notes that if electricity avoided costs were a significant portion of Enbridge Gas's total avoided cost, then it may be appropriate to look at using IESO's methodology. Enbridge Gas also notes that IESO's electricity avoided costs do not appear to account for significant added load as they do not include global adjustment. The global adjustment is the component that covers the cost of building new electricity infrastructure in the province, maintaining existing resources, as well as providing conservation and demand management programs.[1]

At Exhibit KT1.3 ED Attachment 1 ("IESO_APO_DataTables" MS Excel document), specifically tab "Figure 41", ED provided IESO electricity rates described as "Weighted Average Marginal Costs Forecast, and Historical HOEP". Enbridge Gas is not familiar with these figures, what is included and not included. Enbridge Gas notes they do not appear to include avoided electricity capacity costs or avoided GHG savings. It does not appear as though these are figures the IESO uses for electricity avoided costs for CDM programs. As such they are do not appear to be appropriate to be used as electricity avoided costs for DSM programs.

[1] Global Adjustment (GA) (ieso.ca)

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 56

Enbridge's position on the specific recommendations on 10a-ED 5-OEB STAFF.2 – discount rate to be used for cost effectiveness screening

Response:

As provided in the Company's interrogatory response, Enbridge Gas has historically followed the OEB's guidance on discount rate and will continue to be guided by the OEB's decision in this proceeding.

As outlined in the proposed DSM Framework:[1]

> For the purpose of the cost-effectiveness test (i.e. TRC-Plus), the total avoided costs resulting over the life of the DSM measures need to be discounted to a present value. Consistent with the 2015-2020 DSM Framework, the discount rate used to determine the net present value of avoided costs over the lifetime of DSM measures is 4% (real).

In the 2015-2020 DSM Framework and Guidelines the OEB directed:[2]

> For the purpose of cost-effectiveness tests (i.e., TRC-Plus, PAC, etc.), the total avoided costs resulting over the life of the DSM measures need to be discounted to a present value. Traditionally, the natural gas utilities have used a discount rate that is equal to their Board approved weighted average cost of capital ("WACC"). The Board is of the view that the gas utilities should use a discount rate (real) of 4% when screening prospective DSM programs to determine if they are cost-effective for consideration as part of the new 2015 to 2020 multi-year DSM plan. This discount rate is consistent with that used in the electricity Conservation First framework ensuring that all possible energy conservation programs are screened in a consistent manner.

For additional certainty, the approach continues to be consistent with the current IESO Cost Effectiveness Guide, updated April 1, 2019 which maintains the following:[3]

Use to calculate the NPV of costs and benefits.

Cost Effectiveness Metric	Discount Rates (Real)
Discount Rate	4.00 %

[1] Exhibit C, Tab 1 Schedule 1, Page 49 of 66, Section 11.2 Discount Rate
[2] Filing Guidelines to the 2015-2020 DSM Framework, EB-2014-0134, page 35
[3] IESO Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide, updated April 1, 2019, Appendix A, page 57

Some jurisdictions may apply a lower discount rate or an adder to the benefits included in the cost-effectiveness test to account for the uncertainty associated with non-resource or non-energy benefits. Given that the OEB has directed a 15% non-energy benefits adder be applied to the TRC test coupled with the 4% real discount rate to determine a net present value it has accounted for this potential uncertainty.

Enbridge Gas's position is that the Company believes the OEB's prior guidance continues to be appropriate and that ultimately, the discount rate deemed appropriate by the OEB should be fixed for the duration of the DSM Plan term for consistency.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 60

ED.22(D) – To provide the 2021 figures with draft results for item (d), DSM participants that receive the furnace rebate.

Response:

The following DSM participants received the furnace rebate applicable for the program year:

	2018	2019	2020	2021
L-EGD	13,037	14,257	8,777	5,711
L-UG	14,152	8,993	4,451	1,435
Total	27,189	23,250	13,228	7,146

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence

Undertaking

Tr: 62

ED.22(D) – To advise if it is expected that furnace installation rates for 2023 to 2027 will be materially different from the values for 2021 and if so, why.

Response:

Enbridge Gas has experienced a decline in furnace prevalence over time as it has shifted participation towards building envelope upgrades. The Company expects continued decreased prevalence of furnace upgrades in the Whole Home offering through activities such as broadening and enhancing relationships with contractors supporting building envelope upgrades, an emphasis on the building envelope in the promotional strategy, and through coordination with the federal Greener Homes Grant.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 65

Table with Enbridge's best estimates for incremental costs and installed costs for furnace, boiler, water heaters – both below and above incentive cut-offs.

Response:

For the Whole Home offering TRC is calculated at the Whole Home level not at the measure level. However, in an effort to be responsive Enbridge Gas is providing the proxy cost values below as they have been substantiated historically:

Measure	Baseline Technology	Efficient Technology	Incremental Cost
Furnace[1]	95% AFUE	97% AFUE	$188
Tankless Gas Water Heaters[1]	Storage Water Heater, EF = 0.67	Condensing Tankless Water Heater, EF = 0.91	$2,066
High Efficiency Gas Storage Water Heaters[1]	Storage Water Heater, EF = 0.67	High Efficiency Storage Water Heater, EF = 0.80	$545
Condensing Boiler (<100 Mbtu/h)[2]	82% AFUE	90% AFUE	$2,045
Condensing Boiler (100 to 199 Mbtu/h)[2]	82% AFUE	90% AFUE	$2,984

The substantiation documents provide the incremental cost only, not the baseline technology and efficient technology costs.

[1] TRM Version 6.0, December 16, 2021.
OEB-Natural-Gas-DSM-Technical-Resource-Manual-V6.0-20211216.pdf

[2] EB-2016-0246, filed 2016-12-21, Exhibit B, Tab 1, Schedule 2, Page 4 of 15.
https://www.oeb.ca/consultations-and-projects/policy-initiatives-and-consultations/natural-gas-demand-side-0

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 66

ED.23 – How many customers received incentive payment in 2018-2021 (draft) for water heater ($400 incentive), broken out between tanked and tankless.

Response:

The following DSM participants received the water heater rebate applicable for the program year:

	2018	2019	2020	2021
L-EGD	2,399	2,658	2,123	3,673
Tanked	177	108	29	32
Tankless	2,222	2,550	2,094	3,641
L-UG*	1,834	1,109	1,101	985
Tanked				17
Tankless				968
Total	4,233	3,767	3,224	4,658

*Prior to 2021, L-UG did not have the water heater type field included in tracking systems.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 67

ED.26 – To confirm capital costs for new residential connections, including gas line from the property to the meters, the cost of the meters, and any internal piping.

Response:

The IR response did not include the cost of the meters. The tables below are updated to include the cost of the meter based on the current average cost for new residential connections:

Capital Costs to Connect New Residential Developments										
Union Gas Rate Zone	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021B**	**2022B**	**2023B**	**2024B**
Number of Projects	-	-	-	-	-	-	-	-	-	-
Number of Residential Customers	10,307	11,635	12,328	12,561	9,396	9,753	10,298	10,115	9,897	9,842
Total Capital Cost (Net - includes Meter Purchase)	**31,922,845**	**34,043,797**	**31,448,673**	**33,591,485**	**34,266,431**	**35,073,230**	**35,737,917**	**40,543,046**	**36,009,578**	**36,937,283**
Portion Funded via rates ($)	**34,737,249**	**36,342,220**	**33,564,233**	**38,828,941**	**36,779,740**	**37,584,802**	**39,209,368**	**44,237,413**	**39,751,727**	**40,789,271**
Portion funded by New Customers ($) (CIAC)	**(2,814,404)**	**(2,298,423)**	**(2,115,560)**	**(5,237,456)**	**(2,513,309)**	**(2,511,572)**	**(3,471,451)**	**(3,694,367)**	**(3,742,149)**	**(3,851,988)**
Capital Costs by Work Type										
Mains (Net)	**7,948,368**	**10,592,440**	**6,720,788**	**7,909,791**	**10,841,818**	**9,536,317**	**9,724,818**	**11,075,262**	**9,811,856**	**10,073,119**
Portion Funded via rates ($)	9,857,497	12,094,296	8,015,277	12,201,075	12,640,883	11,342,460	12,258,977	13,772,150	12,543,625	12,885,070
Portion funded by New Customers ($) (CIAC)	(1,909,129)	(1,501,856)	(1,294,489)	(4,291,284)	(1,799,065)	(1,806,143)	(2,534,159)	(2,696,888)	(2,731,769)	(2,811,951)
Service (Net)	**18,128,537**	**17,185,244**	**17,572,991**	**18,461,387**	**16,470,715**	**18,770,124**	**18,755,006**	**21,359,434**	**18,922,866**	**19,426,729**
Portion Funded via rates ($)	19,033,812	17,981,811	18,394,062	19,407,559	17,184,959	19,475,553	19,692,298	22,356,913	19,933,246	20,466,766
Portion funded by New Customers ($) (CIAC)	(905,275)	(796,567)	(821,071)	(946,172)	(714,244)	(705,429)	(937,292)	(997,479)	(1,010,380)	(1,040,037)
Other (Net - Stations)	**942,914**	**902,486**	**1,115,470**	**997,734**	**1,080,914**	**1,941,861**	**1,389,260**	**1,582,180**	**1,401,694**	**1,439,017**
Portion Funded via rates ($)	942,914	902,486	1,115,470	997,734	1,080,914	1,941,861	1,389,260	1,582,180	1,401,694	1,439,017
Portion funded by New Customers ($) (CIAC)	-	-	-							
Meters & Regs (Net)	**3,895,723**	**4,226,538**	**4,834,609**	**4,994,986**	**4,954,713**	**3,871,767**	**4,862,409**	**5,537,631**	**4,905,928**	**5,036,559**
Portion Funded via rates ($)	3,895,723	4,226,538	4,834,609	4,994,986	4,954,713	3,871,767	4,862,409	5,537,631	4,905,928	5,036,559
Portion funded by New Customers ($) (CIAC)	-	-	-			-				
Meter Purchase (Net)	**1,007,303**	**1,137,089**	**1,204,815**	**1,227,587**	**918,271**	**953,161**	**1,006,424**	**988,539**	**967,234**	**961,859**
Portion Funded via rates ($)	1,007,303	1,137,089	1,204,815	1,227,587	918,271	953,161	1,006,424	988,539	967,234	961,859
Portion funded by New Customers ($) (CIAC)	-	-	-	-	-	-	-	-	-	-

Capital Costs to Connect New Residential Developments										
EGD Rate Zone	**2015A**	**2016A**	**2017A**	**2018A**	**2019A**	**2020A**	**2021B**	**2022B**	**2023B**	**2024B**
Number of Projects	-	-	-	-	-	-	-	-	-	-
Number of Residential Customers	22,597	23,289	26,174	23,011	19,295	20,320	20,325	19,704	19,393	18,972
Total Capital Cost (Net - includes Meter Purchase)	**39,455,592**	**48,758,959**	**42,823,217**	**65,265,335**	**46,319,593**	**66,799,405**	**57,631,430**	**57,148,112**	**57,004,215**	**56,348,323**
Portion Funded via rates ($)	**49,024,107**	**68,110,991**	**45,456,523**	**69,784,387**	**49,205,457**	**68,933,323**	**60,874,634**	**60,456,180**	**60,378,444**	**59,790,036**
Portion funded by New Customers ($) (CIAC)	**(9,568,515)**	**(19,352,032)**	**(2,633,306)**	**(4,519,052)**	**(2,885,864)**	**(2,133,918)**	**(3,243,204)**	**(3,308,068)**	**(3,374,229)**	**(3,441,714)**
Capital Costs by Work Type										
Mains (Net)	**18,826,741**	**24,951,576**	**20,997,672**	**20,188,398**	**21,507,744**	**18,663,521**	**19,497,513**	**19,349,428**	**19,309,658**	**19,094,256**
Portion Funded via rates ($)	24,872,984	30,594,025	23,547,218	22,668,461	24,237,213	19,958,592	21,702,892	21,598,914	21,604,134	21,434,621
Portion funded by New Customers ($) (CIAC)	(6,046,243)	(5,642,449)	(2,549,546)	(2,480,063)	(2,729,469)	(1,295,071)	(2,205,378)	(2,249,486)	(2,294,476)	(2,340,365)
Service (Net)	**17,554,831**	**20,123,602**	**17,765,193**	**40,724,873**	**21,729,426**	**44,769,403**	**34,635,640**	**34,372,580**	**34,301,931**	**33,919,288**
Portion Funded via rates ($)	21,077,103	33,833,185	17,848,953	42,763,862	21,885,821	45,608,250	35,673,465	35,431,161	35,381,684	35,020,637
Portion funded by New Customers ($) (CIAC)	(3,522,272)	(13,709,583)	(83,760)	(2,038,989)	(156,395)	(838,847)	(1,037,825)	(1,058,582)	(1,079,753)	(1,101,348)
Other (Net - Stations)	**555,996**	**1,244,870**	**1,132,394**	**1,157,272**	**871,374**	**906,895**	**948,245**	**941,043**	**939,109**	**928,633**
Portion Funded via rates ($)	555,996	1,244,870	1,132,394	1,157,272	871,374	906,895	948,245	941,043	939,109	928,633
Portion funded by New Customers ($) (CIAC)	-	-	-	-	-	-	-	-	-	-
Meters & Regs (Net)	**309,619**	**162,877**	**369,973**	**945,927**	**325,349**	**473,712**	**563,670**	**559,389**	**558,239**	**552,012**
Portion Funded via rates ($)	309,619	162,877	369,973	945,927	325,349	473,712	563,670	559,389	558,239	552,012
Portion funded by New Customers ($) (CIAC)	-	-	-	-	-	-	-	-	-	-
Meter Purchase (Net)	**2,208,405**	**2,276,034**	**2,557,985**	**2,248,865**	**1,885,700**	**1,985,874**	**1,986,362**	**1,925,672**	**1,895,278**	**1,854,134**
Portion Funded via rates ($)	2,208,405	2,276,034	2,557,985	2,248,865	1,885,700	1,985,874	1,986,362	1,925,672	1,895,278	1,854,134
Portion funded by New Customers ($) (CIAC)	-	-	-	-	-	-	-	-	-	-

Note the 2021-2024 CIAC amounts for the Union Gas rate zone have been updated to reflect a 3yr average cost (previously shown as a 5yr average) to align with the EGD rate zone presentation.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 77

To respond to Table 4 – STAFF.13 and provide when it would need OEB guidance in order to implement increased savings direction of +10 percent.

Response:

In the above referenced Table 4 detailed in the interrogatory response to Exhibit I.6.EGI.STAFF.13, Enbridge Gas provided a sensitivity analysis which illustrated an estimate of the incremental gas savings results that could be achieved in the scenario of a further 20% increase in budget levels in year one above what has been proposed in Enbridge Gas's DSM plan application for its core resource acquisition type programs, i.e. Residential, Low Income, Commercial and Industrial.

The incremental dollar increase illustrated in the scenario analysis amounts to an additional $21,376,676 above the proposed portfolio budget of $142,260,000 outlined for year one of the Company's multi-year DSM plan. This addition would translate to a total budget of approximately $163.6 million in 2023, an approximately 24% increase over the OEB 2022 approved budget of $132 million. This scenario projected an additional 9.5% net annual gas savings across the four scorecards, or approx. 9.98 million m^3 beyond the 105.6 million m^3 projected in the Company's original DSM plan proposal for 2023.

Accompanying the table, Enbridge Gas provided an overview of where budget investments would be directed for each sector in order to increase gas savings results. Of note, the scenario outlined did not contemplate any increase to the portfolio administration budget proposed by the Company for 2023.

Notwithstanding the Company's firm belief that a 24% year over year budget increase for 2023 does not reflect the OEB's direction for modest budget increases, in consideration of responding to this undertaking the Company believes it would be challenging to employ all the additional $21 million in a fully effective manner within the 2023 calendar year. Assuming that the OEB approved the program complement put forward in Enbridge Gas's DSM plan including approval of the overall approach of the Company's DSM application (comprising the DSM Framework, budget distributions, program design details, scorecards, cost recovery and DSMI approach as proposed) and was able to provide a Decision on the DSM application by the end of August as

originally requested by the Company, Enbridge Gas believes the most aggressive ramp up would be to deploy 50% of the Table 4 scenario or approx. $10.7 million additional program dollars in each of the 2023 and 2024 program years with the goal of driving on average an additional 4.75% forecast incremental net annual gas savings in each of those years. Additionally, as provided in the proposed DSM Framework, the Company would have access to an additional 15% overspend annually to pursue results in excess of 100% forecast achievement in programs which may prove to be very successful.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 83

To provide comment on the feasibility of ramping up savings and assuming the commensurate necessary budget increase, under two scenarios, annual percentage bases of 10 percent and 25 percent per year, 2024-2027

Response:

In an effort to address the scenarios to ramp up gas savings as posed by Environmental Defence (ED), Enbridge Gas has drawn on analysis provided in the Company's interrogatory response to Exhibit I.6.EGI.STAFF.13 part c.

For the scenario to ramp up savings annually by 10% for 2024-2027, Enbridge Gas referenced Table 4 of the aforementioned interrogatory response which provided a sensitivity analysis forecasting an estimate of approx. 9.5% incremental gas savings results that could be achieved in the scenario of a further 20% increase in each of the program budgets above what has been proposed in Enbridge Gas's DSM plan application specifically for its four core resource acquisition type programs, i.e. Residential, Low Income, Commercial and Industrial. Relevant data from Table 4 in Exhibit I.6.EGI.STAFF.13 part c is summarized here:

Sensitivity scenario +20% Budget Increase by Sector

	Incentive costs (incremental)	Promotion Costs (incremental)	Delivery Costs (Incremental)	Admin Cost (incremental)	Total Budget (Incremental)	Incremental net m3
Residential Program	$6,737,410	$1,180,000	$243,550	$ -	$8,160,960	2,297,660
Low Income Program	$2,322,342	$1,024,400	$1,155,796	$95,000	$4,597,538	718,406
Commercial Program	$3,174,012	$293,787	$1,260,756	$324,000	$5,052,555	2,011,306
Industrial Program	$3,084,023	$49,600	$ -	$432,000	$3,565,623	4,949,075
				Totals:	**$21,376,676**	**9,976,447**

Enbridge Gas has utilized this analysis to provide a simplified illustration with assumptions of how a similar year over year gas savings target increase of 9.5% would ramp up for the 2024-2027 term with commensurate budget increases. These figures are summarized below:

		revised 2024-2027 to model 10% incremental gas savings ramp up scenario			
	2023 Budget	**2024 Budget**	**2025 Budget**	**2026 Budget**	**2027 Budget**
Program budget	$123,900,000	$148,680,000	$178,416,000	$214,099,200	$256,919,040
Portfolio Administration budget	$18,360,000	$19,278,000	$20,241,900	$21,253,995	$22,316,695
Total budget	**$142,260,000**	**$167,958,000**	**$198,657,900**	**$235,353,195**	**$279,235,735**
Budget Increase yr/yr		18.1%	18.3%	18.5%	18.6%
Target (Annual net m^3)	**105,558,506**	**115,534,953**	**126,454,285**	**138,405,614**	**151,486,476**
Gas Savings Increase yr/yr		9.5%	9.5%	9.5%	9.5%

The Company's view is that year over year budget increases for 2024 through 2027 in excess of 18% (to facilitate incremental year over year gas savings targets of 9.5%) does not reflect the OEB's direction for modest budget increases. Further it is not possible to respond to the question of feasibility posed in this undertaking without considerably more time and analysis by the Company.

For the second scenario requested by ED to ramp up savings annually by 25% for 2024-2027, Enbridge Gas referenced Table 1 (specifically the Total portfolio row of data) from the interrogatory response to Exhibit I.6.EGI.STAFF.13 part c which summarized data from the Online 2019 APS data files, and utilized the net cubic meters and net total budget figures to compare Scenario A and Scenario C as shown in the table below. This analysis provides an illustration of a ramp up of an incremental 20% annual savings:

From APS Online files	**APS Scenario A**			**APS Scenario C**		
2023	**Net M3**	**Net $**	**Net $/M3**	**Net M3**	**Net $**	**Net $/M3**
Residential	31,738,358	$18,109,260	$0.57	39,124,756	$42,508,692	$1.09
Commercial	42,514,097	$30,052,031	$0.71	45,295,028	$49,208,075	$1.09
Industrial	46,954,518	$31,072,136	$0.66	61,837,488	$83,702,576	$1.35
Total	121,206,972	$79,233,428	$0.65	146,257,273	$175,419,343	$1.20

The analysis illustrates the approximate increase in net m3 in scenario C compared to scenario A is 20% with a corresponding increase in net $ in scenario C compared to scenario A of 120%.

Enbridge Gas has utilized this analysis to provide a simplified illustration with assumptions of how a year over year gas savings target increase of 20% would ramp up for the 2024-2027 term with commensurate budget increases. These figures are summarized below:

		revised 2024-2027 to model 20% incremental gas savings ramp up scenario			
	2023 Budget	**2024 Budget**	**2025 Budget**	**2026 Budget**	**2027 Budget**
Program budget	$123,900,000	$272,580,000	$599,676,000	$1,319,287,200	$2,902,431,840
Portfolio Administration budget	$18,360,000	$23,868,000	$31,028,400	$40,336,920	$52,437,996
Total budget	**$142,260,000**	**$296,448,000**	**$630,704,400**	**$1,359,624,120**	**$2,954,869,836**
Budget Increase yr/yr		108%	113%	116%	117%
Target (Annual net m^3)	**105,558,506**	**126,670,207**	**152,004,249**	**182,405,098**	**218,886,118**
Gas Savings Increase yr/yr		20.0%	20.0%	20.0%	20.0%

The Company's view is that year over year budget increases for 2024 through 2027 in excess of 108% (to facilitate incremental year over year gas savings targets of 20%) in no way reflects the OEB's direction for modest budget increases. It is not possible to respond to the question of feasibility posed in this undertaking without considerably more time and analysis by the Company.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 102

To explain the basis for the estimated costs for residential gas heat pumps.

Response:

Please see response at Exhibit JT1.21.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 105

In relation to in parts d and h, to provide a range of seasonal coefficient of performance figures or confirm that these are seasonal coefficient of performance figures, in ED 38, where there is a reference to 1.1 to 1.6.

Response:

The seasonal coefficients of performance (COP) are not published by the residential gas heat pump manufacturers at this time. The COP provided in Exhibit I.10.EGI.ED.38 represents the range of performance over a heating season and is a function of different outdoor air temperatures and water outlet temperatures.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence

Undertaking

Tr: 106

For J and K to provide the basis for each of the installed cost estimates for gas heat pumps and the cold-climate heat pump, air-source heat pump.

Response:

Please see response at Exhibit JT1.21.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 108

To provide the calculation for hybrid heat pumps savings.

Response:

On March 4, 2022, Enbridge Gas discussed with NRCan the possibility of providing Environmental Defence (ED) the NRCan Hybrid System Assessment Tool. After consideration, NRCan confirmed they would be agreeable to ED reviewing the tool but not the inner workings or algorithms.

Subsequently on March 10, 2022, Enbridge Gas provided ED a contact at NRCan so that ED could get in touch with them directly to get any necessary agreements in place to access the tool.

Enbridge Gas understands that ED has been in touch with NRCan to get access to the tool and Enbridge Gas has provided ED with the inputs it used to generate Table 1 in Exhibit I.10h.EGI.STAFF.77.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 112

To provide figures and assumptions not already included in STAFF 77, in relation to installed costs.

Response:

Please note that in the process of providing the detailed information requested in this undertaking, two errors were uncovered related to one of the illustrative examples, which modelled a "Post 80's Toronto archetype home" water and space heating installation as outlined in Table 3 in Exhibit I.10h.EGI.STAFF.77.

1. The domestic hot water heater energy factor used to calculate the base case used a 0.81EF water heater however, the excel calculations to determine the gas heat pump scenario, which are attached at undertaking JT.1.23, incorrectly used a different energy factor value of 0.61EF. The savings values have been updated and are provided in Table 3 below. The original incorrect values are shown in parenthesis.
2. The all-electric scenario costs were incorrectly totaled in Table 3 of Exhibit I.10h.EGI.STAFF.77. The corrected value has been updated and is provided in Table 3 below. The original incorrect value is shown in parenthesis.

In this scenario, the corrected values result in a reduced NPV of the gas heat pump system and an increased NPV of the all-electric solution. As a result, as corrected the NPV of the all-electric solution is less negative than the NPV of gas heat pump solution in this scenario

When considering the relative merits of gas heat pumps and all-electric solutions, the following also needs to be considered:

(a) The ability of each solution to "plug and play"

As stated in Exhibit I.10h.EGI.STAFF.77, the scenario for the all-electric solution is dependent on key assumptions that limit its market potential. The modelled solution assumes there is no need for upgrading the home's electrical service nor for deeper retrofits to reduce the heating load and thereby minimize reliance on the electric resistance back up in the all-electric solution. Simply incorporating the cost of an electric service upgrade, which as stated in Exhibit I.10h.EGI.STAFF.77 is estimated to cost up

to $2,000, would eliminate most if not all of the cost advantage of the all-electric solution illustrated in the Table 3 scenario.

The gas heat pump replaces conventional gas-fired heating equipment without the need for home upgrades. As such, it has broader market applicability (and therefore greater ability to scale) than an all-electric solution while achieving similar GHG reductions. For this reason alone, the Company foresees many household applications where gas heat pumps will be more cost effective, and likely more in demand than an all-electric heating solution.

(b) The relative market maturity of each technology

Electric air source heat pumps have been in market for a number of years and have seen costs decline. Enbridge Gas believes further declines are still possible and intends to support the adoption of electric heat pumps through its hybrid heating offer.

Gas heat pumps have yet to enter the market however and estimates for installed costs are based on initial minimum production volumes. Similar to electric heat pumps, Enbridge Gas expects that increasing volumes will significantly impact the economics of gas heat pumps over time and lower costs to the point that they will eventually become cost effective. It would be premature to dismiss gas heat pumps on the basis of current economics considering that electric heat pumps have been in market much longer.

(c) Breakdown of costs

The estimated cost of $15,000 for a residential gas heat pump is based on the average installed pricing provided by two manufacturers (reflecting an average equipment cost of $11,000 plus an estimated $4,000 installation cost). The $11,000 equipment cost includes all the necessary components of a gas heat pump, including the air handler and storage tank. As noted above, these cost estimates represent market entry prices based on low production volumes. It is expected that these costs will come down significantly with scale.

The $11,100 all-electric heating solution is comprised of $6,600 for a ccASHP and $4,500 for an air handler with electric resistance back-up. The costs were provided from contractor invoices from a recent Pilot Program in London and confirmed with a manufacturer of heat pumps to ensure the costs are reasonable and in line with future cost projections.

A detailed breakdown of costs and savings is provided in the tables below. Where detailed breakdowns are not possible, it is noted.

Table 1: Post 80's Toronto archetype home

		Air conditioner - end of life Furnace – not at end of life		**Air conditioner - end of life Furnace – end of life**
	Gas furnace – 95% AFUE, 13 SEER air conditioner **2 Ton A/C**	**Hybrid Heating with Smart Controls** **3 ton heat pump**	**All electric – CCHP with electric resistance backup** **3 ton heat pump**	**All electric – CCHP with electric resistance backup** **3 ton heat pump**
Year 2022 Natural Gas consumption (m3)	1,797 Consumption for space heating Includes furnace	1,041 Consumption for space heating Includes furnace	0	0
Year 2022 Electricity Consumption (kWh)	723 Consumption for space heating Includes furnace	3,027 Consumption for space heating Includes furnace and heat pump No further breakdown available	7,589 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available	7,589 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available
Year 2022 Operating Costs	$705 $629 Gas $76 Electricity Costs for space heating Includes furnace natural gas and electric costs	$634 $364 Gas $270 Electricity Costs for space heating Includes furnace and heat pump natural gas and electric costs	$798 $798 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs	$798 $798 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs

Year 2030 Natural Gas consumption (m3	1,797 Consumption for space heating Includes furnace	221 Consumption for space heating Includes furnace	0	0
Year 2030 Electricity Consumption (kWh	723 Consumption for space heating Includes furnace	6,532 Consumption for space heating Includes furnace and heat pump No further breakdown available	7,589 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available	7,589 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available
Year 2030 Operating Cost	$1,119 $1,043 Gas $76 Electricity Costs for space heating Includes furnace natural gas and electric costs	$766 $128 Gas $638 Electricity Costs for space heating Includes furnace and heat pump natural gas and electric costs	$798 $798 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs	$798 $798 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs
Installed cost	$8,000 $3,250 A/C $4,750 Furnace	$11,350 $6,600 heat pump $4,750 furnace	$11,100 $6,600 heat pump $4,500 air handler	$11,100 $6,600 heat pump $4,500 air handler
Incremental Cost	N/A	$3,350	$7,850	$3,100
NPV	N/A	$-312	$-5,613	$-863

Table 2: Pre 80's Toronto archetype home

		Air conditioner - end of life Furnace – not at end of life		**Air conditioner - end of life Furnace – end of life**
	Gas furnace – 95% AFUE, 13 SEER air conditioner **2 Ton A/C**	**Hybrid Heating with Smart Controls** **3 ton heat pump**	**All electric – CCHP with electric resistance backup** **3 ton heat pump**	**All electric – CCHP with electric resistance backup** **3 ton heat pump**
Year 2022 Natural Gas consumption (m3)	2,236 Consumption for space heating Includes furnace	1,528 Consumption for space heating Includes furnace	0	0
Year 2022 Electricity Consumption (kWh)	844 Consumption for space heating Includes furnace	2,967 Consumption for space heating Includes furnace and heat pump No further breakdown available	11,768 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available	11,768 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available
Yea 2022 Operating Costs	$872 $783 Gas $89 Electricity Costs for space heating Includes furnace natural gas and electric costs	$803 $ 535 Gas $ 268 Electricity Costs for space heating Includes furnace and heat pump natural gas and electric costs	$1,246 $ 1,246 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs	$1,246 $ 1,246 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs

Year 2030 Natural Gas consumption (m3	2,236 Consumption for space heating Includes furnace	678 Consumption for space heating Includes furnace	0	0
Year 2030 Electricity Consumption (kWh	844 Consumption for space heating Includes furnace	7,867 Consumption for space heating Includes furnace and heat pump No further breakdown available	11,768 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available	11,768 Consumption for space heating Includes air handler, auxiliary resistance backup heating and heat pump No further breakdown available
Year 2030 Operating Cost	$1,386 $1,297 Gas $89 Electricity Costs for space heating Includes furnace natural gas and electric costs	$1,145 $394 Gas $751 Electricity Costs for space heating Includes furnace and heat pump natural gas and electric costs	$1,246 $ 1,246 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs	$1,246 $ 1,246 Electricity Costs for space heating Includes heat pump, auxiliary resistance backup heating and heat pump electric costs
Installed cost	$8,000 $3,250 A/C $4,750 Furnace	$11,350 $6,600 heat pump $4,750 furnace	$11,100 $6,600 heat pump $4,500 air handler	$11,100 $6,600 heat pump $4,500 air handler
Incremental Cost	N/A	$3,350	$7,850	$3,100
NPV	N/A	$-1,272	$-8,205	$-3,455

Table 3: Post 80's Toronto archetype home

	Gas furnace – 95% AFUE, .81 EF water heater, 13 SEER AC	**Gas Heat Pump +13 SEER AC**	**All electric – CCHP with electric resistance backup and electric HPWH UEF water heater** 3Ton heat pump
Natural Gas consumption (m3)	2,127 1797 space heating 330 water heating	1,634(~~1563~~) Includes both space and water heating since they are provided by the same GHP unit	0
Electricity Consumption (kWh)	779 723 space heating 56 water heating Space cooling consumption not included	779 Value assumed to be similar to base case Includes both space and water heating since they are provided by the same GHP unit Space cooling consumption not included	9,120 7589 space heating 1531 water heating Space cooling consumption not included
Year 2022 Operating Costs	$828 $745 Gas $83 Electricity Costs for space and water heating Includes furnace and gas water heater natural gas and electric costs Space cooling costs not included	$656(~~$630~~) $573 Gas $83 Electricity Costs for space and water heating Includes gas heat pump natural gas and electric costs Space cooling costs not included	$998 $998 Electricity Costs for space and water heating Includes heat pump, auxiliary resistance backup heating, heat pump and HPWH Space cooling costs not included
Year 2030 Operating Costs	$1,316 $1233 Gas $83 Electricity Costs for space and water heating Includes furnace and gas water heater natural gas and electric costs Space cooling costs not included	$1,030(~~$990~~) $947 Gas $83 Electricity Costs for space and water heating Includes gas heat pump natural gas and electric costs Space cooling costs not included	$998 Costs for space and water heating Includes heat pump, auxiliary resistance backup heating, heat pump and HPWH Space cooling costs not included

Installed cost	$10,500 $4,750 furnace $3,250 A/C $2,500 water heater	$18,250 $15,000 GHP $3,250 A/C	$15,100(~~$17,250~~) $4,500 Air Handler $6,600 heat pump $4000 heat pump water heater
Incremental Cost	N/A	$7,750	$4,600(~~$6,750~~)
NPV	N/A	$-4,732(~~$-4,298~~)	$-2,686(~~$-4,836~~)

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence

Undertaking

Tr: 114

To provide a breakdown of the peak load calculation, for all scenarios given.

Response:

Provided below are the peak electrical load values by month for each scenario in Exhibit I.10h.EGI.STAFF.77b) Tables 1, 2 and 3.

Table 1

Peaks by Month	Gas furnace – 95% AFUE, 13 SEER air conditioner	Hybrid Heating with Smart Controls	All electric – CCHP with electric resistance backup
Jan	140 W	2702 W	7895 W
Feb	140 W	2543 W	6405 W
Mar	140 W	2542 W	4708 W
Apr	138 W	2285 W	3860 W
May	135 W	720 W	2484 W
Jun	2392 W	2729 W	3418 W
Jul	4381 W	4931 W	5091 W
Aug	3635 W	4139 W	4146 W
Sep	1659 W	1517 W	2817 W
Oct	131 W	1977 W	3216 W
Nov	135 W	2571 W	3914 W
Dec	138 W	2659 W	6103 W

Table 2

Peaks by Month	Gas furnace – 95% AFUE, 13 SEER air conditioner	Hybrid Heating with Smart Controls	All electric – CCHP with electric resistance backup
Jan	157 W	2851 W	10404 W
Feb	158 W	2829 W	9252 W
Mar	157 W	2505 W	6907 W
Apr	156 W	2237 W	5078 W
May	153 W	917 W	2659 W
Jun	1767 W	2005 W	3034 W
Jul	3207 W	3595 W	3917 W
Aug	2791 W	3163 W	3346 W
Sep	1353 W	1533 W	2625 W
Oct	149 W	2042 W	3705 W
Nov	153 W	2601 W	5202 W
Dec	156 W	2942 W	8749 W

Table 3

Peaks by Month	Gas furnace – 95% AFUE, 13 SEER air conditioner	Gas Heat Pump +13 SEER AC	All electric – CCHP with electric resistance backup and electric HPWH water heater
Jan	140 W	NRCan model is unable to calculate GHP peak loads. Loads are assumed to be similar to the base case.	7895 W
Feb	140 W		5311 W
Mar	140 W		4148 W
Apr	138 W		2737 W
May	135 W		890 W
Jun	2392 W		2430 W
Jul	4381 W		4543 W
Aug	3635 W		3707 W
Sep	1659 W		1745 W
Oct	131 W		2199 W
Nov	135 W		2718 W
Dec	138 W		5173 W

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 115

To provide confirmation that when Table 3 was put together, it was done with more complex and more detailed underlying excel spreadsheets.

Response:

Enbridge Gas developed a simple excel spreadsheet calculating the natural gas saved by upgrading to a gas heat pump scenario utilizing the base case consumption data outputs from the NRCan home heating calculator. Please see Attachment 1.

Residential GHP Gas Savings

Base Case Assumptions		
Furnace efficiency		95%
Hot water tank efficiency		81%
Annual gas consumption for space heating		80%
Annual gas consumption for DHW heating		20%
Annul Gas consumption (m3) (source: NRCan tool)		2,127
EE Case		
Avg. Effciency of residential GHP		120%
Overall efficiency of Base Case		92.2%
Gas saving		**23%**
Annual gas saving (m3)		493
GHP gas consumption (m3)		1,634
Costs		
2022 Gas cost for space heating and water heating (source: NRCan tool)	$	745
2022 Electric cost for space heating and water heating (source: NRCan tool)	$	83
2022 $/m3 cost (includes 2022 carbon tax)	$	0.35
2022 Calculated natural gas cost for gas heat pumps	$	573
2022 Total cost for gas heat pump including electricity	$	656
2030 Gas cost for space heating and water heating (source: NRCan tool)	$	1,233
2030 Electric cost for space heating and water heating (source: NRCan tool)	$	83
2030 $/m3 cost (includes 2030 carbon tax)	$	0.58
2030 Calculated natural gas cost for gas heat pumps	$	947
2030 Total cost for gas heat pump including electricity	$	1,030

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 122

To provide comment on repayment using the open bill program.

Response:

CMHC loans could be repaid via Enbridge Gas bills using the Open Bill Access Program (OBA). CMHC would have to comply with the same requirements as other Open Billers would have to comply for joining and using the program. To facilitate the addition of a new Open Biller to the program, Enbridge Gas completes due diligence steps such as background checks, setting up the Biller in billing and financial systems, completing contracting steps, and establishing credit.

The Open Biller also needs to take steps to be part of the OBA program, such as but not limited to: providing details about their legal entity and billing details, signing the Open Bill Agreement, providing financial assurances and receivables entitlement as required, establishing banking to facilitate funds transfers, and meeting system technical requirements. The technical requirements allow the Biller to interface with Enbridge Gas's system in order to submit bill transactions directly or via a transaction entry tools; this may require systems development on behalf of the Biller.

It is Enbridge Gas's experience that the process to establish a new Biller is up to six months in duration.

ENBRIDGE GAS INC.

Undertaking Response to Environmental Defence (ED)

Undertaking

Tr: 128

To advise, if the incentive pool were pegged to something, should that be the lifetime cubic metres or the net benefits, or something else. Also, if you were to move to a pegging based on net benefits, does Enbridge believe the number should maintain at 5.34 or be higher or lower, and does Enbridge have a position on that.

Response:

The Company would like to make clear that ED's suggestion that the maximum available incentive pool was in some way established by Enbridge Gas by targeting a percentage (i.e., 5.34%) of forecast net benefits is erroneous. Enbridge Gas examined no such calculation in designing the proposed shareholder incentive mechanism. As outlined in evidence at Exhibit C, Tab 1, Schedule 1, page 14 of 66, Enbridge Gas initiated its shareholder incentive approach based on the premise that the maximum shareholder incentive achievable for Enbridge Gas should be consistent with the total amount approved by the OEB for the two legacy utilities in the 2015-2020 framework, i.e., approx. $20.9 million. Given the year over year program budgets for the 2023-2027 term are proposed to increase by 3% growth plus inflation and given that the portfolio administration budget is proposed to increase by inflation year over year, the Company proposed that the shareholder incentive increase annually over the term by an amount less than inflation.

It is also important to understand, given that budgets proposed in the DSM plan have been built to target achievement of 100% metric results, and that the 15% available overspend in no way provides the funds that would be necessary to attain the 150% achievement in portfolio results required to earn the maximum available incentive and, based on the clear historical precedent of average DSMI earnings over the past framework term, the notion that the Company would be able to earn anywhere close to the maximum available incentive is purely hypothetical. To the contrary, the Company will be required to work very hard to achieve its 100% targets.

All this to say that the premise for this undertaking is inaccurate.

Should the OEB wish to consider an alternative approach to scaling shareholder incentives in relation to one or more factors of the DSM plan, a framework for scaling resource acquisition, equity and market support type programs (as described below) to

either net annual gas savings results or budgets based on a framework implemented by the California Public Utilities Commission in its recent Energy Efficiency Rulemaking[1] may be appropriate for consideration. That framework disaggregates the California portfolios into three segments, including:

- ***Resource Acquisition:*** Programs with a primary purpose of, and a short-term ability to deliver cost effective avoided cost benefits.
- ***Equity:*** Programs with a primary purpose of serving hard-to-reach or underserved customers and disadvantaged communities.
- ***Market Support:*** Programs with a primary objective of supporting the long-term success of the energy efficiency market by educating customers, training contractors, building partnerships, or moving technologies towards greater cost-effectiveness.

The Company recommends that the incentive pool for each program type should be increased using scalars appropriate to that program type. To illustrate:

- Scalars for the non-residential resource acquisition type scorecard incentive pools would be increased for the metric (assumed to be annual net gas savings) directed in the OEB's final performance incentive mechanism.
- Scalars for incentive pools tied to Low income and Residential programs would be scaled to the budgets devoted to these programs. (The proposed scalar for these programs is tied to budget rather than savings because the equity value to the portfolio of these programs is larger than their share of delivered savings).
- Scalars for incentive pools tied to Multi Year and Long Term programs would be scaled to the budgets devoted to these programs.

Should the OEB wish to adjust the performance incentive mechanism to deviate from Enbridge Gas's proposal, the Company recommends these scalars be adjusted accordingly. That is, incentive pools (relative to Enbridge Gas's original incentive mechanism proposal) should scale based on the OEB's ultimate decision regarding program budget and performance targets, as well as the OEB's final performance incentive mechanism.

[1] California Public Utilities Commission, Proposed Decision of ALJs Fitch and Kao, Rulemaking 13-11-005, *Assessment of Energy Efficiency Potential and Goals and Modification Of Portfolio Approval and Oversight Process*, 4/16/2021. (https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M378/K256/378256443.PDF)

ENBRIDGE GAS INC.

Undertaking Response to Association of Power Producers of Ontario (APPrO)

Undertaking

Tr: 133

To explain the derivation of the table at Exhibit F, Tab 1, Schedule 3.

Response:

Exhibit F, Tab 1, Schedule 3 provides class average DSM unit rates based on the 2021 volumetric billing unit forecast (column d). The class average DSM unit rates are applied to representative customer billing units (column g) to provide an estimate of the impact at a customer level by rate class. The DSM unit rates in Exhibit F, Tab 1, Schedule 3 do not reflect approved rate design methodologies of each individual rate class and therefore, actual unit rates and customer bill impacts will vary based on consumption and demands, depending on the applicable rate class.

Exhibit I.10e.EGI.APPrO.5, Table 1 provides the detailed unit rates for the large volume rate classes, Rate T2 and Rate 100, based on approved rate design methodologies. The rows in Table 1 provide all rate components impacted by the 2023 DSM Budget for Rate T2 and Rate 100. As an example, the approved rate design methodology for firm Rate T2 unit rates is to recover the allocation of DSM budget costs in the monthly demand charge, as provided in rows 2 and 3 of Table 1.

ENBRIDGE GAS INC.

Undertaking Response to Green Energy Coalition (GEC)

Undertaking

Tr: 155

To provide a breakdown of IRP framework proceeding costs to show OEB'S costs, intervenor costs, legal fees, and other stakeholder costs not otherwise included; any estimate of fully allocated costs of staff time; any other categories with estimates or tracked costs associated with the proceeding; an estimate to show how it will scale to this proceeding.

Response:

The chart below shows a breakdown of costs related to the IRP proceeding. The Company does not track time of Enbridge Gas employees who work on regulatory proceedings and as such there are no costs to be provided for this. The Company also does not know how these costs will scale for this proceeding as the IRP proceeding was a framework proceeding, whereas this proceeding has both a framework component as well as a plan component. In addition, each proceeding is unique in the number of procedural steps needed to adequately process an application.

Cost Category	Amount
Intervenor Costs	$762,267
External Legal Counsel	$279,955
Consultants	$100,316
Total	$1,142,438

ENBRIDGE GAS INC.

Undertaking Response to Pollution Probe (PP)

Undertaking

Tr: 178

To confirm the average measure life value for Enbridge's DSM portfolio.

Response:

The 2023 forecast portfolio net gas savings weighted average measure life is 16.4 years.

ENBRIDGE GAS INC.

Undertaking Response to Ontario Greenhouse Vegetable Growers (OGVG)

Undertaking

Tr: 7

With respect to exhibit I.6.EGI.OGVG.1, Tables 1 to 5, to update those tables to include 2021 results for the contract rate class.

Response:

Tables 1 to 5 are updated for contract rate classes below:

Table 1 below indicates the EGD rate zones and Union rate zones annual average number of contract customers by rate class for the period of 2015-2021:

Table 1

Contract Market / Rate Zone	Rate Class	2015	2016	2017	2018	2019	2020	2021
EGD	Rate 100	2	2	3	3	4	9	15
EGD	Rate 110	227	269	263	274	282	335	392
EGD	Rate 115	25	27	27	26	22	20	21
EGD	Rate 125	5	5	4	4	4	4	4
EGD	Rate 135	42	45	45	43	43	40	42
EGD	Rate 145	52	38	37	33	26	22	19
EGD	Rate 170	26	25	26	27	23	21	22
EGD	Rate 200	1	1	1	1	-	1	1
EGD	Rate 300	2	2	2	2	1	2	1
EGD	Rate 315	2	2	1	1	-	-	1
Union North	Rate_20	50	47	46	44	54	57	58
Union North	Rate_25	80	78	79	78	55	52	52
Union North	Rate_100	10	11	11	11	12	12	12
Union South	Rate_M4	156	165	185	208	232	239	230
Union South	Rate_M5	80	72	59	38	42	38	39
Union South	Rate_M7	28	28	30	30	36	47	56
Union South	Rate_M9	2	2	3	3	4	4	4
Union South	Rate_M10	2	2	2	3	2	2	2
Union South	Rate_T1	37	37	37	37	37	39	39
Union South	Rate_T2	22	22	23	24	25	25	25
Union South	Rate_T3	1	1	1	1	1	1	1
Total		852	881	885	891	905	969	1036

Table 2 indicates the EGD rate zone and the Union rate zones' annual average number of contract customer by rate class based on January-2022 month-end:

Table 2

Contract Market / Rate Zone	Rate Class	Jan-22
EGD	Rate 100	16
EGD	Rate 110	412
EGD	Rate 115	18
EGD	Rate 125	4
EGD	Rate 135	41
EGD	Rate 145	18
EGD	Rate 170	25
EGD	Rate 200	1
EGD	Rate 300	1
EGD	Rate 315	1
Union North	Rate_20	60
Union North	Rate_25	70
Union North	Rate_100	12
Union South	Rate_M4	227
Union South	Rate_M5	38
Union South	Rate_M7	62
Union South	Rate_M9	4
Union South	Rate_M10	3
Union South	Rate_T1	39
Union South	Rate_T2	25
Union South	Rate_T3	1
Total		1078

Table 3 below indicates the total number of contract customers in the EGD rate zone and Union rate zones who were DSM participants by rate class from 2015-2021:

Table 3

Contract Market	Rate Class	Unique Customers
EGD	RATE 100	6
EGD	RATE 110	183
EGD	RATE 115	12
EGD	RATE 135	26
EGD	RATE 145	5
EGD	RATE 170	11
Union North	Rate 20	38
Union North	Rate 100	15
Union South	Rate M4	180
Union South	Rate M5	40
Union South	Rate M7	55
Union South	Rate T1	31
Union South	Rate T2	22
Total		**624**

NOTES:
- Table 3 includes a customer count which is not the same as the unit or participant count. In some cases, multiple units can be installed for a single customer (e.g. prescriptive programs). In other cases, programs did not report on participant numbers but are included here to be responsive (e.g. EGD Low Income TAPS).
- Table 3 includes only unique participants. Participants who participated in multiple years were only counted once.
- Rate class categorization for this analysis was determined based on the customers current rate class in order to answer b) iii and b) iv and is not necessarily the same rate class the customer was in at the time the project was implemented. The EGD rate zone home labeling program delivered in 2015 was excluded.

Table 4 below indicates the total number of customers in the EGD rate zone and Union rate zones who were DSM participants by rate class from 2015-2021, more than once

Table 4

Contract Market	Rate Class	Repeat Customers
EGD	RATE 100	5
EGD	RATE 110	113
EGD	RATE 115	12
EGD	RATE 135	20
EGD	RATE 145	4
EGD	RATE 170	6
Union North	Rate 20	29
Union North	Rate 100	15
Union South	Rate M4	149
Union South	Rate M5	27
Union South	Rate M7	55
Union South	Rate T1	28
Union South	Rate T2	21
Total		**484**

NOTES:
- Table 4 includes a customer count which is not the same as the unit or participant count. In some cases, multiple units can be installed for a single customer (e.g. prescriptive programs). In other cases, programs did not report on participant numbers but are included here to be responsive (e.g. EGD Low Income TAPS).
- Rate class categorization for this analysis was determined based on the customers current rate class in order to answer b) iii and b) iv and is not necessarily the same rate class the customer was in at the time the project was implemented. The EGD rate zone home labeling program delivered in 2015 was excluded.

Table 5 below indicates the total number of customers in the EGD rate zone and Union rate zones who were not DSM participants by rate class from 2015-2021

Table 5

Contract Market	Rate Class	Customers That Have not Particpated
EGD	RATE 100	10
EGD	RATE 110	229
EGD	RATE 115	6
EGD	RATE 135	15
EGD	RATE 145	13
EGD	RATE 170	14
Union North	Rate 20	22
Union North	Rate 100	-3
Union South	Rate M4	47
Union South	Rate M5	-2
Union South	Rate M7	7
Union South	Rate T1	8
Union South	Rate T2	3
Total		**369**

ENBRIDGE GAS INC.

Undertaking Response to Ontario Greenhouse Vegetable Growers (OGVG)

Undertaking

Tr: 11

To provide a description of the ratio of customer account representatives to contract rate customers, essentially, you know, with some narrative about how many contract customers an average account representative is responsible for.

Response:

Enbridge Gas' Energy Solutions Advisors (ESAs) provide support to customers regardless of rate class. Each ESA is assigned accountability for customers based on the market segment and geographic regions they support, which include a combination of contract rate and general service accounts. As such, there is no standard ratio of contract rate accounts for each ESA. On average, an ESA will have accountability for approximately 175 accounts, of which 40 could be contract rate.

ENBRIDGE GAS INC.

Undertaking Response to Ontario Greenhouse Vegetable Growers (OGVG)

Undertaking

Tr: 19

To consider the issues surrounding a funding solution where contract rate customers through their contracting with Enbridge are able to essentially fund their DSM investments using the savings that they experience over an appropriate period of time, similar in nature to how contract rate customers can fund their what otherwise would be their capital contribution requirements through the hourly allocation factor.

Response:

Enbridge Gas does not believe financing DSM investments, which are assets owned and operated by the contract rate customer, is an appropriate activity for a utility to undertake. The DSM investments made by a customer are in assets that are also owned by the customer. This contrasts with the financing of capital contributions for distribution assets that are owned by the utility.

There are numerous customer financing options available in the market today, and as such, the availability of financing is not considered a barrier for contract rate participation in the DSM programs.

ENBRIDGE GAS INC.

Undertaking Response to Anwaatin Inc.

Undertaking

Tr: 29

To file the report referred to in STAFF 41.

Response:

Please see Attachment 1 for the Building Knowledge Canada Inc.'s Report, "Phase 1: Utility DSM Future Scope Developments for Indigenous Communities" and Attachment 2 for Enbridge Gas's Indigenous Existing Homes – Energy Conservation Measures.

Enbridge Gas Preliminary Insight:

The timing of this study was to inform future direction of Indigenous On-Reserve Single Family programming; however, the research was put on hold with impacts of the COVID pandemic. Although the details available in this preliminary report are consistent with Enbridge Gas's findings in this community, Enbridge Gas will continue to monitor for all DSM-related measures.

Now that COVID restrictions are lifting, Enbridge Gas will revisit the original pilot, and use this as an opportunity to evolve the scope, which may include a review of Part 3 buildings. In addition, the impact of recent Federal Greener Homes Indigenous initiative will also be a consideration to better understand what level of support is being offered through this initiative and how Enbridge Gas can best complement those efforts.

Enbridge Gas is committed to explore all DSM opportunities for Indigenous On and Off-Reserve Enbridge Gas Customers.

BUILDING KNOWLEDGE CANADA INC.

PHASE 1: UTILITY DSM FUTURE SCOPE DEVELOPMENT FOR INDIGENOUS COMMUNITIES

Project Update Report : December 7, 2020

50 Fleming , Unit 6 , Cambridge, ON, N1T 2B1
TEL: 1-800-267-6830/519-658-6232 | FAX: 519-658-6103

Project

DATE: Dec 7, 2020

TO: Caroline Knight & Maye Fernandez Perez, Enbridge.

FROM: Andrew Oding, Rob Johnston, Michael Gilizan , Building Knowledge Canada

RE: PHASE 1: UTILITY DSM FUTURE SCOPE DEVELOPMENT: **Project Update December 7, 2020**

Background

Due to the limitations of the current Indigenous Home Weatherization Program offering there is little opportunity to weatherize on-reserve homes. Current Audits are narrow in scope and blower door testing is for the purposes of determining insulation levels and air tightness only. With little opportunity on this front Enbridge undertook a **two-phased** approach to look at alternatives for next generation DSM planning for on-reserve housing stock.

Phase 1

The scope of work outlined the work and deliverables needed to implement and fulfill the first phase of this initiative. The first phase helps to inform evaluation issues that are occurring with the audit results for the Indigenous DSM files. The first phase included a thorough study of housing stock on reserve to determine what the true needs and opportunities are with respect to :

- resource reduction / management (gas, fuel)
- energy-savings (GJ, kW)*
- carbon reduction(ghg tonnes-operational)
- affordability (reducing home operation/ ownership cost)
- Building Science Priorities
    - considerations for occupant health, safety and IEQ
    - asset protection –durability & life span of residence
    - asset protection & climate change Adaptability

** (Future building code requirements e.g. Net Zero Ready NBC 2020-30 (Pan Canadian Framework on Climate Change and Growth)*

Once the on-site audits were complete a iterative energy modelling exercise was undertaken to assess various ECM's(energy conservation measures). Concurrently, a building science review based on holistic outcomes was applied to prioritize the ECM's, to ensure upgrades would result in safe, healthy, durable living environments.

The on-site audits enabled a team of building envelope / IAQ experts to conduct testing and assessments of actual residences . There are many assumptions about on-reserve homes but without a proper study of the unique housing stock a proper pilot could not be launched without the on-site review and insights provided.

There are currently 14 Indigenous communities with residential gas service in the Legacy Union Gas franchise area (there are more if you include commercial). New Indigenous communities are scheduled to come onto gas through community expansion in both LEG and LUG but not enough communities to sustain a continued framework (without new measures) for a new framework. Unfortunately, Phase 1 of this project was completed with limited access to most of the current communities due to the COVID pandemic. Therefore the balance of this report is based on outcomes and observations drawn from the Nipissing community review and on-site testing.

Objectives

1. To develop a comprehensive list of impactful DSM measures and technologies that can be considered for future DSM pilot program delivery
2. To develop and execute a series of exercises (e.g. site testing and observations, energy modeling, environmental scanning and surveys) meant to identify key potential DSM strategies

Deliverables and Schedule: Update

Task	Description	Week	OCT 21	OCT 28	NOV 4	NOV 11	NOV 18	NOV 25	DEC 2	DEC 9	DEC 16	DEC 23
1	**Develop Key benchmarks and metrics for surveys and community visits**											
1.1	develop key metrics that will be used to identify and prioritize strategies											
2	**Develop homeowner surveys and benchmarking data collection forms**											
2.1	develop questionnaire for homeowners in key communities											
2.2	develop on-site benchmarking data collection form and deliverables											
3	**Coordinate and execute community visits and benchmarking**											
3.1	planning /scheduling											
3.2	community 1											
3.3	community 2											
3.4	community 3											
3.5	community 4											
3.6	community 5											
5	**Coordinate and execute archetype housing iterative modeling analysis**											
5.1	collect and coordinate file of housing archetypes: PDF or CAD files											
5.2	develop HOT 2000 iterative modeling base files for each archetype											
5.3	execute iterative model on each house type/archetype											
6	**Develop list of proposed and prioritized strategies**											
6.1	Develop List of strategies and prioritize.											
7	**Develop final report and analysis**											
7.1	develop final report DRAFT											
7.2	presentation of report to client-face-to-face meeting											
7.3	deliver final report with clarifications and changes											
8	**Deliver supportive training to stakeholders** **OPTIONAL**											
8.1	Presentation, train-the trainer											
8.2	Presentation, train-the trainer											

COMPLETE

COMPLETE

COMPLETE FOR COMMUNITY 1

COMPLETE FOR COMMUNITY 1

COMPLETE FOR COMMUNITY 1

COMPLETE FOR COMMUNITY 1

Community 1: Nipissing overview

Number of residences: 13 residences

Types of homes: Single Detached, residential occupancy

Testing / Inspection points:

- In –situ IAQ conditions –temp,RH
- Blower Door-Infiltration test
- Ventilation review
- HVAC review
- Enclosure detailing review: local wetting, staining, drainage detailing
- Occupant lifestyle : Observations and Formal Questionnaire

General Site Observations –Community 1 -Nipissing

1. RANGE HOOD DOES NOT EXHAUST TO EXTERIOR IN MANY HOMES… AND SOME WITH GAS RANGES
2. MANY HOMEOWNERS COMMENTED ON WINDOW CONDENSATION DURING COLD MONTHS
    - ONE OWNER WITH HRV MENTIONED THEY HAD NO ISSUES WITH CONDENSATION AND RH IN THE WINTER
3. AVERAGE **RH LEVELS OBSERVED 45-50+%**
    - LOTS OF PETS AND HOUSE PLANTS NOTICED IN HOMES
    - 10 of 12 HOMES WITH EXHAUST –ONLY VENTILATION SYSTEMS e.g. BATH FANS
4. AIR TIGHTNESS
    - OVERALL AIR SEALING WAS DONE QUITE WELL : 1.4 ACH50 to 4.6 ACH50 / **Avg = 4.0ACH50**
    - 2 HOMES= VERY LEAKY : 7.6 AND 8.54 ACH50
    - 3-4 HOMES WITH SPRAY FOAMED CRAWL SPACE TENDED TO TEST BETTER
5. ALL HOMES HAD NATURAL GAS CONNECTION
6. MANY HOMES HAD WOOD BURNING APPLIANCES **REMOVED/DISCONNECTED, STATED THIS WAS A REASON IN THE PAST TO NOT INSTALL A RANGE HOOD THAT EXHAUSTS TO THE EXTERIOR**
7. COMMENTS ABOUT DRAFTY WINDOWS .
    - OBSERVED MOST SITTING AREAS/DINING AREAS WERE VERY CLOSE TO LARGE WINDOWS

TASK 5 & 6 : OVERVIEW

- Task 5 Coordinate and execute archetype iterative modeling analysis
- Task 6 Develop list of proposed / prioritized strategies

Building upon the on-site inspections in community 1, BKC developed a modeling strategy to assess potential DSM ECM's (Energy Conservation Measures). Two archetype homes were selected being representational of the existing housing stock in community 1. A 1200sqft single detached, single story residence and a 2200sqft, 2 story, single detached residence. A group of ECM's was applied to each archetype to assess the impact on the following:

1. resource reduction / management (gas, fuel)
2. energy-savings (GJ, kW)
3. carbon reduction(ghg tonnes-operational)
4. affordability (reducing home operation/ ownership cost)
5. Building Science Priorities
    a. considerations for occupant health, safety and IEQ
    b. asset protection –durability & life span of residence
    c. asset protection & climate change Adaptability

In addition to energy modeling, an estimate for completion of each ECM was provided. The estimates were based on **regional quotes from contractors** and from the **NRCan LEEP CBAT Cost Building Assessment Tool.**

See spread sheet file: ENBRIDGE INDIGENOUS EXISTING HOMES - ECMs

Utility Rate Assumptions: Gas - $0.231113 / Electricity - $0.139	ECM ENERGY CONSERVATION MEASURES-New Construction -Single *detached 1 story Approx. 1200sqft,OBC Zone 2, WWR 9.4%*											
Measure or Technology	Total Annual Gas Savings (M3)	Total Annual Gas Savings (MJ)	Total Annual Electricity Savings (kWh)	Total Annual Electricity Savings (MJ)	Total Annual Energy Savings (MJ)	Estimated GHG Emissions Savings (Tonnes/year)	Total Annual Utility Cost savings	Estimated RENOVATION Upgrade Cost	Estimated CBAT NEW CONSTRUCTION Upgrade Cost	Building Science Priority (Hot Priority / Medium Priority / Low Priority)	Tier 5 -NZReady applicable	House As A System / Building Science Notes
R40 to R60 attic	45.70	1736.6C	0.00	0.00	1700.00	0.09	$10.56	$1,600.00	$ 1,300.00			
R50 to R60 attic	15.00	570.00	0.00	0.00	550.00	0.03	$3.47	$1,300.00	$ 300.00	3	TIER 5	Limited energy savings above R50(attic). Some opportunity to increase air tightness during renovation/attic work.
R40 to R80 attic	68.50	2603.0C	0.00	0.00	2550.00	0.13	$15.83	$1,900.00	$ 2,100.00		TIER 5	
Air tightness 5 ACH50 to 0.6 ACH5C	160.50	6099.0C	0.00	0.00	5980.00	0.31	$37.09	$15,000.00	$ 7,000.00		TIER 5	Significant energy savings. Air tightness is required to limit interstitial condensation in highly insulated enclosures.
Air tightness 3 ACH50 to 1.5 ACH5C	143.30	5445.4C	0.00	0.00	5340.00	0.27	$33.12	$11,000.00	$ 1,500.00		TIER 5	Significant impact on heating and cooling loads.
Air tightness 3.5ACH50 to 0.6 ACH5C	89.70	3408.6C	0.00	0.00	3340.00	0.17	$20.73	TBD	$ 6,400.00	1	TIER 5	Increasing air tightness MUST be done in tandem with mechanical, balanced ventilation-e.g. HRV,ERV
Air tightness 3.5ACH50 to 1.5 ACH5C	72.50	2755.0C	0.00	0.00	2700.00	0.14	$16.76	TBD	$ 1,800.00		TIER 5	Increases occupant comfort-less drafts. Enables good IAQ-Can control interior environment
Air tightness with AEROBARRIER 5 ACH50 to 1.5 ACH50	143.30	5445.4C	0.00	0.00	5340.00	0.27	$33.12	$7,000.00	$ 4,000.00		TIER 5	
Air tightness with AEROBARRIER 3.5ACH50 to 1.5 ACH5C	72.50	2755.0C	0.00	0.00	2700.00	0.14	$16.76	$7,000.00	$ 4,000.00		TIER 5	
Above Grade Wall 2x6 16" oc R22 to 2x6 16" oc R22 +3)	183.80	6876.8C	0.00	0.00	6840.00	0.35	$42.43	$8,500.00	$ 1,700.00	2	TIER 5	Energy savings. Increases durability of wall by keeping structural cavity warm/dry(limiting dew point). Limits thermal bridging
Above Grade Wall 2x6 16" oc R22 to 2x6 16" oc R22 +3	113.00	4264.0C	0.00	0.00	4210.00	0.21	$26.12	$8,700.00	$ 1,300.00			Increased occupant comfort. Warmer walls/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces
Below Grade Wall R12 blanket to R20 Blanket	30.30	1133.4C	0.00	0.00	1120.00	0.06	$7.00	$1,300.00	$ 400.00	2		Energy savings. Increases durability of wall by keeping structural cavity warm/dry(limiting dew point). Limits thermal bridging
Below Grade Wall R12 batt 2x4 stud to 2x4 24"oc R22batt + R	76.90	2922.2C	0.00	0.00	2870.00	0.15	$17.77	$5,000.00	$ 3,000.00		TIER 5	Increased occupant comfort. Warmer walls/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces
No slab insulation to R10 Thermal break and underslab	2.80	106.40	0.00	0.00	110.00	0.01	$0.65	$1,500.00	$ 1,500.00	3	TIER 5	Limited energy savings -dependant on surface area of slab and basement vs above grade space ratio Significant impact on comfort. E.g. finished basements/living space.Warmer floors/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces Impact on health. Warmer slab surface decreases potential for condensation and "adsorbed" water in porous building materials. Can help with minimizing water vapor transfer and/or air leakage from below slab. Some synergies with radon remediation details.
Window 1.6u/.45 SHGC to 1.2u/.45 SHGI	91.00	3458.0C	0.00	0.00	3390.00	0.17	$21.03	$18,000.00	$ 3,500.00		TIER 5	Potential for significant energy savings depending on WWR window-to-wall ratio. Energy savings/electricity -related to reducing cooling loads(AC power) through low-E coating
Window 1.6u/.45 SHGC to 1.2u/.45 SHGI	59.00	2242.0C	0.00	0.00	2200.00	0.11	$13.64	$16,000.00	$ 3,500.00	2	TIER 5	Significant health impact. Lower U/better insulated windows reduce condensation potential. Allows occupants to maintain healthy ranges of relative humifty without condensation issue on windows(35%-45% winter)
Window 1.6u/.45 SHGC to 1.2u/.25 SHGC LOW SOLAR/2 COA	33.50	1273.0C	0.00	0.00	1250.00	0.06	$7.74	$18,300.00	$ 3,700.00		TIER 5	Significant comfort impact. Warmer glass-occupant experiences less heat loss through radation to cold surfaces. Reduction in convective "drafts" from cold air on glass. LOW SOLAR-2 COATS LOW E Significant energy savings/electricity -related to reducing cooling loads(AC power) by upwards of 40-50%
HWT 0.67 UEF to HWT tankless condensing 0.95 UEF	100.80	3830.4C	0.00	0.00	3760.00	0.19	$23.30	$2,800.00	$ 2,500.00	2	TIER 5	Energy savings / Occupant satisfaction more hot water / Health impact is significant condensing appliance with sealed intake and exhaust.
No DWHR to DWHR 42% 2 showers	0.00	0.00	402.90	1450.44	1450.00	0.02	$56.12	$850.00	$ 850.00	3	TIER 5	Energy savings / Occupant satisfaction-increased recovery rate for HW appliance e.g. more hot water.
No DWHR to DWHR 60% 2 showers	0.00	0.00	544.10	1958.76	1960.00	0.02	$75.79	$950.00	$ 950.00		TIER 5	
100% electric tank to HWT tankless condensing 0.95 UEF)	($34.80)	(1272.4G)	3361.3C	12100.68	($170.00)	(0.49)	$390.85	$2,800.00	$ 2,500.00	3	TIER 5	Operational cost savings / Occupant satisfaction- faster recovery rate e.g. more hot water.
DEB Base HRV 55% to HRV 75%	26.90	1022.20	0.00	0.00	1000.00	0.05	$6.22			1		Energy savings w/ heat recovery addition . Significant health impact: provide ventilation regardless of building pressure(balanced ventilation). Provides some ability to limit high interior relative humidity during winter months. Balanced mechanical ventilation is a requirment in all new housesing and in renovations wherein air tightness has been increased. e.g. New windows, air sealing, additional insulation, etc ERV: Will provide additional energy savings (vs HRV) for air conditioning. Occupant health & comfort-ERV better controls humidity during AC season . ERV may reduce over-drying of home during winter months.
Exhaust Vent 7/bath fans to HRV/ERV 40% with ECM motor	(3.20)	(171.60)	(66.10)	(236.36)	(340.00)	(0.01)	($9.13)				TIER 5	FOM Motors Will provide savings in Electricity in addition to gas use reduction
	0.00		0.00									
			0.00									
NO AC to 13.5 seer window-shaker	0.10	3.80	(1287.10)	(4613.56)	(4630.00)	(0.06)	($179.27)	$650.00	$ 650.00	3		
95% NG Furnace with PSC motor to 98% AFUE NG furnace with	0.00	0.00	0.00	0.00	0.00		$0.00	$3,900.00	$ 3,200.00			
GTG: Elec baseboard to 95% NG furnace w/ECM (Dual Fuel) an	(353.50)	(13433.00)	7189.5C	25887.20	12710.00	(0.36)	$919.80	$10,000.00	$ 12,000.00	2	TIER 5	
GTG: Elec baseboard to COMBO w/ TPT 90+ ASHP HSPF 8.E	(788.00)	(29944.00)	10877.2C	39157.92	9830.00	(1.03)	$1,333.08	$18,800.00	$ 10,000.00		TIER 5	
Standard Operating Conditions to Reduced Operating Conditio	(56.20)	(2135.60)	1164.3C	4191.48	2190.00	(0.06)	$149.20			1		Energy Star Appliances and ALL CFL or LED lighting in home

Conclusions & Observations

The accompanying document –**spread sheet file *"ENBRIDGE INDIGENOUS EXISTING HOMES – ECMs""*** should be referenced while considering these conclusion and observations.

The following recommendations are made within context of the Pan Canadian Efficiency framework which identifies the goal of ALL existing homes and buildings achieving aggressive energy reductions: e.g. net zero ready-like energy performance. More specifically, the proposed 2020 tiered energy code (part 9.36) has been used as a reference (see appendix A).

These recommendations are prioritized based on building science fundamentals. Therefore, prior to aggressive insulation measures, consideration should first be given to ventilation and air tightness. In addition, some mechanical upgrades related to space heating/cooling may be best prioritized AFTER upgrades to the enclosure are complete, thus enabling proper sizing of equipment & systems based on accurate heat loss/heat gain loads.

1. **Balanced ventilation with heat recovery HRV/ERV**
   Based on field observations and feedback, the current ventilation strategies are not adequate to enable further enclosure enhancements (e.g. adding more insulation, improving air tightness). Prior to applying further enclosure upgrades we would suggest the following:
   - Prioritize investment in mechanical ventilation systems e.g. HRV or ERV
   - Engage key stakeholders , through training, to understand why ventilation is critical to achieving further efficiency measures. This would include ventilation education: fresh air , humidity control, pollutant control, combustion air vs make up air , and more.
   - What products and installation techniques are available
   - Available control strategies and integration into existing HVAC systems
   - Proper use and maintenance of units by contractors and homeowners

   Note: Given the current pandemic and concerns related to maintaining healthy indoor environments, the focus on ventilation is far more critical.

2. **Air tightness**
   Air tightness of the enclosure will have a significant and meaningful impact on all existing homes:
   - Reduced potential for interstitial condensation inside highly insulated enclosures
   - Reduce space heating and space cooling loads
   - Enhanced control over interior conditions (always more difficult to control a sieve…)
   - Reduced operating costs related to energy use

   Making an existing home air tight has become more feasible as the industry becomes more aware of technologies and products that enhance the air barrier. E.g. Air tight window & door products, use of spray foam insulation (an air barrier at manufacturers specifications), proprietary aerosolized air sealing (AeroBarrier^{tm})

3. **Domestic Hot Water**
   Space conditioning loads continue to decrease as energy codes advance and retrofit programs move towards net zero energy. Contextually, the domestic hot water load of a typical home will soon surpass the energy load associated with space heating. There remains significant opportunity to elevate the hot water efficiency of existing homes through
   - Condensing type hot water devices
   - Drain water heat recovery combined with more efficient DHW devices
   - Providing direct vent /sealed vent appliances in existing homes,

4. **Windows**
   New window product with U values of 1.2U> and Low E coating options(SHGC .7 - .15>) may have a more significant impact on an existing home than would additional attic or wall insulation. In addition, high performance windows also:
   - Decrease condensation potential
   - Allow for higher RH, healthier levels of RH in the winter- 35% min
   - Increase comfort-Less radiant loss to cold surface
   - Lower Fuel use/Energy use
   - Significant reduction in AC loads (electrical)

5. **Below Grade**
   Basements are frequently used as living spaces. With below –grade heat loss representing 25% of the total structural loss for a typical home, investment in enhancing the below grade enclosure can benefit the home in many ways. Enhancing the performance of below grade living spaces for improved energy efficiency can also provide
   - Improved re-sale value of the home
   - Additional water and moisture control detailing

6. **Above grade walls**
   To further improve the performance of most existing homes , adding insulation to the above grade opaque assembly will have limited impact on energy reduction , reduced fuel use and better durability* UNLESS the insulation is
   - added to the exterior of the home in a continual layer(e.g. EIFS,)
   - added carefully to the existing interior wall using high R spray foam insulation or high density insulation materials

7. **Space Conditioning- Mechanicals**
   Replacement of space conditioning systems, primarily heating systems, with condensing –type equipment, does still provide some limited energy savings and reduced fuel consumption. However, due to the adoption of condensing type equipment in the building code during the early 1990's , and the impact of more recent energy efficiency retrofit programs , this ECM may have limited improvement on many existing homes.

   Given the significant impact enclosure efficiency, enhancements may have on the homes heating/cooling load, it is important for HVAC equipment upgrade to be consider future load profiles of the home. Over sized systems can lead to
   - Reduced efficiency of the system
   - Limited durability / life expectancy of equipment due to short cycling
   - Significant comfort issues and humidity control concerns due to short cycling

   Given the changing load profiles in homes that undergo energy efficiency upgrades, the societal goal of reducing carbon AND recognizing the future potential for standard air conditioning in homes, here are some opportunities to be considered:
   - Dual fuel heating and cooling systems –ducted ,air source heat pump combined with back up gas heating system. Includes efficient. High SEER AC capability.
   - Dual Fuel "Combo" tankless domestic hot water & space heating system. Combine with air source heat pump(AC)

**exception to this would be older, historical buildings wherein no insulation currently exists with the structure.*

ABOUT BUILDING KNOWLEDGE CANADA INC.

Building Knowledge Canada (BKC) originally began in 1986 as a division of Air Solutions, then incorporated independently in 2009. BKC is the largest residential energy evaluation / home performance company in Canada with over 43,000+ high performance home evaluations/ratings completed across Canada since its creation.

The firm specializes in practical building science for residential buildings/homes including energy modeling, enclosure and HVAC design and forensics, indoor air quality & thermal comfort design , air tightness testing & air barrier design and forensics, , HVAC residential commissioning,enclosure water management detailing & forensics; All with the clear goal of achieving energy efficieincy, envelope durability and occupant health and comfort.

Building Knowledge Canada is a leader in building performance strategies and an expert on the industry's cutting edge initiatives. BKC's credentials include qualifications in the following areas:

- Recognized Building Science Trainers: Natural Resources Canada
- High Performance Building Science Training for Builders, Trade Contractors, Architects, Sales-Marketing Teams, Real Estate Industry, Building Officials
- Building Science/Building Envelope Diagnostics & Testing
- Energy Software Modeling and Design Analysis including Hot 2000, Remrate, and Retscreen
- Building Code Compliance - NBC and OBC Energy Compliance: Performance/Prescriptive/Comparative
- Air Barrier/Tightness Detailing, Diagnostics and Evaluations
- CMHC Trained Indoor Air Quality Investigators: Training and Audits
- HVAC Design Review, System Diagnostics (HRAI Accredited Staff)
- NET ZERO Home Design Analysis, Modeling and Testing
- LEED
- ENERGY STAR®

BKC contributes its expertise in Building Science Training and Building Code Analysis for several industry partners including both Federal & Provinvial public institutions and private manufacturer's of construction material and HVAC equipment Currently BKC is providing Building Science/Energy Efficiency Training and Consultation for the following clients:

- CMHC Canadian Mortgage & Housing Corp
- CHBA Canadian Home Builders Assoc
- Natural Resources Canada
- NRCan LEEP Division
- ENBRIDGE EnerQuality Corporation
- Dupont / Dow
- Owens Corning
- Venmar VenEE
- Jeld-Wen

BKC team members have been instrumental in the development of numerous industry standards (NRC, CSA, etc.) and participate on various building code and advanced housing program committees :

CHBA Net Zero Council and Program Management Committee

R2000 Program Development Committee

ENERGY STAR® for New Homes Advisory Committee and TAC Committee Chair

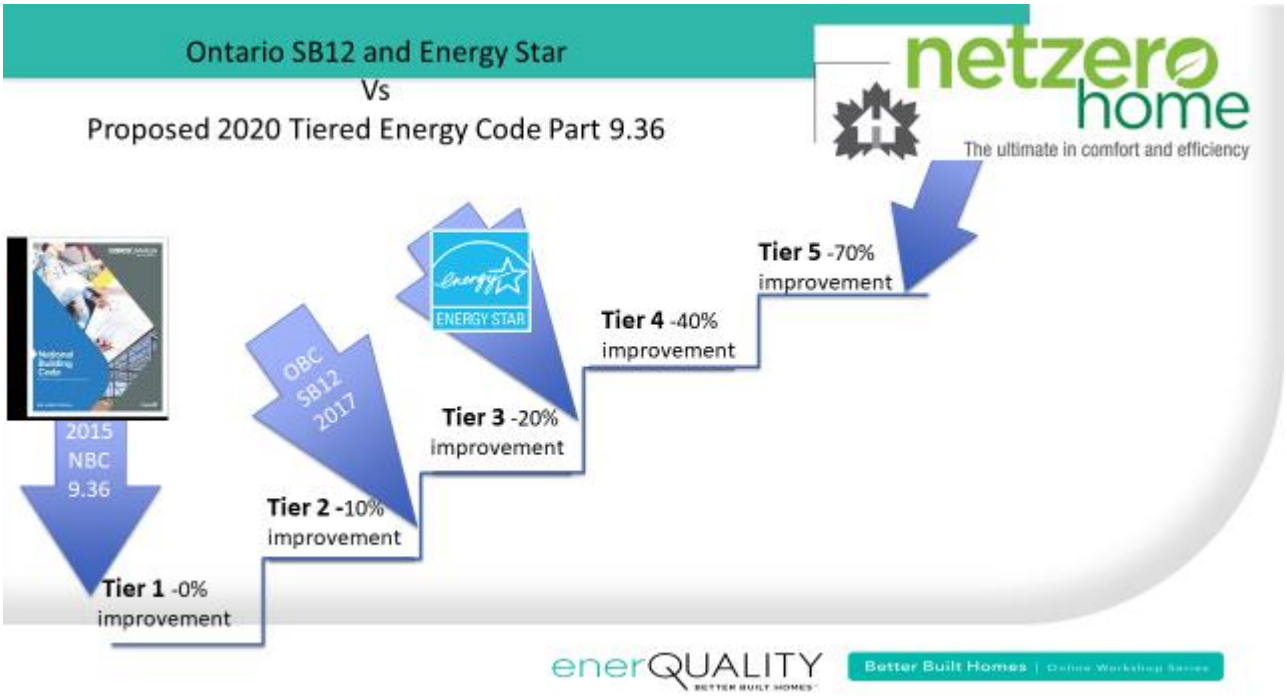
CSA F280 -2012 Development and Committee Chair

Ontario Building Code Part 9 2012 Advisory Committee, Part 7, 3 and 12 Review committees

LEED for Homes/Version 4 Technical Review Committee

BUILDING KNOWLEDGE CANADA INC.

APPENDIX A



Utility Rate Assumptions:	**Gas - $0.231113 / m3** **Electricity - $0.1393/KWh**	**ECM ENERGY CONSERVATION MEASURES-New Construction - Single *detached, Crawlspace, 1 story Approx. 1200sqft,OBC Zone 2, WWR 9.4%***										
Arch type details: **- Attic R50** **- AG Walls R19** **- Windows 1.8 SHGC 0.6**	**- Basements R0 / Floors R19** **- 5 ACH @ 50Pa** **- Space Heating Electric Baseboards** **- Water Heating Electric Tank**	**Total Annual Gas Savings (M3)**	**Total Annual Gas Savings (MJ)**	**Total Annual Electricity Savings (KWh)**	**Total Annual Electricity Savings (MJ)**	**Total Annual Energy Savings (MJ)**	**Estimated GHG Emissions Savings (Tonnes/year)**	**Total Annual Utility Cost savings**	**Estimated RENOVATION Upgrade Cost**	**Estimated CBAT NEW CONSTRUCTION Upgrade Cost**	**Building Science Priority** **High Priority** **Medium Priority** **Low Priority**	**Tier 5 -NZReady applicable**	**House As A System / Building Science Notes**
Measure or Technology													
R50 to R60 attic		0.00	0.00	185.90	669.24	670.00	0.01	$25.90	$1,300.00	$ 300.00	3	TIER 5	Limited energy savings above R50(attic). Some opportunity to increase air tightness during renovation/attic work.
R50 to R80 attic		0.00	0.00	360.00	1296.00	1300.00	0.02	$50.15	$1,900.00	$ 2,100.00		TIER 5	
Air tightness 5 ACH50 to 0.6 ACH50		0.00	0.00	875.70	3152.52	3150.00	0.04	$121.99	$15,000.00	$ 7,000.00	1	TIER 5	Significant energy savings. Air tightness is required to limit interstitial condensation in highly insulated enclosures.
Air tightness 5 ACH50 to 1.5 ACH50		0.00	0.00	794.70	2860.92	2860.00	0.04	$110.70	$11,000.00	$ 3,500.00		TIER 5	Significant impact on heating and cooling loads.
Air tightness with AEROBARRIER 5 ACH50 to 1.5 ACH50		0.00	0.00	794.70	2860.92	2860.00	0.04	$110.70	TBD	$ 6,400.00		TIER 5	Increaseing air tightness MUST be done in tandem with mechanical, balanced ventilation-e.g. HRV,ERV
												TIER 5	Increases occupant comfort-less drafts. Enables good IAQ-Can control interior environment
Above Grade Wall 2x6 16" oc R19 to 2x6 16" oc R22 +10		0.00	0.00	1599.10	5756.76	5760.00	0.07	$222.75	$8,500.00	$ 1,700.00	2	TIER 5	Energy savings. Increases durability of wall by keeping structural cavity warm/dry(limiting dew point). Limits thermal bridging
Above Grade Wall 2x6 16" oc R19 to 2x6 16" oc R22 +5		0.00	0.00	1090.60	3926.16	3930.00	0.05	$151.92	$8,200.00	$ 1,300.00			Increased occupant comfort. Warmer walls/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces
Below Grade Wall R0 to R20 Blanket		0.00	0.00	2141.60	7709.76	7710.00	0.09	$298.32	$1,300.00	$ 400.00	2		Energy savings. Increases durability of wall by keeping structural cavity warm/dry(limiting dew point). Limits thermal bridging
Below Grade Wall R0 to 2x4 24"oc R22batt + R10ci		0.00	0.00	2149.30	7737.48	7740.00	0.09	$299.40	$5,000.00	$ 3,000.00		TIER 5	Increased occupant comfort. Warmer walls/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces
No slab insulation to R10 Thermal break and underslab		0.00	0.00	21.00	75.60	80.00	0.00	$2.93	$1,500.00	$ 1,500.00	3	TIER 5	Limited energy savings -dependant on surface area of slab and basemnt vs above grade space ratio
													Significant impact on comfort . E.g. finished basements/living space.Warmer floors/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces
													Impact on health. Warmer slab surface decreases potential for condensation and "adsorbed" water in porous building materials. Can help with minimizing water vapor transfer and/or air leakage from below slab.
													Some synergies with radon remediation details.
Window 1.8u/.60 SHGC to 1.2u/.45 SHGC		0.00	0.00	391.80	1410.48	1410.00	0.02	$54.58	$18,000.00	$ 3,500.00	2	TIER 5	Potential for significant energy savings depending on WWR window-to-wall ratio. Energy savings/electricity -related to reducing cooling loads(AC power) through lowE coating
Window 1.8u/.60 SHGC to 1.4u/.45 SHGC		0.00	0.00	179.60	646.56	650.00	0.01	$25.02	$17,000.00	$ 3,500.00		TIER 5	Significant health impact. Lower U/better insulated windows reduce condensation potential. Allows occupants to maintain healthy ranges of relative humifity withour condensation issue on windows(35%-45% winter)
Window 1.8u/.60 SHGC to 1.2u/.21 SHGC LOW SOLAR/2 COATS LOWE		0.00	0.00	31.30	112.68	110.00	0.00	$4.36	$18,300.00	$ 3,700.00		TIER 5	Significant comfort impact. Warmer glass-occupant experiences less heat loss through radation to cold surfaces. Reduction in convective "drafts" from cold air on glass.
													LOW SOLAR-2 COATS LOW E Significant energy savings/electricity -related to reducing cooling loads(AC power) by upwards of 40-50%
No DWHR to DWHR 42% 2 showers		0.00	0.00	402.80	1450.08	1450.00	0.02	$56.11	$850.00	$ 850.00	3	TIER 5	Energy savings / Occupant satisfaction-increased recovery rate for HW applaince e.g. more hot water.
No DWHR to DWHR 60% 2 showers		0.00	0.00	544.00	1958.40	1960.00	0.02	$75.78	$950.00	$ 950.00		TIER 5	
100% electric tank to HWT tankless condensing 0.95 UEF)		(334.80)	(12722.40)	3534.30	12723.48	250.00	(0.48)	$414.95	$2,800.00	$ 2,500.00	3	TIER 5	Operational cost savings / Occupant satisfaction- faster recovery rate e.g. more hot water/Health impact is significant-condensing appliance with sealed intake and exhaust.
Exhaust Vent w/bath fans to HRV 75%		0.00	0.00	854.20	3075.12	3070.00	0.04	$118.99	$2,000.00	$ 1,900.00	1	TIER 5	(Note: A modified calculation was use to model the primary bath fan to give a more realiztic represent the energy consumption of the bathfans and the building science that is involved with the exhaust only ventilation.)
Exhaust Vent w/bath fans to ERV 65 %		0.00	0.00	755.50	2719.80	2720.00	0.03	$105.24	$2,300.00	$ 2,300.00		TIER 5	
Exhaust Vent w/bath fans to OEB Base HRV 55%		0.00	0.00	636.70	2292.12	2290.00	0.03	$88.69	$2,000.00	na			Energy savings w/ heat recovery addition . Signficant health impact: provide ventilation regardless of building pressures(balanced ventilation). Provides some ability to limit high interior relative humidity during winter months.
Exhaust Vent w/bath fans to HRV/ERV 80% with ECM motors		0.00	0.00	966.10	3477.96	3480.00	0.04	$134.58	$3,000.00	na		TIER 5	Balanced mechancial ventialtion is a requirment in all new houseing and in renovations wherein air tightness has been increased. e.g. New windows, air sealing, addtional insulation, etc
													ECM Motors: Will provide savings in Electrictiy in addition to gas use reduction
NO AC to 13.5 seer window-shaker		0.00	0.00	(1330.50)	(4789.80)	(4790.00)	(0.06)	($185.34)	$650.00	$ 650.00	3		
HTG: Elec baseboard to 98% AFUE NG furnace with ECM motor		(1091.20)	(41465.60)	11293.10	40655.16	0.00	(1.58)	$1,320.94	$3,900.00	$ 1,200.00			
HTG: Elec baseboard to 95% NG furnace w/ECM (Dual Fuel) and ASHP HSPF 8.6		(404.70)	(15378.60)	8521.50	30677.40	15600.00	(0.39)	$1,093.51	$10,000.00	$ 12,000.00	2	TIER 5	
HTG: Elec baseboard to COMBO w/ TPF .90+ ASHP HSPF 8.6		(835.70)	(31756.60)	11935.90	42969.24	11830.00	(1.06)	$1,469.53	$18,800.00	$ 19,000.00		TIER 5	
Standard Operating Conditions to Reduced Operating Conditions		0.00	0.00	752.00	2707.20	2710.00	0.03	$104.75			3		Energy Star Appliances and ALL CFL or LED lighting in home

Utility Rate Assumptions:	Gas - $0.231113 / m3 Electricity - $0.1393/KWh	ECM ENERGY CONSERVATION MEASURES-New Construction - Single *detached, Crawlspace, 1 story Approx. 1200sqft,OBC Zone 2, WWR 9.4%*										
Arch type details: - Attic R50 - AG Walls R20 - Windows 1.8 SHGC 0.45	- Basements R20 / Floors R20 - 3 ACH @ 50Pa - Space Heating 94% AFUE - Water Heating Electric Tank	Total Annual Gas Savings (M3)	Total Annual Gas Savings (MJ)	Total Annual Electricity Savings (KWh)	Total Annual Electricity Savings (MJ)	Total Annual Energy Savings (MJ)	Estimated GHG Emissions Savings (Tonnes/year)	Total Annual Utility Cost savings	Estimated RENOVATION Upgrade Cost	Estimated CBAT NEW CONSTRUCTION Upgrade Cost	Building Science Priority High Priority Medium Priority Low Priority	Tier 5 -NZReady applicable	House As A System / Building Science Notes
Measure or Technology													
R50 to R60 attic		18.40	699.20	3.50	12.60	690.00	0.04	$4.74	$1,300.00	$ 300.00	3	TIER 5	Limited energy savings above R50(attic). Some opportunity to increase air tightness during renovation/attic work.
R50 to R80 attic		35.50	1349.00	6.80	24.48	1340.00	0.07	$9.15	$1,900.00	$ 2,100.00		TIER 5	
Air tightness 3. ACH50 to 0.6 ACH50		34.30	1303.40	6.60	23.76	1300.00	0.06	$8.85	TBD	$ 6,400.00	1	TIER 5	Significant energy savings. Air tightness is required to limit interstitial condensation in highly insulated enclosures.
Air tightness 3 ACH50 to 1.5 ACH50		26.30	999.40	5.00	18.00	1000.00	0.05	$6.77	TBD	$ 1,800.00		TIER 5	Significant impact on heating and cooling loads.
Air tightness with AEROBARRIER 3 ACH50 to 1.5 ACH50		26.30	999.40	5.00	18.00	1000.00	0.05	$6.77	$7,000.00	$ 4,000.00		TIER 5	Increaseing air tightness MUST be done in tandem with mechanical, balanced ventilation-e.g. HRV,ERV
												TIER 5	Increases occupant comfort-less drafts. Enables good IAQ-Can control interior environment
Above Grade Wall 2x6 16" oc R20 to 2x6 16" oc R22 +10		162.90	6190.20	31.40	113.04	6180.00	0.31	$42.02	$8,500.00	$ 1,700.00	2	TIER 5	Energy savings. Increases durability of wall by keeping structural cavity warm/dry(limiting dew point). Limits thermal bridging
Above Grade Wall 2x6 16" oc R20 to 2x6 16" oc R22 +5		113.10	4297.80	21.80	78.48	4290.00	0.22	$29.18	$8,200.00	$ 1,300.00			Increased occupant comfort. Warmer walls/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces
Below Grade Wall R20 to 2x4 24"oc R22batt + R10ci		0.80	30.40	0.10	0.36	30.00	0.00	$0.20	$5,000.00	$ 3,000.00	2	TIER 5	Increased occupant comfort. Warmer walls/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces
No slab insulation to R10 Thermal break and underslab		3.80	144.40	0.70	2.52	140.00	0.01	$0.98	$1,500.00	$ 1,500.00	3	TIER 5	Limited energy savings -dependant on surface area of slab and basemnt vs above grade space ratio Significant impact on comfort . E.g. finished basements/living space.Warmer floors/less cold spots result in better comfort e.g. occupant experiences less heat loss through radation to cold surfaces Impact on health. Warmer slab surface decreases potential for condensation and "adsorbed" water in porous building materials. Can help with minimizing water vapor transfer and/or air leakage from below slab. Some synergies with radon remediation details.
Window 1.8u/.45 SHGC to 1.2u/.45 SHGC		82.20	3123.60	15.80	56.88	3110.00	0.16	$21.20	$18,000.00	$ 3,500.00	2	TIER 5	Potential for significant energy savings depending on WWR window-to-wall ratio. Energy savings/electricity -related to reducing cooling loads(AC power) through lowE coating
Window 1.8u/.45 SHGC to 1.4u/.45 SHGC		61.80	2348.40	11.90	42.84	2340.00	0.12	$15.94	$17,000.00	$ 3,500.00		TIER 5	Significant health impact. Lower U/better insulated windows reduce condensation potential. Allows occupants to maintain healthy ranges of relative humifity withour condensation issue on windows{35%-45% winter)
Window 1.8u/.45 SHGC to 1.2u/.21 SHGC LOW SOLAR/2 COATS LOWE		49.10	1865.80	9.40	33.84	1860.00	0.09	$12.66	$18,300.00	$ 3,700.00		TIER 5	Significant comfort impact. Warmer glass-occupant experiences less heat loss through radation to cold surfaces. Reduction in convective "drafts" from cold air on glass. LOW SOLAR-2 COATS LOW E Significant energy savings/electricity -related to reducing cooling loads(AC power) by upwards of 40-50%
No DWHR to DWHR 42% 2 showers		0.00	0.00	402.80	1450.08	1450.00	0.02	$56.11	$850.00	$ 850.00	3	TIER 5	Energy savings / Occupant satisfaction-increased recovery rate for HW applaince e.g. more hot water.
No DWHR to DWHR 60% 2 showers		0.00	0.00	544.00	1958.40	1950.00	0.02	$75.78	$950.00	$ 950.00		TIER 5	
100% electric tank to HWT tankless condensing 0.95 UEF)		(359.60)	(13664.80)	3785.70	13628.52	220.00	(0.52)	$444.24	$2,800.00	$ 2,500.00	3	TIER 5	Operational cost savings / Occupant satisfaction- faster recovery rate e.g. more hot water/Health impact is significant-condensing appliance with sealed intake and exhaust.
Exhaust Vent w/bath fans to HRV 75%		83.60	3176.80	16.10	57.96	3170.00	0.16	$21.56	$2,000.00	$ 1,900.00	1	TIER 5	(Note: A modified calculation was use to model the primary bath fan to give a more realiztic represent the energy consumption of the bathfans and the building science that is involved with the exhaust only ventilation.)
Exhaust Vent w/bath fans to ERV 65 %		72.00	2736.00	13.90	50.04	2730.00	0.14	$18.58	$2,300.00	$ 2,300.00		TIER 5	
Exhaust Vent w/bath fans to OEB Base HRV 55%		62.40	2371.20	12.00	43.20	2360.00	0.12	$16.09	$2,000.00	na			Energy savings w/ heat recovery addition . Signficant health impact: provide ventilation regardless of building pressures(balanced ventilation). Provides some ability to limit high interior relative humidity during winter months.
Exhaust Vent w/bath fans to HRV/ERV 80% with ECM motors		86.40	3283.20	91.10	327.96	3540.00	0.17	$32.66	$3,000.00	na		TIER 5	Balanced mechancial ventialtion is a requirment in all new houseing and in renovations wherein air tightness has been increased. e.g. New windows, air sealing, addtional insulation, etc ECM Motors: Will provide savings in Electrictiy in addition to gas use reduction
NO AC to 13.5 seer window-shaker		0.10	3.80	(1279.40)	(4605.84)	(4610.00)	(0.06)	($178.20)	$650.00	$ 650.00	3		
HTG: 94% AFUE to 98% AFUE NG furnace with ECM motor		22.10	839.80	138.40	498.24	1320.00	0.05	$24.39	$3,900.00	$ 1,200.00	2		
HTG: 94% AFUE to 95% NG furnace w/ECM (Dual Fuel) and ASHP HSPF 8.6		562.70	21382.60	(2052.80)	(7390.08)	13570.00	0.98	($155.91)	$10,000.00	$ 12,000.00		TIER 5	
HTG: 94% AFUE to COMBO w/ TPF .90+ ASHP HSPF 8.6		114.50	4351.00	1833.80	6601.68	10860.00	0.30	$281.91	$18,800.00	$ 19,000.00		TIER 5	
Standard Operating Conditions to Reduced Operating Conditions		(40.00)	(1520.00)	1156.50	4163.40	2670.00	(0.02)	$151.86			3		Energy Star Appliances and ALL CFL or LED lighting in home

ENBRIDGE GAS INC.

Undertaking Response to OEB Staff

Undertaking

Tr: 64

Enbridge to propose or provide a weighted average measure life for its portfolio for the pending term from 2023-2027; a threshold which the company should keep the portfolio above.

Response:

While Enbridge Gas will maintain appropriate flexibility, within the parameters outlined in the proposed DSM Framework and the Company's DSM plan proposal, to shift resources between programs and program offerings to effectively pursue results and maximize gas savings opportunities, Enbridge Gas commits to exercise this flexibility in a way that aims to maintain a minimum threshold portfolio weighted average measure life (WAML).

The forecast portfolio weighted average measure life (WAML) of Enbridge Gas's plan for the 2023 program year is 16.4 years[1] on a net basis.

In conjunction with the Company's DSM plan proposal which assesses results for most programs based on annual net gas savings metrics, Enbridge Gas proposes it will operate its portfolio with the goal of maintaining a minimum WAML threshold (minimum WAML threshold) of 13.12 years[1] (i.e. not more than 20% below the annual DSM plan forecast WAML) based on portfolio level annual net gas savings, with the following provisions:

i. The portfolio WAML will be calculated as the sum of a program year's cumulative net gas savings divided by the sum of that program year's net annual gas savings.
ii. The portfolio WAML calculation will exclude the Large Volume program results due to the self-direct design of the program which limits the ability of the utility to prioritize longer measure life projects with this customer group.
iii. The WAML calculation and the minimum WAML threshold will be subject to adjustments to account for changes in measure life assumptions outside of the utilities control, i.e. updates to TRM measure lives and the Custom Measure Life table as may be revised as part of the annual TRM review process.

[1] This value is based on the specific program and target proposals outlined by Enbridge Gas in its 2023-2027 DSM plan application, any changes proposed to this program and target composition will require a recalculation of the WAML and minimum WAML threshold upon which this guidance is proposed by the Company.

ENBRIDGE GAS INC.

Undertaking Response to OEB Staff

Undertaking

Tr: 66

Enbridge to update Attachment 2 to STAFF 24 to include the posterity mirror model scenario a results for all sectors from 2023 to 2027.

Response:

Please see Attachment 1 for updates to table as requested.

Additionally for further context relating to the challenges faced in developing the Mirror Model, why the outputs do not reflect an alternative version of the 2019 APS, and therefore why there is no substantive value in performing any comparisons to the Mirror Model, please see response to Exhibit JT1.2.

ENBRIDGE GAS INC.

Undertaking Response to OEB Staff

Attachment 1 has been provided in excel.

ENBRIDGE GAS INC.

Undertaking Response to OEB Staff

Undertaking

Tr: 69

Enbridge to provide a list of transition guidance required from the OEB in order to transition from its legacy plans to its new integrated plan beginning in 2023.

Response:

Enbridge Gas is confident its DSM application appropriately and comprehensively reflects the OEB's December 1st DSM letter both in terms of reflecting the overall objectives of DSM and further, in responding to specific goals communicated by the OEB with regard to considerations for programming, prioritizing of particular customer groups and highlighted areas of focus in program delivery.

Enbridge Gas expects however that the specific details and considerations to be addressed in terms of transition guidance sought from the OEB in order for the Company to transition from 2022 legacy plans to a single integrated 2023-2027 Multi-Year DSM Plan effective January 1, 2023 will depend very much on the OEB's ultimate decision on Enbridge Gas's DSM application, including both the proposed DSM Framework and the DSM plan proposal. The more the OEB's decision reflects components (new or alternative) that differ from the application put forth by the Company, and the magnitude of these differences, the more time, planning and transition considerations may be necessary to ensure Enbridge Gas can be prepared to effectively deliver a full complement of DSM programming in the next calendar year.

Most notably, without a clear indication on the OEB's desired total budget envelope, the Company is challenged to predict the impact to the DSM application as proposed and the possible need for significant updates to the DSM plan which may also necessitate additional transition considerations commensurate with ramp up expectations.

Assuming the OEB approves a DSM Framework and DSM Plan that is not fundamentally or structurally different, and with overall budgets and distribution to the sectors similar to that originally proposed, Enbridge Gas does believe there is value in taking actions in advance of 2023 in order to allow for the best outcomes for both ratepayers and the Company. The following paragraphs, as provided in the interrogatory response to Exhibit I.50.EGI.PP.50 address consideration of transition elements:

Enbridge Gas notes that a significant portion of the proposed program portfolio for 2023 consists of fully integrated versions of existing programming. The 2015-2020 Framework and legacy utility DSM Plans have reasonable provisions that offer flexibility to operate and can accommodate continuity planning for these programs within the budgetary boundaries afforded by the OEB approval for 2022. Enbridge Gas notes that 2023, the proposed base year of the term, has a material budget increase from 2022 approved budgetary levels, and includes a number of new programs and also incremental resources that are required to be in place in order to achieve the performance levels and targets being proposed. Assuming that a final decision by the OEB meets the requested date of August 2022, Enbridge Gas believes that having clear guidance from the OEB on the transitional elements from historical framework and DSM Plans to a new framework and DSM Plan is crucial to support delivery of the goals and objectives for the term.

This should include specific guidance on incremental budgetary amounts, if any, that can be utilized in 2022 to support results for the 2023-2027 term, presumably through accessing of the DSMVA for this purpose. This should also include clear indication of allowable usage of the 2022 budget envelope net new or incremental program activities. Specifically, once approved, the OEB may wish to signal that existing 2022 budgets can be utilized to ramp up the Building Beyond Code program, since some of the existing new construction programming will no longer be offered, thus transitioning of the existing budget could provide continuity of support to the building community. Similarly, once approved, the Low Carbon Transition program would benefit from some budgetary allowance to ramp up the program activities contemplated.

The Company notes that ramp up activities would not be expected to have a large impact on budgets since there would only be 4 months to both plan and execute any activities. Additionally, budget may be available to be transferred from activities that are already wound down or in the process of being wound down, so any impacts on ratepayers would likely be small. Enbridge Gas requests that the OEB be explicit in the decision on expectations for 2022, as clear expectations will allow for a more seamless 2022 DSM clearance proceeding.

ENBRIDGE GAS INC.

Undertaking Response to Small Business Utility Alliance (SBUA)

Undertaking

Tr: 88

To confirm (a) whether if a small business customer is effectively using residential scale equipment, do they have access to any sort of rebates or incentives; to the extent that a customer, a commercial customer is not eligible for the rebate for residential-size equipment, please explain why that is the case, what Enbridge's rationale was in determining that eligibility criterion.

Response:

Eligibility in the Residential program is based on the type of account held with Enbridge Gas as well as the type of dwelling. If for example a yoga studio or other small business is operating out of a home in the residential account class, it would be eligible to participate in the Smart Home, Whole Home or Single Measure offering where the offering criteria is met.

If the Enbridge Gas account is identified as a commercial account, the facility would not qualify for the Residential program. They would however qualify for the following commercial program offerings.

Measure	Residential Offerings	Commercial Offerings	Notes
Attic Insulation	Whole Home Single measure	Custom	Enbridge Gas supports this measure through the custom offering when it is part of a major renovation, which is when the measure is most likely to be cost effective. As standalone projects, Enbridge Gas's Custom offering supports flat roof insulation projects. It does not support attic insulation in cases where a commercial customer has a cathedral roof because of their low prevalence.

Exterior Wall Insulation	Whole Home Single measure	Custom	Enbridge Gas supports this measure through the custom offering when it is part of a major renovation, which is when the measure is most likely to be cost effective.
Basement wall insulation	Whole Home Single measure	Custom	Enbridge Gas supports this measure through the custom offering when it is part of a major renovation, which is when the measure is most likely to be cost effective.
Professional air sealing	Whole Home Single Measure	N/A (existing building) Air Tightness Testing (for new construction)	Enbridge Gas does not offer an incentive for professional air sealing for existing commercial customers. This is because Enbridge Gas has placed its initial focus on launching a standalone residential offer. Lessons learned from the residential offer will inform a potential expansion to commercial customers. Commercial and multi-residential projects built to OBC part 3, 10 or 11 will have access to incentives for air tightness testing and air sealing.
Condensing boiler	Whole Home	Custom	Several small commercial customers benefit from boiler incentives through the Custom Commercial offering each year. This includes residential scale boilers.
Furnace	Whole Home	N/A	With condensing furnaces now code at 95% AFUE, there is limited opportunity for savings as a stand-alone measure. As a result, furnaces were discontinued from the Commercial Prescriptive offer at the end of 2019. For the Whole Home offer, furnace rebates function to attract participation and influence the adoption of other measures.

ENERGY STAR® qualified Water Heater (tank type/tankless)	Whole Home	Midstream (tankless only)	The Prescriptive Midstream offer includes residential-sized water heaters.
Adaptive Thermostats	Smart Home	Custom	To expand the uptake of this measure, Enbridge Gas is researching ways to simplify savings calculations associated with adaptive thermostats in commercial properties so that they can be deployed through other offers such as Prescriptive and Direct Install.

ENBRIDGE GAS INC.

Undertaking Response to Small Business Utility Alliance (SBUA)

Undertaking

Tr: 100

For each residential measure that is available in Enbridge's plan, whether it is also available to commercial customers.

Response:

Please see the Undertaking Response at Exhibit JT2.8.

ENBRIDGE GAS INC.

Undertaking Response to OEB Staff

Undertaking

Tr: 106

Enbridge will make best efforts to provide a high-level response to the program recommendations that have been made and I want to be clear as to what portions of those reports the company will be responding to. And that include Optimal's Exhibit L Staff 2 Report at pages 36 through 38, the SBUA executive summary, which is at pages 1 and 2, and the EFG report at page 36 which is section 1 (the portfolio and program design summary of key points, the five bullets.)

Response:

Evidence	Referenced Page	Topic/Sector/ Program	Expert's Recommendation	Enbridge Gas Response
SBUA - Green Energy Economics Group	Page 1	Commercial - Small Business	1. Offer a wider array of measures and provide as streamlined a way as possible for small business customers to access them.	This recommendation is in line with Enbridge Gas's objective to provide DSM participation opportunities for all customers including ensuring small commercial customers are appropriately served.
SBUA - Green Energy Economics Group	Page 1	Commercial - Direct Install/Custom	2. Follow Massachusetts' lead by offering a "turnkey" pathway for small business customers to seamlessly participate in a direct install program followed up by a custom measure package.	Yes, Enbridge Gas intends to offer a turnkey pathway as outlined in Exhibit E, Tab 1, Schedule 4, page 22, "To facilitate this turnkey solution, Enbridge Gas equips contracted service providers with the training and sales support tools to identify, qualify, quote, and install eligible measures." Additionally, Enbridge Gas is open to exploring opportunities to integrate custom measures into the Direct Install offering.

SBUA - Green Energy Economics Group	Page 1	Commercial - Prescriptive	3. Prescriptive Programs a. Offer all typically cost-effective measures as prescriptive measures, with incentives that cover most of the incremental measure costs, including residential type equipment.	Not all cost-effective measures lend themselves well to being offered as a prescriptive measure, as some measures are a lot more customized and require more site-specific inputs to properly estimate gas savings than others. Furthermore, Enbridge Gas maintains different incentive level coverage of incremental costs within the Prescriptive and Direct Install offers based on the different type of customers whom these programs target.
SBUA - Green Energy Economics Group	Page 1	Commercial - Direct Install	4. Direct Install a. Allow small businesses to participate in DSM programs more than once. Do not limit participation in DSM programs if previously participated in a DSM program. b. Include additional direct install measures such as adaptive thermostats, boiler tune-ups, and water heating measures.	a) Enbridge Gas's approach on the current program, taking into consideration budgetary constraints, was to ensure that the maximum number of unique participants could participate in Direct Install but not limit participation in other prescriptive/custom programming opportunities. b) Enbridge Gas is open to introducing additional measures to the Direct Install offering including adaptive thermostats, boiler-tune-ups, and water heating measures, provided they prove to be cost-effective.

SBUA - Green Energy Economics Group	Page 1-2	Commercial - Custom	5. Custom Program a. Create a comprehensive custom program component tailored for small businesses that is fed in from the Direct Install program. b. Offer an assessment to identify all cost-effect efficiency measures for a building. c. Provide incentives for all the identified efficiency measures that cover most of the incremental measure costs.	a) Custom programs are typically more time and resource intensive, and therefore would not represent an effective approach at engaging a large proportion of the vast small business sector. b) An assessment could be offered to support small businesses; however, it would come at a significant cost relative to potential savings. c) Project implementation costs do not necessarily align with potential gas savings. Therefore, to optimize results, savings relative to project cost are considered in prioritizing measures where a more significant proportion of incentives is offered. In a non-budget constrained scenario, Enbridge Gas could support this recommendation, however given the proposed budget, Enbridge Gas believes it has appropriately prioritized the budgets and respective target audiences of its current program mix to optimize program reach and results.
SBUA - Green Energy Economics Group	Page 2	Coordination with External Parties	6. Coordinate with IESO CDM when performing energy assessments for commercial buildings to treat the building as a whole and identify natural gas and electric savings opportunities at the same time.	Enbridge Gas maintains regular communication with the IESO who are tasked with delivering electricity CDM programming in Ontario. In an effort to leverage collaborative opportunities, both the IESO and Enbridge Gas are committed to coordinating the delivery of DSM programs with electricity CDM programs where appropriate.
SBUA - Green Energy Economics Group	Page 2	Commercial - Indigenous Support	7. Designing efficiency programs that focus on small businesses will also help indigenous businesses.	Enbridge Gas agrees with this statement.

SBUA - Green Energy Economics Group	Page 2	Low Carbon Transition	10. Promote a fuel-neutral approach in the Low Carbon Transition Program that includes electric technologies and maximizes carbon reductions.	Enbridge Gas believes that its Low Carbon Transition Program provides a fuel-neutral approach to supporting the ongoing evolution of energy efficiency for customers as evidenced by the program's inclusion and support of projects encompassing both electric air source heat pumps and gas heat pumps. In either case, given the OEB's stated primary objective for DSM - "assisting customers in making their homes and businesses more efficient in order to help better manage their energy bills," to be eligible for DSM programming, participants must be Enbridge Gas customers and therefore by definition use natural gas in their homes or businesses.
SBUA - Green Energy Economics Group	Page 2		11. Provide annual reporting on small business DSM spending, participation, and natural gas savings.	Enbridge Gas can commit to providing annual reporting on spending, savings, and participation for the small volume customer metric, of which small business should be a major segment. To provide similar reporting for small business specifically, Enbridge Gas would need a better understanding of what other factors need to be considered in defining small businesses, and then determine what it can provide with its available data.
OEB Staff2/Optimal Energy	Page 54 of the PDF Doc	Residential	1. Coordinate delivery of the gas program with the equivalent electric utility program.	Enbridge Gas maintains regular communication with the IESO who are tasked with delivering electricity CDM programming in Ontario (not the electric utilities). In an effort to leverage collaborative opportunities, both the IESO and Enbridge Gas are committed to coordinating the delivery of DSM programs with electricity CDM programs where appropriate.

OEB Staff2/Optimal Energy	Page 54 of the PDF Doc	Residential	2. Ensure that expenses related to home audits are completely covered by the program (as opposed to paid by the customer and rebated).	From 2012-2016, Enbridge Gas paid a portion of the audit costs upfront. Based on feedback from Service Organizations the upfront cost of the assessment with reimbursement after the program process did not represent a barrier where the rebate payment was made on a timely, known basis. When compared to the relative trade off of fixed costs that may not result in an energy savings where a participant does not proceed with the offer and the administrative requirements of managing an upfront payment process it was decided to not pursue this approach. Instead, funding is focused on those participants who complete upgrades, and in so doing motivates follow through on the opportunities identified in the energy assessment to be eligible for the rebate.
OEB Staff2/Optimal Energy	Page 54 of the PDF Doc	Residential	3. Lower the barriers of participation in the whole home program by training a set of qualified contractors who offer standardized pricing.	Enbridge Gas does not feel it is appropriate for the utility to dictate pricing for a competitively procured service delivered by third parties. The potential variation of travel, labour, and installation costs by region due to the very large and diverse geography covered by Enbridge Gas does not make this a practical exercise. Enbridge Gas will continue to broaden and enhance relationships with contractors over the term of the Plan, with the intent to further engage and educate this market as well as, provide additional support and connect customers to reputable contractors.

OEB Staff2/Optimal Energy	Page 54 of the PDF Doc	Residential	4. Offer incentives for pre-weatherization barriers and health and safety.	Enbridge Gas does not support incentives for pre-weatherization costs noted in the report for the Residential program. Available funding for incentives should continue to be directed to energy saving upgrades. The ability to address pre weatherization items has not been a common barrier identified for the Residential program historically. Support for select pre-weatherization items such as mold testing and hoarding situations is provided through the Home Winterproofing offering in the Low Income program. These have been observed barriers limiting the ability to participate in DSM that low income energy consumers often do not have the means to remedy without support.
OEB Staff2/Optimal Energy	Page 54 of the PDF Doc	Residential	5. Eliminate furnaces and boilers completely as offered measures, as they are now code baseline, and any promotion through the program creates a lost opportunity for electrification.	The goal of the Whole Home offering, which should not be lost, is not the replacement of a furnace or boiler in isolation but rather the implementation of the other multiple measures (a minimum of two, or three energy efficiency measures in cases where a furnace is installed) that the whole home approach is seeking to promote. HVAC contractors have and continue to be a lead generation source for Whole Home offering program participation as gas fired equipment is a visible point of gas consumption in homes with defined replacement decisions unlike building envelope upgrades where opportunities are less obvious. These measures have importance and visibility to the homeowner and provide an opportunity to promote the value of the home energy assessment and other

				envelope upgrades in the home. In these cases, the customer's interest in a measure which may on its own not be cost-effective is the key to persuading the customer to install a package of measures that are cost-effective in aggregate. This leads to greater overall benefits through the execution of the building envelope improvements. Enbridge Gas has been reducing the value of the furnace and boiler incentive, recognizing the changing code requirements and will continue to monitor the effectiveness of it as a lead generator for this program.
OEB Staff2/Optimal Energy	Page 54 of the PDF Doc	Residential	6. Consider offering 0% financing for weatherization and pre-weatherization measures.	The OEB Decision and Order in EB-2015-0029/EB-2015-0049 determined that the OEB did not view access to financing as a critical deterrent to customers participating in conservation programs and the Company should not assume the role of providing financing to their customers. Additionally, there are multiple financing options available in Ontario for energy conservation, so Enbridge Gas has not proposed any financing options as part of the DSM program.
OEB Staff2/Optimal Energy	Page 54 of the PDF Doc	Residential & Multi-Family	7. Ensure that multi-family buildings and renters/landlords are adequately covered by targeted messaging and participation pathways, and integrating residential and commercial and industrial (C&I) offerings with a one-stop-shopping experience.	As a result of shared spaces, centralized systems, and flow of air between units, efficiency measures addressing multi-family buildings need to be looked at holistically. To ensure a one-stop shopping experience for multi-family buildings, Enbridge Gas relies on its ESAs to work with property management firms of large multi-family buildings to support them in identifying and implementing relevant in-suite and common area measures. Enbridge Gas also works through the

				service providers of multi-family buildings as a pathway to participation by influencing service provider recommendations.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Residential	8. Proactively coordinate with other funding sources such as government or nonprofit programs to offer enhanced incentives where possible.	Enbridge Gas is actively coordinating its DSM programs with other funding sources as evidenced by the collaboration with IESO and the discussions with NRCan and will continue to proactively engage in this area. The resulting offer approach would be based on the consultation between the parties.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Residential	9. Perform direct installation of low-cost measures such as aerators, showerheads, smart thermostats, and pipe insulation during the initial energy assessment.	Enbridge Gas does not support aerators, showerheads, or pipe insulation in the Residential program. These measures were supported in the prior DSM framework and had been proposed for continuation in the 2016 - 2020 Plan term. The OEB"s Decision and Order in EB-2015-0029/EB-2015-0049 did not approve the continuation of these measures in residential programming. Enbridge Gas Registered Energy Advisors are not qualified to install a smart thermostat at the time of an energy assessment. Aerators, showerheads, and pipe insulation are delivered and installed at the time of the assessment through the Low Income Home Winterproofing offering. Additionally, Enbridge Gas does install the smart thermostat through the Low Income Winterproofing offering, however this is done in a subsequent visit after the initial energy assessment by a certified gas technician.

OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Residential	10. Use virtual audits and hybrid audits to add more customized program participation pathways.	Enbridge Gas is currently conducting a pilot on virtual audits to determine its viability as a future offering enhancement.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Residential	11. Consider adding a behavioral program.	A Home Energy Report behavioural offering had been proposed for the 2016 - 2020 Plan term however it was not approved in the OEB's Decision and Order in EB-2015-0029/EB-2015-0049. Jurisdictional research revealed that natural gas utilities saw low savings attributed to behavioural based programming, and most jurisdictions that offered this type of programming applied a dual-fuel approach which is currently not an option available through CDM programming in Ontario.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Residential	12. Consider adding a midstream smart thermostat program.	Enbridge Gas's Smart Home offer provides an instant point-of-sale rebate to buy down the cost of the unit for residential customers. Enbridge Gas believes the incentive directed at the customer to motivate action continues to be appropriate. The report further noted ideally a midstream program would be promoted jointly with the IESO, however this is not an option currently available through CDM programming in Ontario. Enbridge Gas is committed to coordinating the delivery of DSM programs where possible and has coordinated its moderate income Smart Home offer with the IESO's Energy Affordability Program.

OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Low Income	13. Investigate the cause of the low cost to achieve natural gas savings in the low-income sector for EGI compared to other leading jurisdictions and ensure that most resources are dedicated to comprehensive energy retrofits.	Enbridge Gas's current approach for the single family low income begins with undertaking a comprehensive energy assessment to identify all DSM opportunities. In the multi-family segment ESAs begin the customer journey by working with the owner/property managers to assess the potential saving opportunities, as they are in the best position to determine what will fit with their capital spending plans, increasing the likelihood that the DSM opportunities will be realized. Enbridge Gas continues to review jurisdictional best practices, to ensure DSM is running optimally within the current framework for the low-income customers.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Low Income	14. Ensure that EGI's programs are able to meet the needs of smaller, one- to four family low-income rentals including the ability to easily initiate and complete the participation process, in addition to larger multi-family renters. Consider adding a scorecard metrics to explicitly reward participation in this segment.	Enbridge Gas agrees meeting the needs of smaller, one-to-four family low income rentals is challenging due to the difficulty in identifying these buildings and building owners. Once identified most units can either participate in the Home Winterproofing Program, or the Affordable Housing Multi-Residential building. To continue to address methods for identifying these opportunities, Enbridge Gas has actively consulted and will continue to work with multiple market associations and utilities, including CEE, CIETA, Fortis, and Efficiency Nova Scotia to share learnings and outcomes as the industry grapples with how to identify this market.

OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Low Income	15. Ensure large multi-family buildings are treated comprehensively with both in-unit and common area measures, even if the common area measures do not go through the “low-income” program.	All Enbridge Gas's current and proposed programs available to large multi-family buildings allow for the inclusion of both in-suite and common area measures to be pursued by customers.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Low Income	16. Closely coordinate with any non-profits, community action agencies, federal/local governments, etc., who are offering programs or funding for efficiency in Low Income buildings. Any additional funding would ideally be used to prioritize cost & safety upgrades so that EGI funds can be used to push to install more measures on the cost-effective priority list. EGI could also leverage existing infrastructure by providing funding directly to these agencies.	Enbridge Gas continues to look for opportunities to partner or collaborate with non-profits, community action agencies, and federal/provincial/local governments. Enbridge Gas currently is working with IESO which is the only agency offering funding for efficiency in low income buildings in Ontario today with the recent alignment of CDM/DSM Delivery Agents to facilitate co-delivery of Affordable Housing Single Family programming. This is a significant effort which will allow Enbridge Gas to leverage coordination opportunities across the province. Additionally, Toronto Community Housing has a tenant education program which Enbridge Gas has sponsored.

OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	Low Income	17. Link efficiency programs with credit collections and payment plan departments, as is being done in Illinois.	Enbridge Gas has successfully collaborated with customer care staff administering the LEAP (Low-income Energy Assistance Program) for several years to promote participation in the DSM Home Winterproofing Program (HWP). Offering fully subsidized envelope improvements to the homes of impacted customers helps with ongoing energy bill costs, as such Enbridge Gas works with an outreach agency who income qualifies these LEAP customers on Enbridge Gas's behalf to ensure all LEAP qualified residents are encouraged to participate in HWP.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	C/I	18. Significantly reduce or eliminate incentive caps for C&I projects.	A large majority of Enbridge Gas's projects do not reach the proposed incentive caps, and those that do typically yield adequate gas savings on their own and do not require a significantly higher incentive than the cap. Therefore, Enbridge Gas has not proposed a higher incentive cap. It is also important to note that incentives are not necessarily the primary driver for projects, especially larger scale ones. In many cases, the technical support provided by ESAs is viewed as equally or even more important. That said, Enbridge Gas does introduce limited time offers to explore changes in incentive structure, including doubling the incentive and increasing project caps. Enbridge Gas is open to continuing to test the impacts of higher project caps through its limited time offers.

OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	C/I	19. Perform a process evaluation with an express goal of understanding programs influence on decision making process and recommend ways to increase participation and reduce free ridership.	Enbridge Gas has completed several process evaluations, including one recently completed on the Commercial Custom / Prescriptive / Direct Install offers. Further details can be seen in the response provided in Exhibit I.5.EGI.Staff.10.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	C/I	20. Consider moving towards negotiated incentives for custom projects.	Negotiated incentives may result in the perception of affording some customers preferential treatment over others. Instead, Enbridge Gas prefers to host limited time offers whereby all customers within a specific segment and/or rate class have the ability to earn an increased incentive on projects that meet specific criteria.
OEB Staff2/Optimal Energy	Page 55 of the PDF Doc	C/I	21. Evaluate the effectiveness and extent of current account management for large and medium customers and encourage account managers to push to create multi-year Memoranda of Understanding outlining specific energy commitments. Alternatively, expand the Energy Performance (Whole Building P4P) program to include all large C&I customers.	Enbridge Gas's Energy Solutions Advisors have and continue to work with large customers year after year to identify and implement various projects, often functioning as an extension of their teams providing both hands-on technical support and financial support. Seeking commitment to an energy target through an MOU in order to have access to this level of support is not the approach adopted by Enbridge Gas - it is neither customer-centric nor does it provide flexibility to customers who are at different stages of maturity in terms of energy management. Enbridge Gas agrees with BOMA's evidence where it is suggested that Performance Based programming works best among customers that meet certain characteristics such as

				those with consistent and predictable operating hours and those that have centralized decision making over the facility. Therefore, the Whole Building P4P offering is not necessarily suitable for all large C&I customers.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	C/I	22. Consider adding RCx/SEM/Energy Manager programs.	Enbridge Gas' experience with offering stand-alone RCx and SEM programs has not proven to be cost effective. In 2020, Enbridge Gas collaborated with the IESO on the Energy Manager program targeting the Ontario institutional market. The IESO has since decided to discontinue this offering at the end of the year. Based on these experiences, Enbridge Gas has incorporated elements of RCx and SEM programming into its proposed Custom offering, which provides customers with flexibility to participate in energy management initiatives that they have shown most interest in such as audits, studies, and metering, without the need for a distinct program offering. The Energy Performance Program also takes a strategic energy management approach and supports RCx measures. Enbridge Gas also believes our Energy Solutions Advisors who work with named accounts year after year, often as an extension of their teams, provide a similar level of service to Energy Managers, supporting customers in achieving goals and targets in a cost effective manner.

OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	C/I	23. Ensure that the Small Business Direct Install Program effectively integrates with the electric side, and focus the gas program on envelope measures, as is done in the residential sector.	Enbridge Gas maintains regular communication with the IESO, who are tasked with delivering electricity CDM programming. In a common effort to improve programming for customers and reduce costs, both the IESO and Enbridge Gas are committed to coordinating the delivery of DSM programs with electricity CDM programs where possible, which includes the potential for collaboration on direct install for small business. Historically, the Enbridge Gas Direct Install offering supported both envelope measures such as air curtains, as well as non-envelope measures, such as Demand Control Kitchen Ventilation (DCKV) – a technology that moderates excess air infiltration. Restricting the Direct Install offering to envelope measures would therefore exclude other cost effective measures, like DCKV, that would benefit small customers.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	C/I	24. Revisit the technical caps for the Large Volume Program, for both technical assistance and implementation.	The proposed Large Volume Program budget was set to address the cost concerns from some Large Volume Program ratepayers. Increasing the caps would impact budget. Enbridge Gas has dedicated Technical Account Managers who work with Large Volume customers to provide technical assistance at no additional cost to the customer, reducing the need for incremental incentives to support technical assistance.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	C/I	25. Ensure robust project-level measurement and verification activities on projects funded through the Large Volume program.	All Large Volume projects have some form of measurement, for example, custom calculations performed by ESAs to determine energy savings. The Large Volume program has been subject to verification by the board selected Evaluation Contractor. Typically, this has taken the

				format of CPSV (Custom Project Saving Verification) of a statistical representative sample of projects.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	C/I	26. Withhold a portion of the efficiency charge on the Large Volume Self-direct to help cover program administrative costs.	The proposed Large Volume Program already contemplates that customers in the Large Volume rate classes pay for Large Volume Program admin costs and for a share of the portfolio admin costs.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	C/I	27. Clarify cost-effectiveness requirements, and ensure that each customers' multiyear efficiency plan is cost-effective on an aggregate level.	Customers work with ESAs to produce annual energy efficiency plans (EEPs). Multi-year EEPs were considered as an alternative to program design but ultimately rejected as an option due to the administrative complexity and chose instead to offer more flexibility to customers through increased measure eligibility. Enbridge Gas would be open to ensuring that customer EEPs are cost effective but would want to understand further the potential impact to customers.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	C/I	28. Ensure that EGI's other programs can effectively meet the needs of eligible customers, with a goal of demonstrating enough value that customers opt not to self-direct.	The Large Volume Program was created to mitigate the cost impacts to customers while also providing the same benefits as C&I programming. Customers that qualify for the Large Volume program are among the largest of the Utility and, as DSM costs are a factor of consumption, inclusion of Large Volume customers as part of the C&I programming portfolio could result in them incurring a disproportionately larger DSM cost.

OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	BBC - New Construction	29. Revamp the incentive structure on Energy Star Homes to motivate additional participation, reduce free ridership, and encouraging additional savings beyond the minimum to achieve Energy Star certification.	Enbridge Gas believes the proposed incentive structure for the Energy Star Homes path already adequately addresses the ability to effectively motivate additional participation, while reducing free ridership concerns by actively targeting jurisdictions that have shown previously low participation rates. The primary barriers identified with builders not pursuing this level of energy efficiency in their builds were: 1) incremental cost of construction and 2) associated costs with labelling. The largest ESNH service provider in the province of Ontario, Building Knowledge, states the following with respect to the current Incremental Costs of construction associated with ESNH. "Based on our work with builders over the last 10+ years, providing Energy Star for New Homes support/design development/testing/inspections and labelling for over 30k residences, we have observed the following: • Increasing the efficiency of a part 9 new residential home (SB12 2017) to meet the ESNH standards 17.2 will add approximately $1,650 to $2,000 in hard cost. • Depending on home geometry (e.g. single vs attached or MURB), the hard cost increase associated with ESNH vs 17.2 may be lower than OR higher than the above estimate. As a result of its consulting with Building Knowledge, Enbridge Gas believes its overall incentive of $1,650 is more than sufficient to adequately motivate builders to

				participate in the program, and that its active targeting of builds taking place in municipalities that have previously had low penetration of Energy Star new home builds is a reasonable approach to addressing potential free ridership issues.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	BBC - New Construction	30. Add pre-construction financial support for builders constructing net zero homes for feasibility studies, modeling, and other expenses needed to achieve net zero. Also consider adding an intermediate savings level which gives increased incentives for buildings that approach net zero but do not quite reach it.	The points outlined in this recommendation are already addressed in the NZER offer, as referenced in EB-2021-0002, Exhibit E, Tab 2, Schedule 2, Page 13 of 33 - Participants will be guided through a series of activities to support the design and construction of the NZER discovery home, including: • Visioning session between the design team and IDP workshop facilitator • IDP workshop followed by an IDP workshop report that summarizes key outcomes for the design team. • Associated trades training to ensure implementation meets designed outcomes • NZER discovery home incentive of $15,000 per home. Builders (inclusive of all subsidiaries) will only be able to participate once and receive a single incentive. • NZER evaluation incentive of $1,500 to assess whether the discovery home achieved the NZER standards. This offer is designed for builders to gain confidence in the ability to achieve the NZER standard. Designing an offer to be accommodating to builders who do not achieve this standard would be counterproductive to the design of this program

OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	BBC - New Construction	31. Offer financial incentives on Commercial New Construction, in addition to training and workshops.	Performance incentives have historically been offered as part of the Commercial Savings by Design offering. As outlined in Exhibit E, Tab 2, Schedule 2, Page 17, #54, "the long timelines between IDP and the final build led to many participants not choosing to complete the requirements to access the final stage incentives." As it relates to the time to build challenges with the earlier offering, Enbridge Gas has decided to shift its focus away from performance incentives, and instead mandate that participating builders supply the energy models that are submitted for permitting purposes to the respective municipalities to Enbridge Gas for review. These models will help inform Enbridge Gas as to the decisions that were made by the builders following the completion of the IDP. A post building participant survey will also be conducted to further explore the impact of the IDP workshop on the final design. The outcome of these findings will influence any potential future program design improvements, including if and how performance incentives should be reintroduced as part of the offering in the future.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	BBC - New Construction	32. Increase the incentive cap for both the ENERGY STAR for New Homes and Net Zero Energy Ready offerings.	See response to Optimal BBC - New Construction recommendations 29 & 30 above.

OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	BBC - New Construction	33. Measure the baseline as standard practice, rather than code minimum.	The proposed ESNH offer considers baseline through our analysis of current jurisdictional penetration levels of ESNH. The offer is designed to drive ESNH levels to go above current levels and realize lost opportunities vs no intervention in these markets. The NZER has included baseline assessments as part of its builder design support, whereby individual builder baselines are assessed and through an IDP process an optimal path is identified for that builder to achieve the NZER standard.
OEB Staff2/Optimal Energy	Page 56 of the PDF Doc	BBC - New Construction	34. Offer incentives for additions and major renovations for residential projects	The current HER program is available to customers looking to perform major renovation projects. Bonus measure incentives provides additional financial support to those customers involved in a major renovation. Those projects involving an addition, are subject to current building code standards, and therefore, low associated incremental savings.
OEB Staff2/Optimal Energy	Page 56 - 57 of the PDF Doc	Low Carbon Transition and Integration with Electric Efficiency	In addition to these specific recommendations, we find that moving towards a true joint delivery model with fully integrated electric and gas programs is likely the single most impactful step that could be taken to improve program delivery and cost efficiency.	Enbridge Gas maintains regular communication with the IESO who are tasked with delivering electricity CDM programming in Ontario. In an effort to leverage collaborative opportunities, both the IESO and Enbridge Gas are committed to coordinating the delivery of DSM programs with electricity CDM programs where appropriate.

GEC - Energy Futures Group	Page 34	Residential	Enbridge's proposed residential Whole Home program should be harmonized with the new federal Greener Homes Program, using an identical design, supporting the same efficiency measures (or at least the subset that save gas), and simply offering increased rebates for individual measures where appropriate and increasing the federal rebate cap per home.	Enbridge Gas agrees the Residential program should be coordinated with the federal Canada Greener Homes Grant, and with the program adapting in the coordinated approach to the federal program to simplify communications and marketing messages. Discussions between Enbridge Gas and NRCan are ongoing to establish an Agreement for a coordinated approach for the program.
GEC - Energy Futures Group	Page 34	Residential	Enbridge's proposed residential Whole Home program should not offer rebates for gas heating or water heating equipment. These are not cost-effective measures. Eliminating such gas equipment rebates would also better align the Enbridge Gas program with the federal program.	See response to Optimal Residential recommendation 5 above.

GEC - Energy Futures Group	Page 34	Low Income	Enbridge's proposed low income program budget is lower (in inflation-adjusted terms) than in recent years, and lower as a percent of total program spending than most leading gas DSM portfolios. It should be increased to the point where it represents at least 20% of total DSM program spending.	Enbridge Gas's 2023 proposed low income project budget is currently 18.6% of the total program budget. This is consistent with actual low income program expenditures from 2016 to 2020 which averaged 18.2% of the total program budget. The proposed budget is also consistent with the findings of the CEE 2020 annual report (Figure 19) which indicates that the 2019 Canadian Natural Gas Expenditures for Low Income is 19% of program expenditures. It should be noted that in United States, the equivalent average spend is much higher than Canada at 26% (Figure 10). Should the OEB be desirous of an increase in the Low Income budget, the IR response to Staff 13 provides a sensitivity analysis which outlines the incremental net annual gas savings that could be forecast with an additional 10% allocation to the Low Income program budget. The 2020 CEE annual report is included at Attachment 1 to this undertaking response.

GEC - Energy Futures Group	Page 34	BBC - New Construction	Enbridge's proposed Building Beyond Codes new construction programs should be removed from its portfolio, with budget reallocated to other programs or to a third party with the appropriate expertise and no profit bias toward one fuel. New construction decisions by builders and future codes should be considered from a fuel agnostic perspective.	Enbridge Gas does not agree with this direction, as it continues to feel that it has a role to play in supporting the market, as outlined in its interrogatory response to Exhibit I.10g.EGI.STAFF.68, to prepare for future code advances that will be implemented over the coming decade. Enbridge Gas has worked closely with 3rd party experts for over a decade to deliver its new construction programs, and feels it has adequate experience to continue doing so. Enbridge Gas has and continues to support fuel agnostic energy savings solutions so long as the end state of the new construction build results in an Enbridge Gas customer remaining in alignment with guidance provided in the EB-2019-0003, OEB Letter Post-2020 Natural Gas Demand Side Management Framework (December 1, 2020), p. 2. "the primary objective of ratepayer funded natural gas DSM is assisting **customers** (emphasis added) in making their homes and businesses more efficient in order to help better manage their energy bills."
GEC - Energy Futures Group	Page 34	Low Carbon Transition	Enbridge's proposal to support the development of gas heat pumps, as part of its Low Carbon Transition program, should be rejected. Residential gas heat pumps are not commercially available today, are highly unlikely to materially impact gas sales for the foreseeable future, may conflict with future electrification	Enbridge Gas disagrees with this recommendation. Natural gas heat pumps (GHPs) are an important next generation energy efficiency technology to replace existing residential furnaces and water heaters. GHPs are commercially available in overseas markets. Three manufacturers of residential GHPs are targeting to make their certified GHP products commercially available in Ontario in 2024. GHPs are a solution aligned to the goals of Canada's market transformation road map for space and water heating, and provides consumer choice in line

			goals, and are far from cost-effective as an efficiency measure. Budget resources would be much better spent on measures that can provide comparable levels of savings today – and cost-effectively.	with direction from the province of Ontario. GHPs are likely to become cost effective with the proper level of market support, given their broad range of applicability and their ability to scale with existing infrastructure.

CEE Annual Industry Report

2020 State of the Efficiency Program Industry

BUDGETS, EXPENDITURES, AND IMPACTS

Consortium for Energy Efficiency

For more information, contact:
Arlene J. Lanciani
Principal Program Manager
Evaluation, Research, and Behavior
reports@cee1.org

Consortium for Energy Efficiency
Ferncroft Corporate Center, 35 Village Road
Middleton, MA 01949

September 2021

Purpose and Limitations

The purpose of this report is to provide a point in time report of US and Canadian program industry energy efficiency and demand response budgets, expenditures, and savings and an annual time series analysis. While this effort constitutes a large and comprehensive survey of program administrators, and while extensive ongoing attention is devoted to data standardization, CEE cautions against making representations and comparisons beyond those provided in this report.

The report documents annual electric and natural gas DSM program industry budgets, expenditures, and impacts at the national level and, where appropriate, by Census region, across the United States and Canada based on data collected through a vast and comprehensive survey of DSM program administrators. CEE believes that using these data in conjunction with past survey efforts portrays an accurate representation of energy efficiency program industry trends over time. The limitations of the data are disclosed below.

There are many limitations to budget, expenditures, and savings data in the DSM industry. First, this survey represents self-reported data by an individual or group of individuals within each responding organization. Although CEE and our collaborator, the American Gas Association, work closely with each responding organization to help respondents properly interpret survey questions and enter the correct information, the accuracy of the data is not verified outside of these efforts. Second, respondents provide data at different times during the data collection period from June to October, and not all program administrators report their information according to the calendar year. CEE and our collaborator have sought greater consistency in data collection from respondents over the years, however, the accuracy of the data is ultimately dependent upon each individual respondent's interpretation of the survey questions, ability to retrieve the relevant information, and verification of the data provided. Furthermore, variation in state policies and reporting requirements along with what we suspect is inconsistent use of terminology likely adds to variation.

Additional factors that affect the viability of comparisons or analytical inferences include differences in regulatory structures, weather effects, customer demographic differences, electric and gas rates, the duration of program experience, and underlying drivers that shape a program administrator's portfolio.

Given the wide variation in the circumstances surrounding individual data points, we do not believe these data are suitable for comparisons at any level other than the levels represented within this report. CEE encourages reviewers to inquire as to the sufficiency of the method or quality of supplemental data for the specified purpose when using this information beyond the stated limits.

Terms of Use

Acknowledgements

CEE would like to thank the gas and electric energy efficiency and demand response program administrators in the United States and Canada that participated in this year's industry data collection. We appreciate the time and effort given by all survey respondents throughout the data collection process, including extensive clarification and follow-up. CEE is also grateful to members who have provided feedback and insights on this work over the years.

CEE appreciates our continuing collaboration with the American Gas Association (AGA), which provides natural gas industry data collected from their members for a similar research effort. CEE extends special thanks to Sapna Gheewala and Paul Pierson of the American Gas Association for their coordination on survey development and the logistics of data collection.

This report was produced by Arlene Lanciani, and Jayne Piepenburg of the CEE Evaluation, Research, and Behavior Team. Assistance with outreach, data verification, and database programming was provided by Qianyi-Channie Lin.

Executive Summary

This report concludes CEE's fifteenth consecutive data collection effort and annual report publication. The primary purpose of the survey and accompanying report is to capture industry budgets, expenditures, and impacts over time to enable assessment of overall industry trends. This year's report highlights 2020 budget data[1] and 2019 expenditure and impact[2] data compared to previously reported figures to assess industry growth and observe significant changes.

In 2020, the *State of the Efficiency Program Industry Report* continues to illustrate the growth of the energy efficiency industry. Analysis of the data reported by US and Canadian program administrators continues to support the recent

[1] The budget data from survey respondents were collected during the summer and fall of 2020. This report does not capture changes made after that time.
[2] "Impact data" refers to annually reported energy savings data commonly referred to as "ex ante" savings estimates. Ex ante savings are forecasted savings figures used for program and portfolio planning and reporting purposes. DSM program evaluators often review and revise ex ante savings during program or portfolio impact evaluation studies.

trend of increasing demand side management (DSM[3]) program expenditures. In 2019, combined spending on gas and electric DSM programs across the United States and Canada totaled $9.3 billion from all sources and $8.7 billion from ratepayers. Industry expenditures are up three percent compared to 2018 expenditures from all sources and represent an six percent increase over the last five years. CEE member programs accounted for almost $6.5 billion, or about 70 percent, of these expenditures. US and Canadian DSM ratepayer-funded programs are estimated to have saved approximately 31,927 GWh of electricity and almost 500 million therms of gas in 2019, which represents 26.5 million metric tons of avoided CO_2 emissions.[4]

Other key findings from this year's industry data collection include the following, listed in US dollars (USD):

Binational Trends: DSM Programs in the United States and Canada

- In 2020, US and Canadian combined gas and electric DSM program budgets from ratepayer funds totaled over $9.2 billion out of the $10.2 billion budgeted from all sources. This represents a one percent increase from 2019 ratepayer funded budgets.
- In 2019, US and Canadian program administrators spent $1.03 billion from all sources—over 91 percent of which came from ratepayers—on demand response programs. This represents a six percent increase over 2018 levels.
- Natural gas program expenditures in the United States increased over 14 percent between 2018 and 2019, totaling $1.77 billion.
- The largest sources of non-ratepayer funding budgeted for 2020 US electric DSM activity included wholesale capacity market revenues (two percent) and the Regional Greenhouse Gas Initiative (one percent of total budgets). US electric and gas program administrators also cited several miscellaneous sources,[5] while Canadian electric and gas program administrators reported 100 percent ratepayer funding for DSM programs

Gas and Electric DSM in the United States:

- US gas and electric DSM expenditures totaled $9.3 billion from all sources and over $8.7 billion from ratepayers in 2019, representing an increase of about nine percent for expenditures from all sources and for for ratepayer funding as compared to 2018. This represents an six percent increase in US DSM expenditures over the last five years.

[3] For the purposes of this report, DSM programs encompass both energy efficiency (EE) and demand response (DR) funding.
[4] Calculated using the EPA Greenhouse Gas Equivalencies Calculator, "Greenhouse Gas Equivalencies Calculator," Environmental Protection Agency, accessed April 2021, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
[5] Miscellaneous sources of funding included state funding and shareholder funding.

- US DSM expenditures in 2019 represented nearly 0.04 percent of US GDP and 2.55 percent of value added[6] by the US utility industry.
- Ratepayer-funded programs resulted in 40,814 GWh of gross incremental electric savings and over 500 million therms of gas savings in 2019.

Gas and Electric DSM in Canada:

- Canadian gas and electric DSM program expenditures decreased slightly in 2019 relative to 2018 in US dollars, to $712 million USD from $720 million USD in 2018, but increased slightly when considered in Canadian dollars to $950 million CAD from $933 CAD in 2018, a one percent increase.
- Canadian DSM expenditures in 2019 represented 0.06 percent of Canadian GDP (or 0.04 of Canadian GDP in USD) and 2.2 percent of value added by the Canadian utility industry.
- In 2019, ratepayer-funded DSM programs resulted in 974 GWh of gross incremental electric savings and over 118 million therms of gas savings.

This is the eleventh consecutive year of collaboration with the American Gas Association (AGA). Working with AGA has streamlined data collection efforts and helped increase participation and response rates for this survey. The 2020 report reflects data for 332 utility and nonutility program administrators[7,8] operating efficiency programs in all 50 US states, the District of Columbia, and 10 Canadian provinces. More information regarding the 2020 data collection process can be found in Section 2.

[6] The US Department of Commerce Bureau of Economic Analysis defines value added, or the GDP-by-industry as "the contribution of a private industry or government sector to overall (cont. from previous page) GDPValue added equals the difference between an industry's gross output ... and the cost of its intermediate inputs." "Frequently Asked Questions: What is industry value added?" US Department of Commerce Bureau of Economic Analysis, accessed April 2021, bea.gov/faq/index.cfm?faq_id=184.

[7] Survey respondents include electric and gas CEE members, program administrators who are members of AGA, large program administrators who are not members of either organization, and some other program administrators identified through EIA Form 861 DSM data: "Electric power sales, revenue, and energy efficiency Form EIA-861 detailed data files," US Energy Information Administration, http://www.eia.gov/electricity/data/eia861/.

1 Introduction

Over the past fifteen years, CEE has collected data from demand side management (DSM) program administrators in the United States and Canada to provide insight to industry stakeholders regarding overall trends for the electric and natural gas efficiency program industry. In that time, the data have shown impressive growth in industry expenditures and showcase how energy efficiency and demand response initiatives continue to result in energy savings and demand reductions. Even amidst changes in the national policies affecting the energy industry, US and Canadian DSM expenditures increased 26 percent between 2011 and 2019 when adjusted for inflation. Thus, the sustained US and Canadian investment summarized in this report supports the value of gas and electric demand side management programs as a cost-effective means of energy resource acquisition and greenhouse gas mitigation.

This report presents trends in 2019 program expenditures and savings and 2020 budgets reported by US and Canadian DSM program administrators, both electric and natural gas. A total of 332 utility and nonutility program administrators operating efficiency programs in all 50 US states, the District of Columbia, and 10 Canadian provinces are included in this year's report.[9] While this effort constitutes one of the largest and most comprehensive surveys of program administrators in the United States and Canada and extensive ongoing attention is devoted to data standardization, CEE cautions against making representations and comparisons beyond those provided in this report. As previously indicated in the Purpose and Limitations and in the Terms of Use, limitations in the comparability and consistency of the data reduce their analytical usefulness below the state or sometimes the regional level. Section 2 clarifies these limitations and outlines the reasons why use of this information at any level—state, regional, national, or binational—should not extend beyond the intended purpose stated above.

1.1 Report Structure

The 2020 State of the Efficiency Program Industry report is divided into eight sections.

- This section, included under the heading of Introduction, provides an overview of the report's scope, key assumptions, and structure.

[9] CEE improved the way we track and define response rates starting with the 2014 report. See Section 2.1 for more details on this change. Then, with the 2016 report, CEE streamlined the data collection process, details of which are also provided in Section 2.1.

- Section 2, Data Collection and Limitations, describes the report's methodology and includes detailed information on data collection methods, survey response rates, and the limitations of the data presented in this report.
- Section 3,
- Demand Side Management Program Funding in the United States and Canada, presents regional and national data and analysis of natural gas and electric DSM programs.
- Section 4, Evaluation, Measurement and Verification, presents analysis of program expenditures in these areas.
- Section 5, Estimated Program Savings and Environmental Impacts, provides estimated national energy savings data from energy efficiency programs in the United States and Canada. These data are reported by country, fuel type, and customer class.

Appendix A provides a list of the electric energy efficiency program categories used in the 2020 survey and discussed throughout the report.

Appendix B contains tables with electric energy efficiency expenditures by program type for each country, grouped by program category, which are also discussed in Section 3 of the report.

Appendix C contains additional figures regarding electric demand response expenditures in the United States by program type. These figures also expand upon information in Section 3.

Additional data tables that accompany this report present energy efficiency and demand response program expenditures and budgets by state and province.[10] These tables also present energy savings aggregated and reported at the regional level for the United States and the national level for Canada. CEE does not report savings data by state or province due to the risk of misinterpreting program cost-effectiveness and because of limitations associated with comparing program savings data, which are further explained in Section 2 of this report.

For more information on this report, or to obtain the Annual Industry Report brochure or graphics produced for this report, please visit cee1.org. For members, the report is posted in the CEE Forum.

2 Data Collection and Limitations

This section provides context regarding data collection efforts, in particular participant response rates, program funding, reporting periods, program categories, and exchange rate information. This section also states the limitations of the data required to properly interpret the results of this report.

[10] These tables are available at http://www.cee1.org/annual-industry-reports.

CEE collected data during the summer and fall of 2020, in conjunction with the American Gas Association (AGA).[11, 12] CEE collected all electric program data while CEE and AGA collaborated to collect gas program data, with AGA collecting the majority of the information. CEE only collected natural gas efficiency information from organizations that are not AGA members, including statewide program administrators. Collaboration with AGA has streamlined data collection and expanded the sample pool of program administrators over the years, and AGA is a major contributor to this report. AGA also publishes additional information on natural gas DSM programs, including a summary of budgets and expenditures as reported here, energy savings data, information on program implementation and evaluation, and regulatory information. Please contact AGA directly for more on these publications, which are available on their website.

CEE administers this survey annually via an online survey[13] to a variety of DSM program administrators, including investor-owned utilities, nonutility program administrators, municipal power providers, and co-ops. The survey frame included previous survey respondents, all member organizations of AGA and CEE,[14] nonmembers who were expected to have significant DSM programs, and some program administrators who submitted data to the Energy Information Administration (EIA).[15] Due to the constantly changing nature of the DSM industry, it is difficult to identify and survey every program administrator. Despite this challenge, CEE has continuously worked to make its sample frame as representative of the current industry as possible.

[11] The American Gas Association, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States. There are more than 73 million residential, commercial, and industrial natural gas customers in the United States, of which 95 percent—over 69 million customers—receive their gas from AGA members. AGA is an advocate for natural gas utility companies and their customers and provides a broad range of programs and services for member natural gas utilities, pipelines, marketers, gatherers, international natural gas companies, and industry associates. Today natural gas meets more than one-fourth of the United States' energy needs. To find out more, please visit www.aga.org.

[12] CEE began collaborating with AGA in 2009 to increase the report's coverage of natural gas programs.

[13] The electric survey collects information about demand response programs, but the natural gas survey does not because comparable demand response programs do not exist for natural gas.

[14] CEE members include electric and natural gas efficiency program administrators from across the United States and Canada. For more information on CEE membership, please visit www.cee1.org/content/members.

[15] There are many community-owned electric utilities operating efficiency programs in the United States that are not included in this report. The American Public Power Association (APPA) is a nonprofit organization created to serve the nation's more than 2,000 community-owned electric utilities that collectively deliver power to more than 48 million Americans. For more information about APPA or its members, please visit www.publicpower.org.

2.1 Response Rates

Data for this report come from a voluntary survey administered to program administrators in the United States and Canada. Because responding organizations may vary by state or province from year to year, caution should be used in comparing data and inferring trends, especially at the state or provincial level. Despite numerous attempts to follow up, not all organizations included in the sample frame respond to the survey each year. Thus, year–to-year changes in the data reported here cannot be entirely attributed to new or expanded programs and new program administrators. Where appropriate, the analyses below include comparisons of only those respondents who provided information in both 2019 and 2020, alongside the analyses of all data collected.

In 2013, CEE began asking respondents to provide public regulatory documents, program plans, and implementation or evaluation documents in the survey. This has allowed us to verify information provided by survey respondents and, in some cases, to update inaccurate information or to supplement what we received with public data not provided in the survey. Most importantly, these supplemental documents have allowed CEE to uncover unreported information for program administrators who we expected to have significant DSM budgets, expenditures, or savings.

In 2020, this report reflects data from 330 utility and nonutility program administrators operating DSM programs in 50 US states, the District of Columbia, and 10 Canadian provinces. These figures include those organizations accounted for using the streamlined analysis described in the next section. In total, the data collected this year represents 13 more organizations than in 2019. As in the past, CEE concludes that this report represents the vast majority of large efficiency program administrators and that the data provided below sufficiently represent the DSM industry in 2019 and 2020.

2.2 2016 Data Collection Methodology Change

In 2016, in an effort to streamline the survey process and reduce the survey burden on respondents, CEE staff prioritized outreach to those electric program administrators that represent the majority of industry expenditures. For numerous smaller or historically unresponsive program administrators, information from the Energy Information Administration (EIA)[16] or responses provided in a previous survey year[17], adjusting for exchange rates and

[16] Data from the 2016 EIA Form 861 collection effort are available at "Electric power sales, revenue, and energy efficiency Form EIA-861 detailed data files," US Energy Information Administration, http://www.eia.gov/electricity/data/eia861/.

[17] Similar to past years, CEE carried over information from the previous year for a couple of large program administrators that did not respond in 2020, so as to estimate program activity rather than allow totals for these administrators to fall to zero. In 2020, data from 11 program adminsitrators was carried over from 2019 and adjusted by the average rate of change in received responses from 2019 to 2020 to account for general industry trends.

inflation, as appropriate, were incorporated. The organizations for which CEE substituted EIA information or for which CEE carried through information collectively represented less than five percent of total US and Canadian electric DSM expenditures in 2019. As a result, we conclude this process did not impact the US and Canadian natural gas results.

2.3 Funding Sources

In previous survey years, CEE asked respondents to provide budget and expenditure figures from ratepayer funded sources, as well as to list other sources of funding in the survey. Respondents often listed other sources, such as the American Recovery and Reinvestment Act (ARRA), without providing any supporting data figures to indicate the significance of the additional funding. In 2013, CEE began asking electric survey respondents to report budget and expenditure figures using specifically defined categories that included both ratepayer and nonratepayer sources. In 2014, CEE and AGA also began asking gas survey respondents to report additional funding from nonratepayer sources.[18] These changes were intended to improve the consistency and clarity of survey terminology and reporting categories, as well as to obtain a more comprehensive picture of the industry's financial landscape and identify the relative magnitude of funding from sources other than ratepayers.

CEE defines ratepayer funds as dollars secured through special regulator-approved benefit or on-bill tariff charges that are universally collected as supplemental charges to energy bills.[19] CEE defines nonratepayer funds as funds received from sources such as wholesale capacity market revenues, the Regional Greenhouse Gas Initiative (RGGI) proceeds, and dollars specifically allocated to weatherization assistance programs. As of 2015, CEE no longer asks respondents to report funds dispersed from the American Recovery and Reinvestment Act (ARRA), as no ARRA funds were reported in 2014 and we do not believe any significant sources of these funds exist at this point.

In this report, we disclose total figures that represent all funding sources in charts and graphs depicting historical trends. Where appropriate, the text specifically notes the percentage of 2020 budgets and 2019 expenditures and savings attributable to ratepayer funds only.

[18] Only natural gas program expenditures and savings derived from ratepayer dollars are identified in this report. In all, gas program administrators reported that 99.8 percent of expenditures in 2019 were made using ratepayer funding. One hundred percent of natural gas savings reported to CEE and AGA were presumably derived from ratepayer funding. Section 3.2, below, addresses nonratepayer sources of funding in 2020 budgets.

[19] More specifically, CEE clarified starting in the 2018 survey that ratepayer funds include "funds derived from system benefit charges, bill surcharges, utility revenues, budget carryover, and transfers from other program administrators that derive funds from any of the above."

2.4 Reporting Period

CEE asked respondents to provide data representing total program budgets for 2020 and total program expenditures and savings for 2019 that aligned with calendar years. CEE defined the budget year for this survey effort as beginning on January 1, 2020 and ending on December 31, 2020. Similarly, CEE defined the "expenditure and savings year" for this survey effort as beginning on January 1, 2019 and ending on December 31, 2019.

In some cases, respondents indicated that their organization reporting cycles did not align with calendar years and that figures reported were not adjusted accordingly. In these cases, CEE requested supplemental information regarding the specific start date and end date for annual budget figures and annual expenditures figures. CEE did not adjust their reported annual figures to align with the calendar year reporting cycle, however. Therefore, please note that some portion of the 2020 industry budget figures and some portion of the 2019 expenditures and savings figures may include data that fall outside of the January 1 to December 31 reporting cycle. Any year identified in this report should be taken to mean the associated program year for all program administrators.

2.5 Reporting Categories

This publication groups data into customer classes, as in previous years. Electric customer classes in 2020 include residential, low income where separable from residential, commercial, industrial, commercial and industrial (C&I) where commercial and industrial were not separately reported or distinguishable, cross sector, and demand response. Since 2013, the category of evaluation, measurement and verification (EM&V) used in previous reports is included as part of the cross-sector class, which covers activities that span multiple customer classes. Customer classes in the gas data include residential, low income where separable from residential, multifamily where separable from residential and commercial, commercial, industrial, C&I where commercial and industrial were not separately reported or distinguishable, and other.

In 2013, CEE introduced more granular categories within each electric customer class. The categories used in 2013 were adapted, with a few minor changes, from a typology developed through another national research effort.[20] CEE has incorporated questions into the survey that ask respondents to report budgets, expenditures, and impact data by program type if possible.[21] In 2020, as in the six previous survey years, CEE also allowed respondents to provide rough percentage breakdowns of their budgets,

[20] Hoffman, Ian M., et al. "Energy Efficiency Program Typology and Data Metrics: Enabling Multi-state Analyses Through the Use of Common Terminology," Lawrence Berkeley National Laboratory, August 2013, http://emp.lbl.gov/sites/all/files/lbnl-6370e.pdf.
[21] CEE has incorporated program level questions for the electric survey only. CEE will continue work with our members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

expenditures, and impacts by program category, even if they could not provide exact dollar or MWh figures for programs. These changes aim to provide more specific information regarding the types of electric programs administered in the United States and Canada and allow for a more nuanced understanding of program offerings moving forward. See Electric Energy Efficiency Program Categoriesfor a list of the program categories used in 2020, which are consistent with the categories used in the previous four years.

As in past years, CEE based demand response program categories on those specified and defined by the US Federal Energy Regulatory Commission (FERC).[22] FERC defines several demand response program types and groups them into two major categories: "incentive-based programs," which tend to involve customer contracts with utilities to curtail load when necessary, and "time-based programs," which generally employ graduated pricing schemes that motivate customers to reduce load during system peaks.

Highlights of collected program data are presented in the appropriate sections below, but these data only represent respondents who chose, or were able to provide information broken out into the specified program categories. The survey asked respondents who could not report at this level of granularity to break their budgets, expenditures, and savings into customer classes only.

The “not broken out” category includes respondent data not further divided into customer classes. These data appear in the binational and national aggregated totals and charts in this report but, by definition, are not included in the analysis of data by customer classes or program types.

2.6 Other Data Limitations

CEE makes every attempt to collect data that align with the definitions and data requirements outlined in the terminology section of the survey. When staff members identify outlying values in the data, we contact respondents and work with them to obtain accurate information. Furthermore, we believe that improvements resulting from the switch to an online survey format have reduced errors over the past several years.

With regard to budgets, considerable room exists for reporting error, and such errors are not always apparent. "Cycle budgets" provide a prime example and are discussed in more detail in Section 3.3. Annual budgets in this report also present limitations, as they illustrate a snapshot from within the data collection period, whereas expenditures and savings from the previous year have often been finalized by the time the survey is fielded.

The data in this publication do not reflect changes to program budgets after the fall of 2020, such as those due to newly approved programs or budget

[22] CEE sourced demand response terminology from the "2012 Assessment of Demand Response and Advanced Metering: Staff Report," Federal Energy Regulatory Commission, https://www.ferc.gov/legal/staff-reports/12-20-12-demand-response.pdf, December 2012.

cuts. In addition, carryover of unspent funds from 2019 could result in double counting. In light of the caveats outlined above surrounding annual budgets, this report follows previous ones and focuses on expenditures rather than budgets as the best indicator of energy efficiency program industry investment.

Finally, several issues limit the comparability of data—in particular the savings data—across the United States and Canada. These include, but are not limited to, variations in regulatory requirements or program administrator practices for reporting performance data; differences in the interpretation of the terms used in the survey even when standard definitions are provided; differences in accounting practices among program administrators; variations in formulas used to estimate gross and net program savings; and differences in the focus or goals of programs, which often affect the tracking and reporting of different performance data.

Each regulatory jurisdiction provides specific policies for program administrators in that jurisdiction, which can lead to different assumptions and methods for cost-benefit tests, net-to-gross factors, savings equations, avoided transmission and distribution system line losses, measure persistence, and incremental savings reporting between states and provinces. For example, some program administrators may only account for incremental savings resulting from installation of efficient equipment using existing codes as a baseline, whereas others are allowed to account for savings using the efficiency of the replaced equipment as a baseline. These different baseline assumptions may lead to significant variations in the savings claimed by different program administrators for the same efficient equipment in the same replacement scenario. CEE believes that for these reasons, savings data in particular should only be aggregated at the US census region level in the United States and at the national level in Canada.

2.7 Currency Conversions and Corrections for Inflation

For ease of reading, all currency is reported in nominal US dollars (USD) unless otherwise specified. Where used, Canadian dollars (CAD) are also nominal unless otherwise specified. Real US dollars were calculated using the Bureau of Labor Statistics CPI Inflation Calculator,[23] and real Canadian dollars were calculated using the Bank of Canada CPI Inflation Calculator.[24] This report uses an average annual exchange rate of 0.7491 USD = 1 CAD for the 2019 expenditure and savings information (an average of the daily Federal Reserve[25] exchange rate for January 1, 2019 – December 31, 2019) and an average annual exchange rate of 0.7319 USD = 1 CAD for the 2020 budget

[23] "CPI Inflation Calculator," Bureau of Labor Statistics, accessed April, 30, 2021, http://www.bls.gov/data/inflation_calculator.htm.
[24] "Inflation Calculator," Bank of Canada, accessed April, 30, 2021, http://www.bankofcanada.ca/rates/related/inflation-calculator/.
[25] "Canada– Spot Exchange Rate, Canadian $/US$," last modified April, 30, 2021, http://www.federalreserve.gov/releases/h10/Hist/.

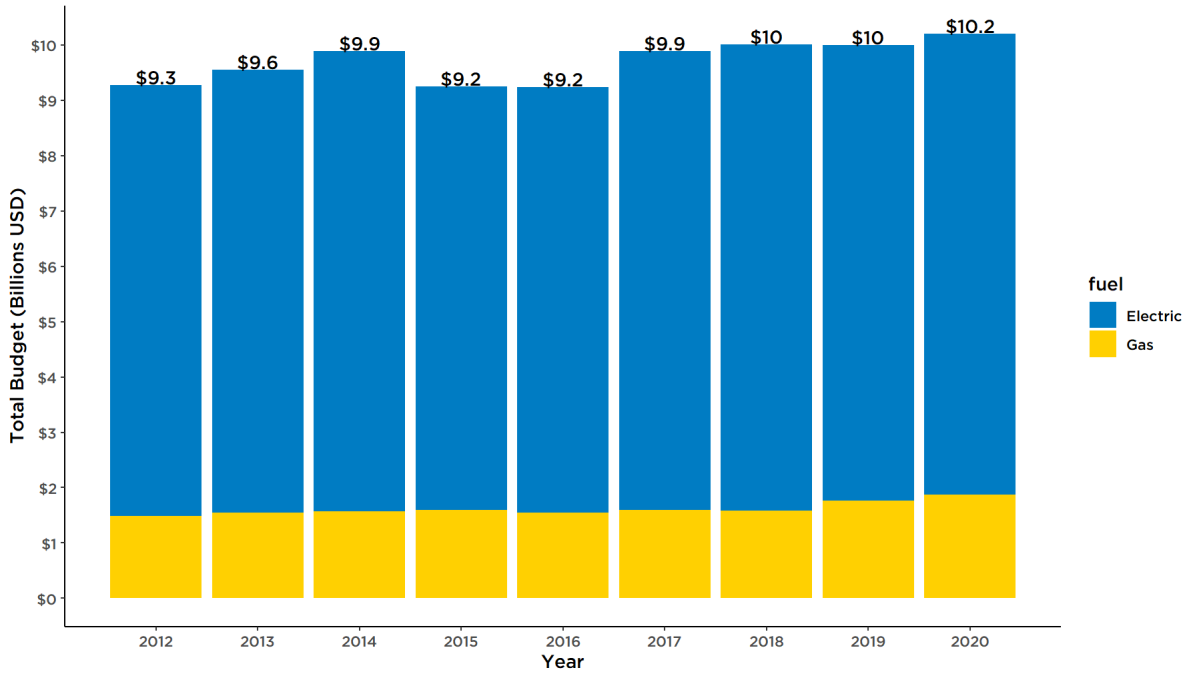
information (an average of the daily Federal Reserve exchange rate computed through June 2020).

3 Demand Side Management Program Funding in the United States and Canada

3.1 Combined DSM Budgets in the United States and Canada

US and Canadian electric and gas DSM program budgets—including both energy efficiency and demand response programs from all surveyed sources—reached $10.2 billion in 2020, representing an inrease of two percent over 2019 (Figure 1).[26] This trend is inline with progress over the last two years, where year-over-year percent change was in the zero to two percent range. In nominal dollars, 2020 program budgets increased by 0.01 percent over 2019

Figure 1. **US and Canadian DSM Program Budgets—Gas and Electric Combined 2011–2020**



Budgets derived exclusively from ratepayer funds accounted for 90 percent, around $9.1 billion, of the total 2020 budget figure. Figure 1 does not isolate demand response budgets, though in 2020 they represent approximately 10 percent of both the total DSM budgets from all sources, about $1.03 billion.

[26] Percentage changes in combined US and Canadian data are not adjusted for inflation. Data are adjusted for inflation for each individual country, however, and are identified throughout the report.

From 2012 to 2015, the percentage of both the total and ratepayer funded DSM budget figures allocated to demand response programs steadily decreased, dropping from 14 percent to 10 percent. That percentage has remained essentially stable from 2015 to 2020.

3.2 Funding Sources

In 2020, ratepayer dollars constituted 93.0 percent of funding for electric DSM programs in the United States. Remaining sources of funding included the wholesale capacity markets (two percent), the Regional Greenhouse Gas Initiative (one percent) and unidentified sources (four percent). Regional Greenhouse Gas Initiative (RGGI) funding constituted three percent of the total funding reported in the northeast region.

In 2020, ratepayer dollars constituted 100 percent of funding for natural gas energy efficiency programs in the United States.

In 2020, 100 percent percent of Canadian funding for both electric and natural gas DSM programs came from ratepayer funding.

3.3 Continued Program Funding

Since 2013, CEE has asked program administrators to report multiyear budgets, referred to in the survey and this report as "cycle budgets," that provide a glimpse into funding that has been set aside for DSM programs over the next several years. This is primarily a quality assurance procedure in that it allows CEE to verify that budgets for individual program years are not arbitrarily overreported and to estimate single-year budgets when program administrators do not allocate funds on an annual basis. In addition, because DSM activity may ramp up at the beginning of a cycle and down at the end of a cycle, this information explains—and anticipates—certain trends.

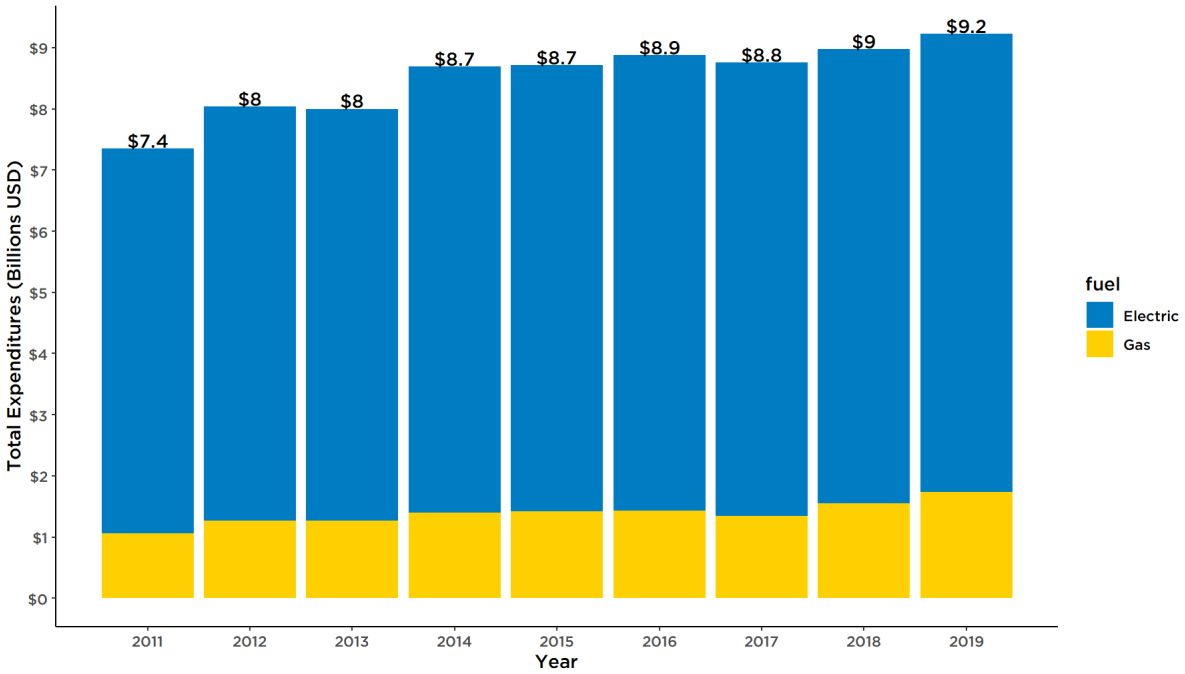
Roughly 47 percent of cycle budgets reported in this year's survey extend past the end of 2021—30 percent end in 2020, ten percent in 2021. Although procurement plans for supply-side energy resources may extend several decades into the future, this signifies that multiyear planning is also integral to DSM activity. Furthermore, in some areas, such as the Pacific Northwest and more recently California, DSM is already anticipated in resource plans spanning a decade or more.

3.4 Combined DSM Expenditures in the United States and Canada

DSM expenditures of US and Canadian program administrators incorporated in this year's survey totaled over $9.2 billion USD in 2019 (a three percent increase over 2018), including $8.7 billion in expenditures from ratepayer funds, an increase of about eight percent compared to 2018. The real difference between 2018 and 2019 is similar, with total DSM expenditures increasing about five percent from all sources when inflation is taken into

account. Figure 2 below illustrates the historic trend of combined US and Canadian DSM expenditures over the years.

Figure 2. **US and Canadian DSM Program Expenditures—Gas and Electric Combined 2010–2018**



Although not isolated in Figure 2, demand response expenditures represent 10 percent of total expenditures in 2018 independent of funding source. This is roughly the same proportion of total DSM expenditures spent on demand response in 2018, which was also around 10 percent, though still less than the proportion spent on demand response from 2011 to 2013, when demand response accounted for between 13 and 14 percent of total DSM program expenditures.

CEE has previously noted that increases in the number of survey respondents year after year could explain some of the historical growth in budgets, expenditures, and savings.[27] As explained in Section 2.1, Response Rates, despite our best efforts, Figure 2 does not depict expenditures year after year from the exact same pool of survey respondents.[28] However, the streamlined

[27] Please note that as the CEE survey panel now contains most large program administrators in the United States, and most of the larger program administrators in Canada. For the 2021 survey effort, CEE reexamined the Canadian panel and was able to improve the representativeness of the data but securing information for additional program administrators. CEE believes that since 2012, the United States panel of survey respondents targeted each year for data is representative of DSM industry at large.

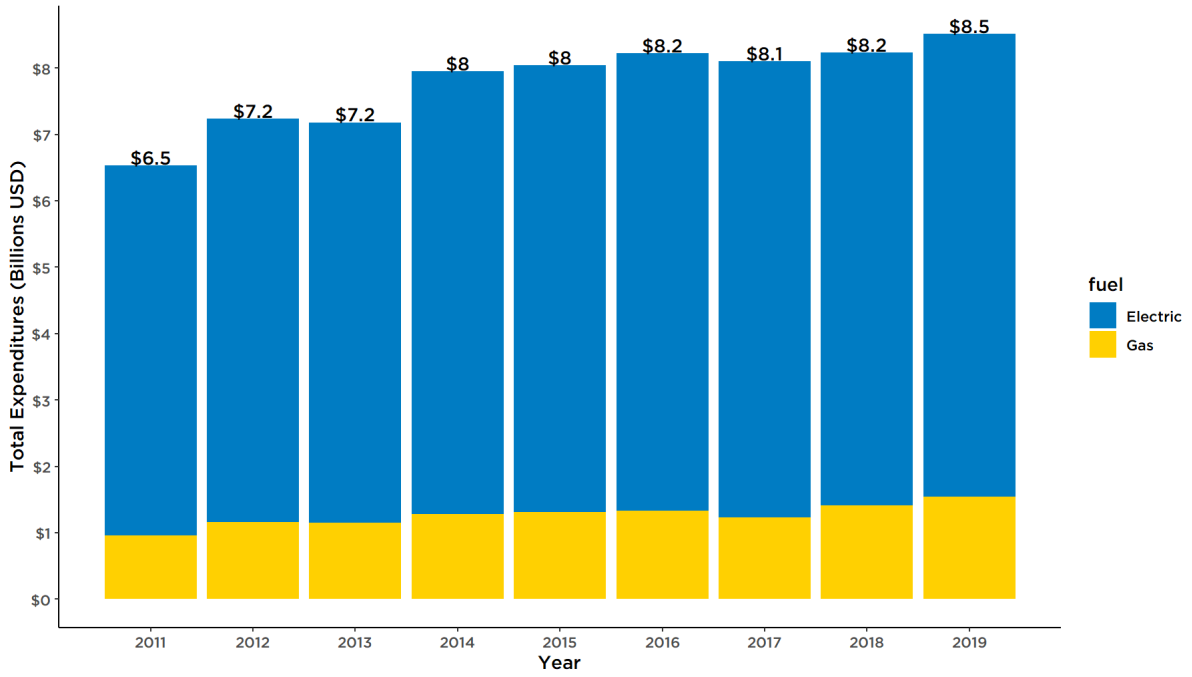
survey process described in Section 2.1, whereby electric responses from 2016to the present were supplemented with other information sources, in part resulted in an exceptionally similar pool of electric program administrators between those survey years.

3.5 United States DSM Trends

US administrators spent nearly $8.5 billion[29] from all sources for gas and electric DSM programs in 2018, as illustrated in 0. This total includes both energy efficiency and demand response.

[29] $8.0 billion of these expenditures were derived solely from ratepayers, an approximate nine percent increase from 2018 in nominal dollars, or an eleven percent increase when adjusted for inflation. Comparing to 2016, the proportion of expenditures from ratepayers increased around eight percent to 2019 in nominal dollars, or five percent when adjusted for inflation.

Figure 3. **US DSM Expenditures—Gas and Electric Combined 2010–2018**



2019 gas and electric DSM expenditures in the United States increased three percent over 2018 expenditures in nominal dollars, a five percent increase when adjusted for inflation. Over the past five years, US inflation-adjusted DSM expenditures have increased almost 15 percent. The $8.5 billion spent by US DSM program administrators represents 0.04 percent of 2019 US gross domestic product and 2.54 percent of the value added by the US utility industry to gross domestic product in 2019.[30]

In 2020, natural gas and electric DSM program administrators in the United States budgeted nearly $9.5 billion from all sources, an increaseof one percent relative to 2019

3.5.1 United States Electric DSM Trends

In 2019, US program administrators spent over $7.0 billion on electric DSM programs, a four percent increase compared to 2018 expenditures, or five percent when accounting for inflation.[31,32] Figure 4 below presents the

[30] Comparisons in this paragraph are based on data from the US Department of Commerce Bureau of Economic Analysis: https://www.bea.gov/iTable/index_industry_gdpIndy.cfm, Most recent update: April, 2021.
[31] In 2019, $6.7 billion of the total expenditures were derived solely from ratepayer funds. When adjusted for inflation, this represents an increase of five percent compared to the proportion of expenditures from ratepayers in 2018. In 2017, 90.6 percent of expenditures came from ratepayer funds, and in 2018, 87.3 percent of expenditures were derived from ratepayer funds.
[32]Inflation adjusted figures were based on the "CPI Inflation Calculator," Bureau of Labor Statistics, accessed May 2021, https://www.bls.gov/data/inflation_calculator.htm.

breakdown of US electric expenditures from 2010 to 2019 by customer class, which represents the sum of either program level data rolled up to customer classes or customer class data provided directly by respondents. "Not broken out"[33] contains data that program administrators could not allocate to a specific program or customer class.

Figure 4. **US Electric DSM Expenditures 2010-2019**

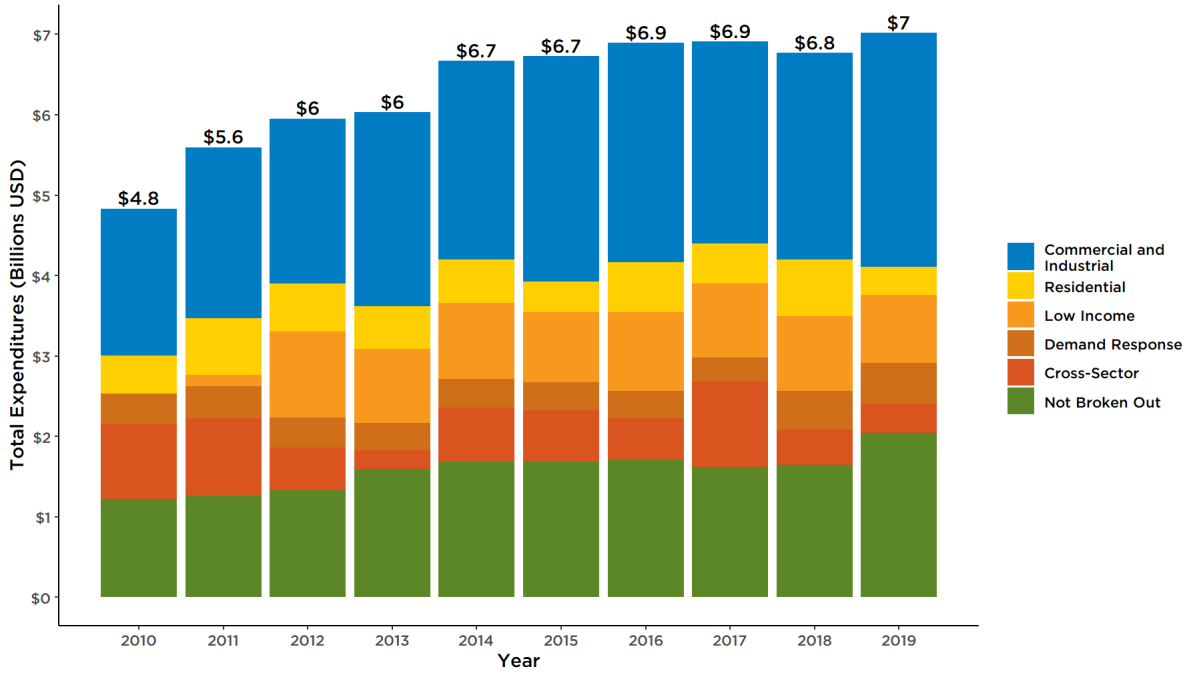
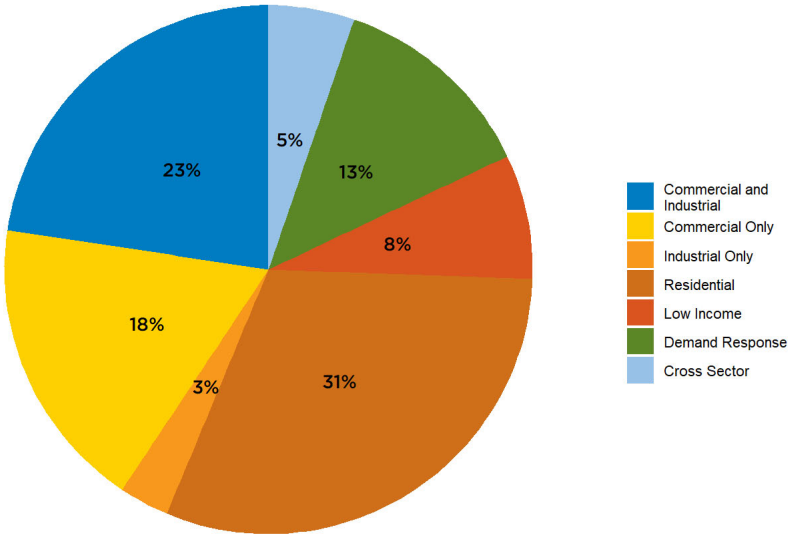


Figure 5 provides a more granular breakdown of 2019 US electric expenditures from all sources by customer class, with the “not broken out” class removed and with commercial and industrial spending separated into commercial, industrial, and C&I classes. Continuing the trend from previous years, the data illustrate that commercial and industrial efficiency programs received the largest share of electric program funding in the United States, comprising 44 percent of 2019 US electric DSM expenditures, a slight decrease in comparison to the 40 percent of 2018 US electric DSM expenditures these sectors constituted. The residential sector received the second largest share of 2019 DSM electric expenditures, 31 percent, an increase of about five percent compared with 2018. Demand response maintained a sizable portion of expenditures at 13 percent, a decrease of about one percent compared with 2017 and 2018 when demand response constituted 16 and 15 percent of total expenditures, respectivly. The remainder of spending was made up of cross sector, at five percent, and low income programs, eight percent.

Figure 5. **2019 US Electric DSM Expenditures by Customer Class**

[33] Please note that the "not broken out" class was added in 2011 to capture any expenditure figures that could not be allocated to individual customer classes, which in some cases includes overall portfolio activities such as EM&V or administration and marketing.



CEE also collected information on expenditure (cost) categories for electric energy efficiency programs, as depicted in 0.

Figure 6. **2019 US Electric Energy Efficiency Expenditures by Category**

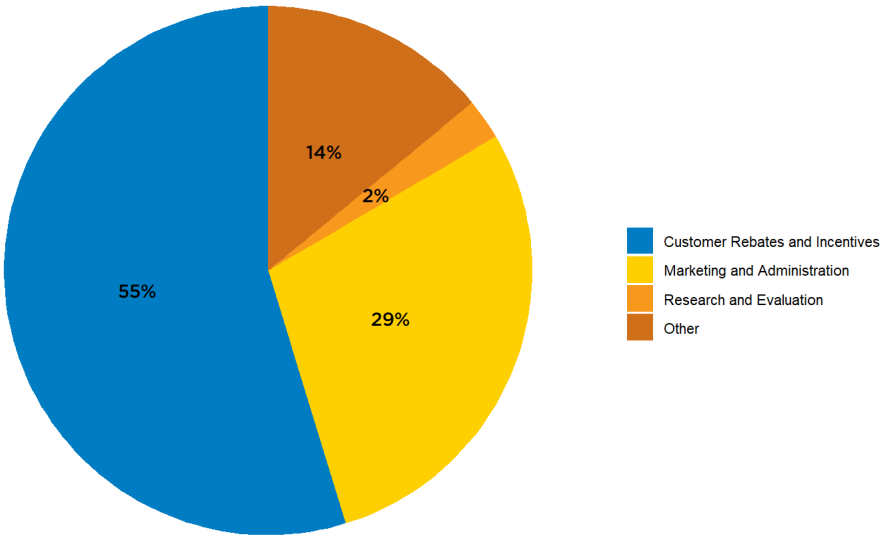


Figure 6 provides an overview of how US program administrators currently allocate electric energy efficiency program expenses, regardless of the targeted customer class. As in the past five years, customer rebate and incentive costs, sometimes classified as direct program costs, represented the largest share of US electric energy efficiency expenditures in 2019 . The "other" category contains all funds that US program administrators could not separate into one of the other three categories. Marketing and administration costs—often referred to as indirect program costs—represented 29 percent of 2019 energy efficiency program expenditures in the United States, a five percent increase in proportion relative to 2018.

3.5.2 United States Program Level Electric DSM Expenditures

Since 2013, CEE has incorporated questions into the US electric survey that ask respondents to report budgets, expenditures, and impact data at the program level when possible[34] (please refer to Section 2.5 for more details on program types). By collecting electric expenditures by program category, CEE intends to track and provide information to help better understand changes or trends in program offerings.

The data in this report represent 213 US electric program administrators, 102 of which provided energy efficiency or demand response expenditures directly in the survey for the program types listed. When data reported for

[34] Only electric respondents were asked to break their program expenditures down by the provided program typology. CEE will continue to work with members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

these program types are aggregated by customer class, they indicate an expenditure breakdown similar to that in Figure 5, which represents all 2019 expenditure data reported in the 2020 survey and includes expenditures from the remaining electric DSM program administrators that did not break out their information at the program level. Therefore, we conclude that the programmatic energy efficiency data we obtained in 2020 are representative of overall US electric expenditure trends.

Figure 7 lists the most common energy efficiency program types in terms of expenditures; these programs represent just over percent of all the programmatic energy efficiency expenditures reported by respondents. Demand response program expenditures are not listed in this report but are discussed in general in Electric Demand Response Program Expenditures.

Figure 7. **Most Common US Electric Energy Efficiency Program Types by 2019 Expenditures**

Customer Class	Program Type	2019 Expenditures
Residential	Other	$512,340,948
Low Income	-	$505,899,670
Commercial & Industrial	Custom	$424,293,642
Commercial & Industrial	Mixed Offerings	$362,467,529
Commercial	Other	$304,421,943
Commercial & Industrial	Prescriptive	$292,482,716
Commercial	Other	$244,543,407
Residential	Consumer Product Rebate – Lighting	$227,948,118
Commercial	Prescriptive Lighting	$173,369,745
Residential	Consumer Product Rebate – Appliances	$117,677,480

Unlike the previous five years where Commercial and Industrial Mixed Offerings program remain the most commonly funded program types, Figure 7 shows thatspending on low-income programs has taken over the top spot in terms of total spending. Commercial and Industrial Mixed Offerings Programs still represent a significant portion of total expenditures, as well as Prescriptive and Custom programs in the same class. For a full disclosure of the US electric energy efficiency program expenditures provided by survey respondents, please refer to List of US and Canadian Electric Energy Efficiency Program Category Expenditures.

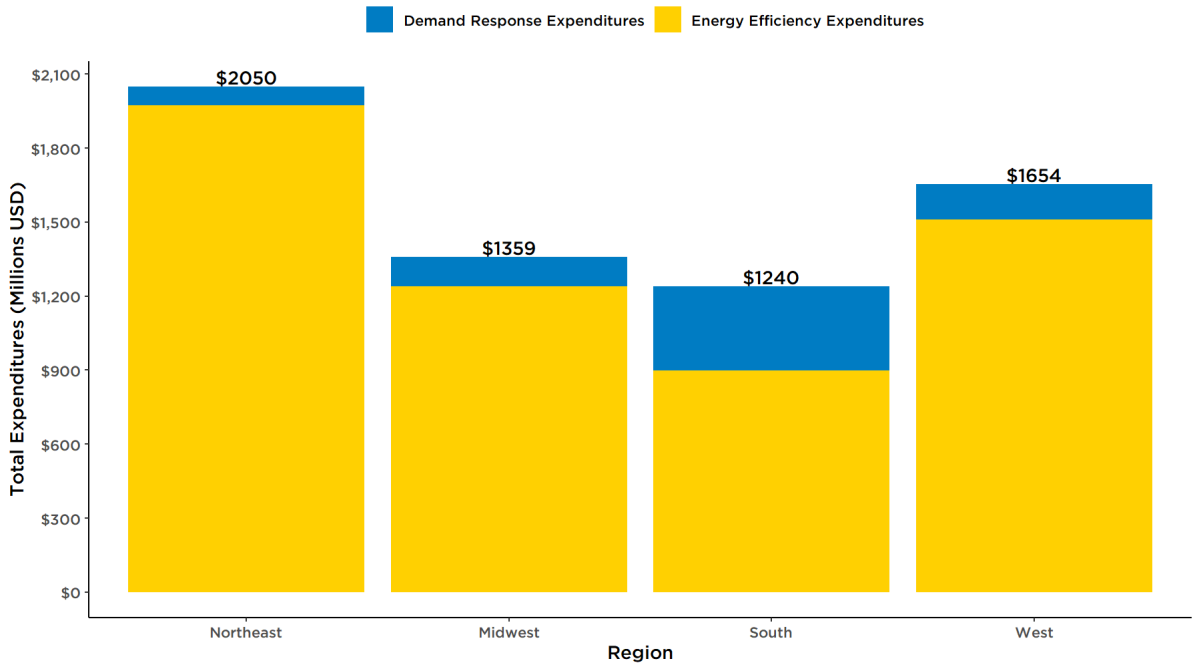
3.5.3 United States Electric Demand Response Expenditures

Consistent with 2017, approximately 51 percent of electric program administrators who reported 2018 energy efficiency program expenditures also provided demand response expenditures, which again suggests that the majority of US electric survey respondents administer both energy efficiency and demand response programs. Demand response expenditures represent

15 percent of US electric DSM expenditures in 2018 (see Figure 5), about the same percentage as in 2016 and 2017 (less by one percent). Demand response expenditures increased by eight percent compared to 2017 in nominal dollars, ten percent when accounting for inflation.

Figure 8 below provides a regional snapshot of DSM expenditures in the United States in 2018, separated into energy efficiency and demand response.

Figure 8. **US Electric Energy Efficiency and Demand Response Expenditures by Region, 2019**



Consistent with previous years, the South and West continue to lead in demand response expenditures. Data indicate that the South represents the highest proportion of demand response expenditures in 2019 (28 percent), followed by the West (nine percent), Midwest (nine percent) and Northeast (four percent). This regional breakdown is similar to 2017 and 2018 in rank order, but the proportion of the total coming from demand response programs is overall less. The Northeast (29 percent decrease, from $99 million to $77 million), South (52 decrease decrease, from $521 million to $342 million), Midwest (11 percent decrease, from $132 million to $119 million), and South (three percent decrease, from $149 million to $145 million) saw decreases in overall demand response spending from 2018 to 2019.

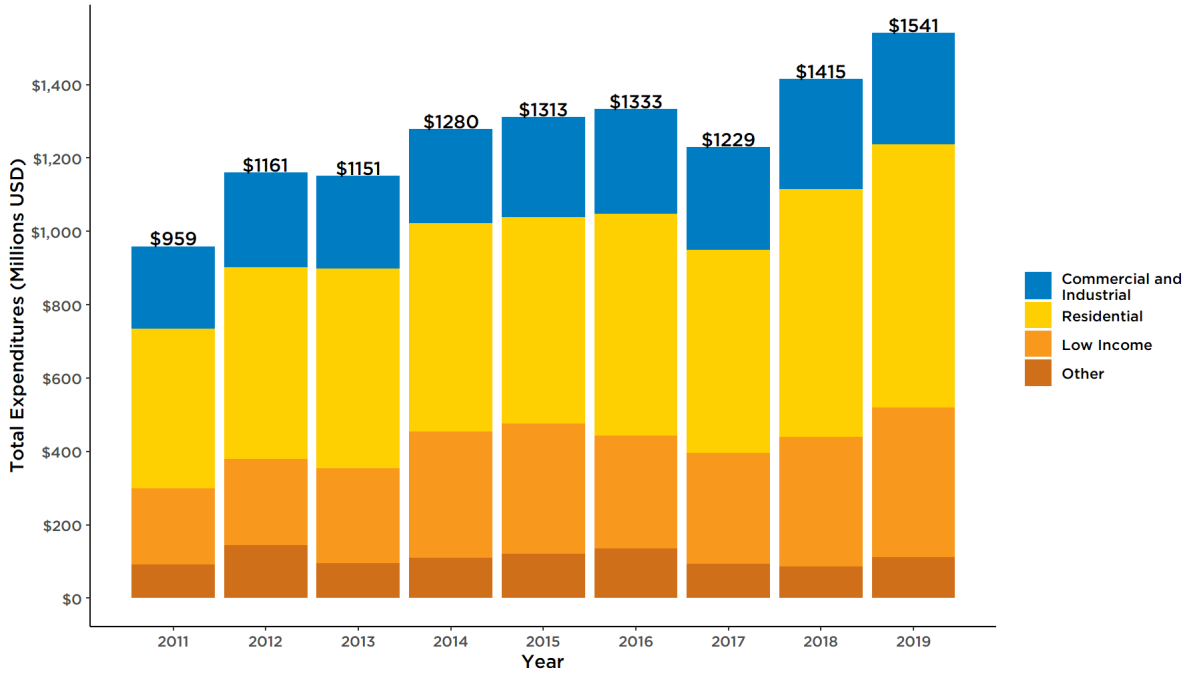
In 2013, CEE modified the demand response program categories to align with those used by FERC. (See Section 2.4 for more information.) FERC defines several demand response program types and groups them into two major categories: "incentive-based" programs and "time-based" programs. Electric Demand Response Program Expenditures contains charts and supporting information regarding these two categories of demand response programs.

3.5.4 United States Natural Gas Trends

This section discusses natural gas energy efficiency program expenditures in the United States.[35] 0 shows that gas program expenditures for energy efficiency programs in the United States increased nine percent between 2018 and 2019. US gas program administrators spent $1.541 billion on natural gas efficiency programs in 2019, an eleven percent increase compared to 2018 after accounting for inflation. This represents a 30 percent increase over 2014 when adjusted for inflation.

[35] Please note that natural gas programs are only energy efficiency programs. Natural gas demand response programs have only reached the pilot stage in a select number of cases within the industry and these efforts are not captured in this report.

Figure 9. **US Natural Gas Expenditures 2011-2019**

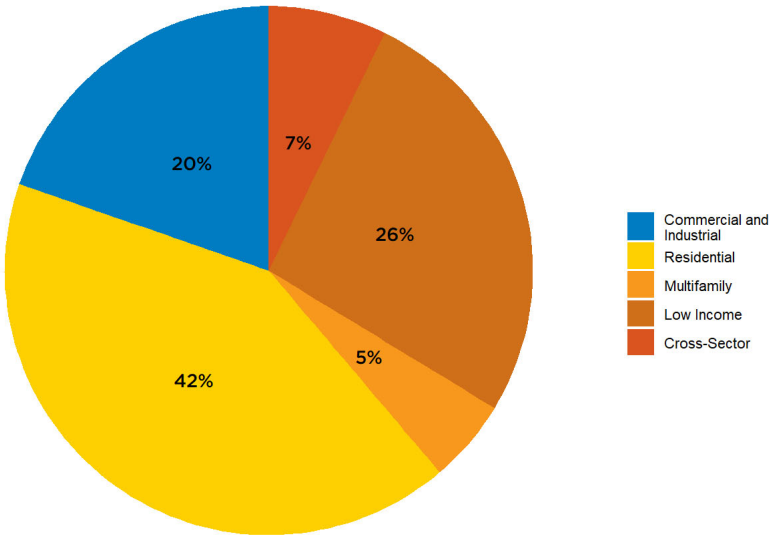


0 presents the magnitude of expenditures from 2011 to 2019 by customer class.[36] The customer class breakdown of 2019 natural gas expenditures is similar to that of 2018 expenditures for most categories.

0 provides a more granular breakdown of 2019 US gas expenditure by customer class. For ease of comparison with previous reports and with a concurrent report by AGA, we did not break commercial and industrial into separate classes in Figures 9 and 10, but multifamily expenditures are separated from residential expenditures in 0. Residential programs continue to represent the largest share of expenditures in 2019 at 42 percent, a decrease of one percent as compared to 2018. Low income and C&I programs follow, accounting for 26 percent and 20 percent of expenditures respectively. Cross-sector expenditures represented seven percent and multifamily expenditures five percent of total expenditures.

[36] For ease of year-to-year comparison, note that 0 combines the commercial and industrial customer classes into one commercial and industrial category, as well as the residential and multifamily customer classes into one residential category, for 2011 through 2019.

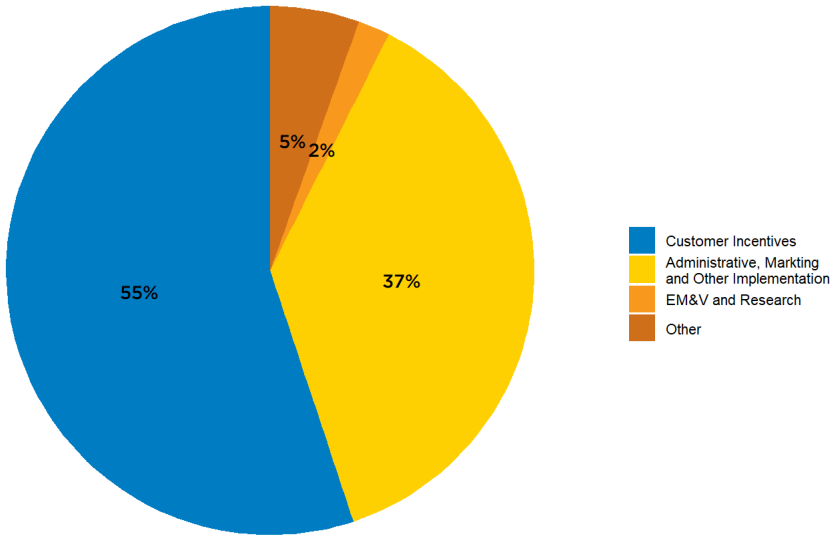
Figure 10. **2019 US Natural Gas Expenditures by Customer Class**



0 separates 2019 gas expenditures in the United States into expenditure categories, which are slightly different from the categories used for US electric programs.[37]

[37] The electric and gas surveys request this information in ways that are similar, though not identical.

Figure 11. **2019 US Natural Gas Expenditures by Category**



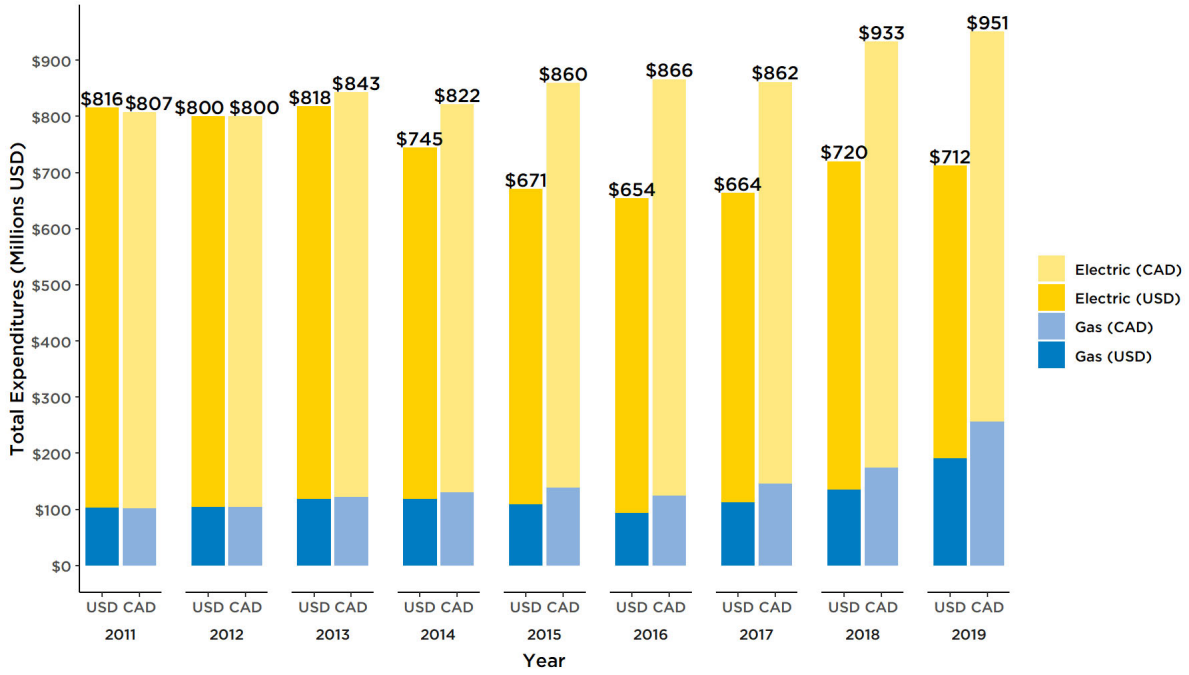
As in 2017 and 2018, customer incentives represented around half of expenditures in 2018 (55 percent) followed by administrative, marketing, and other implementation spending (37 percent). Research, evaluation, measurement, and verification accounted for five percent of the spending, while "other" expenditures accounted for two percent of spending. The "other" category contains all funds that could not be separated into the three specific categories; the proportion of funds identified as “Other” were unusually high in 2018 (24 percent), and the 2019 data showed a return to the proportion of expenditures recorded in the2017 report.

3.6 Canadian DSM Trends

In 2019, Canadian DSM expenditures reached $712 million USD, or $951 million CAD. This represents a slight decrease in overall spending of roughly one percent in USD, or an increase of about one-half of a percent when adjusted for inflation; when considered in CAD, expenditures increased about two percent between 2018 and 2019. Figure 12 below presents Canadian DSM expenditures—including both energy efficiency and demand response programs—from 2011 to 2019 in nominal US and Canadian dollars. Overall, Figure 12 illustrates stable investment by Canadian gas and electric DSM program administrators over the last five years.[38]

[38] This year CEE and AGA attempted to exand the panel of Canadian program adminsitrators represented in our dataset and successfully added several additional administrators that have previously not been captured. In these several cases we received data for 2019 expenditures and 2020 budgets as well as information for one or more back years. This report includes all previously unreported data where possible.

Figure 12. **Canadian DSM Expenditures—Gas and Electric Combined (2011–2019)**



The $951 million CAD spent by Canadian DSM program administrators represents 0.06 percent of 2019 Canadian Gross Domestic Product and two percent of value added by the Canadian utility industry in 2019.[39]

In 2020, reporting natural gas and electric DSM program administrators in Canada budgeted nearly $725 million, or roughly $968 million CAD, to energy efficiency and demand response programs.This represents an 15 percent increase over 2019 DSM budgets in inflation-adjusted USD.

3.6.1 Canadian Electric DSM Trends

CEE reports electric DSM trends by customer class and, as discussed in previous sections, asks survey respondents to report budgets, expenditures, and impact data at the program level when possible.[40] Respondents who were able to provide these data were asked to select a specific program type for each program (see Section 2.4 and Electric Energy Efficiency Program

[39] Comparisons in this paragraph are based on data from Statistics Canada: Statistics Canada. *Table 379-0031 Gross Domestic Product (GDP) at basic prices, by North American Industry Classification System (NAICS), Monthly* (table). CANSIM (database). Last updated April 20, 2021. https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610043401#timeframe. (accessed April 20, 2021).

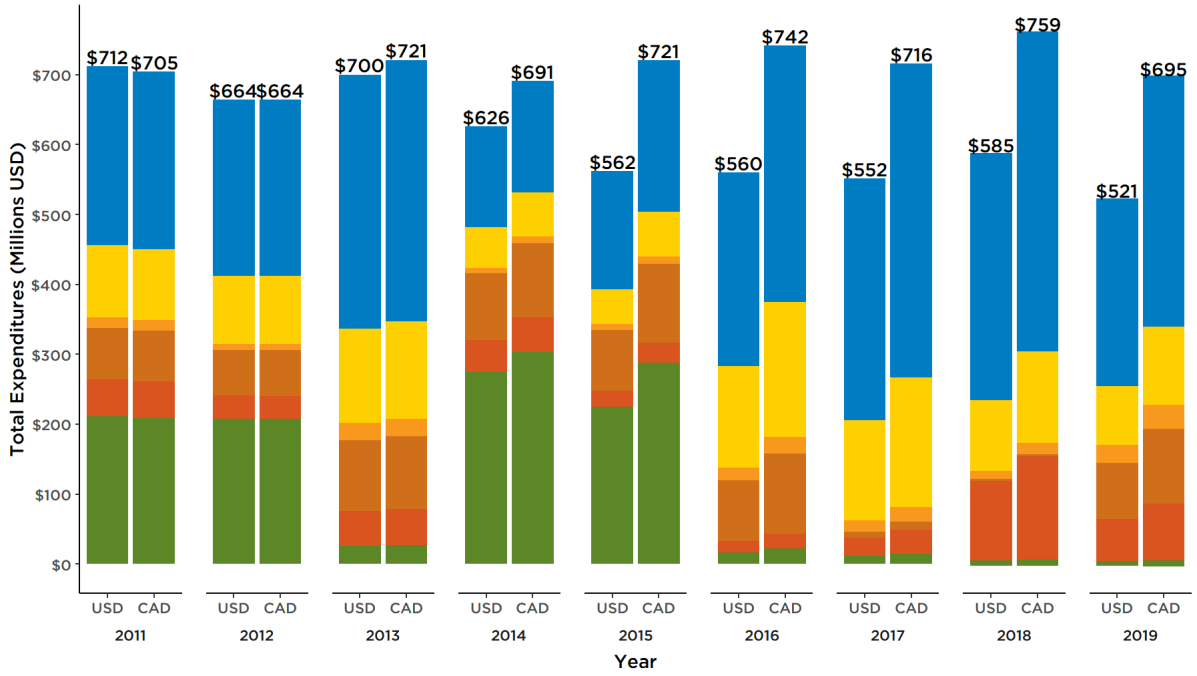
[40] Only electric respondents were asked to break their program expenditures down by the provided program typology. CEE will continue to work with members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

Categories for more information); CEE then aggregates these data in order to report figures for customer class comparisons.

Canadian electric DSM expenditures totaled nearly $521 million USD ($695 million CAD) in 2019, as shown in 0[41] below.

[41] 0 combines the 2019 customer classes of commercial, industrial, and C&I into the "commercial and industrial" category. Where possible, these categories are separated out in Figure 14.

Figure 13. **Canadian Electric DSM Expenditures 2010-2019**



The $695 million CAD spent on electric DSM programs in Canada in 2019 represent an eight percent decrease from 2019 expenditures, also a ten percent decrease when adjusting for inflation. 2019 shows a consistent trend in sector level trends with the exception of demand response. Demand response expenditures returned to proportions similar to 2016, reversing the significant decrease in reported DR expenditures in 2017 and 2018. This change was attributed to two large program administrators who reported a significant increase in their demand response spending in 2019 as compared to 2017 and 2018..

In 2011, CEE added the "not broken out" class to capture any expenditures program administrators could not allocate to individual customer classes,[42] which in some cases includes overall portfolio activities such as EM&V or administration and marketing. Expenditures for 2014, and 2015 allocated to the “not broken out” category were high due to at least one large program administrator not responding in those survey years. In these cases, CEE carried through the previous years’ total expenditures as to develop a “straight line” estimate instead of letting their expenditures drop to zero. The prior expenditures for such program administrators were carried into the respective survey year’s data as an estimate in the "not broken out" category. However, in 2017 through 2019this program administrator was able to

[42] See Section 2.4 above for more detail about the collection and differentiation of budgets, expenditures, and savings in the 2019 survey.

respond to the survey, showing a significant reduction in expenditures reported as "not broken out" and allocated other sector-level categories.

Figure 14 below depicts 2019 Canadian electric DSM expenditures on a more granular level, broken out by customer class and excluding the "not broken out" category. Commercial and Industrial expenditures continue to constitute the largest proportion of spending in Canada in 2019 at about 40 percent. Residential represents the second highest proportion of total Canadian electric DSM spending at 30 percent and increase from the three percent observed in 2018.

Figure 14. **2019 Canadian Electric DSM Expenditures by Customer Class**

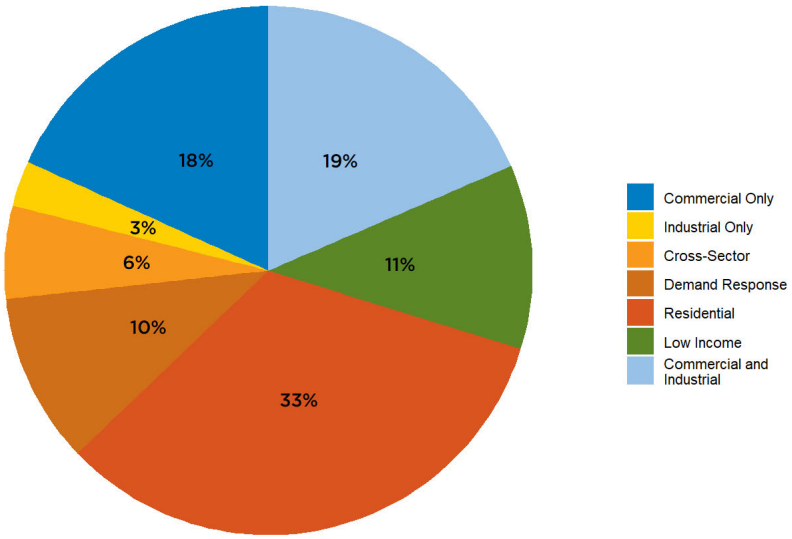
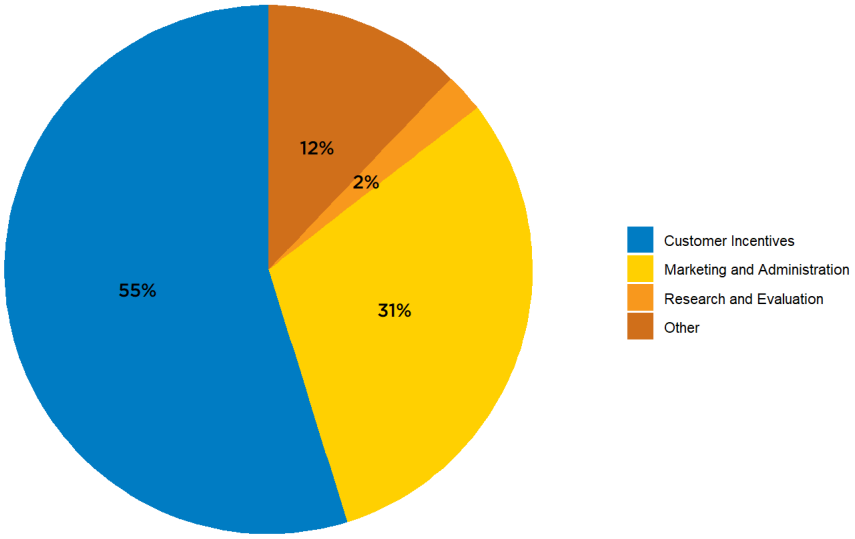


Figure 15 presents the classification of 2019 electric energy efficiency expenditures in Canada by cost category. Customer rebates and incentives represented just over half (55 percent) of 2019 expenditures, followed by marketing and administration (31 percent) and research and evaluation (two percent). The "other" category, which contains all funds that could not be separated into the previous three categories, represented 12 percent. This breakdown is very similar to 2018 ratios.

Figure 15. **2018 Canadian Electric Energy Efficiency Expenditures by Category**



3.6.2 Canadian Program Level Electric DSM Expenditures

Although not depicted in Figure 15 above, in 2019 Canadian program administrators budgeted $543 million (over $725 million CAD) for electric DSM programs. This represents a eight percent increase from 2019 budgets.

Since 2013, CEE has collected program administrator information in more granular categories for each electric customer class in order to begin to better understand what types of electric programs, and possibly what products and systems, are most common in the industry. CEE has incorporated questions into the electric survey that ask respondents to report budgets, expenditures, and impacts data at the program level if possible[43] (please refer to Section 2.4 for more details on program categories). These data, aggregated to customer class, indicate a breakdown similar to that in Figure 14, as all Canadian electric program administrators were able to provide program level data in this year's survey. Therefore, we conclude that the program level data we obtained in 2019 are representative of overall Canadian electric energy efficiency expenditure trends.

Figure 16 lists the most common energy efficiency program types in terms of expenditures, excluding program funding categorized as "other." Demand

[43] CEE incorporated program level questions for the electric survey only. CEE will continue to work with our members and with AGA in the future to determine whether this approach is feasible for the gas program administrators surveyed.

response program level expenditures are not listed in this report but are discussed in general in Electric Demand Response Program Expenditures.

Figure 16. **Most Common Canadian Electric Energy Efficiency Program Types by 2019 Expenditures**

Customer Class	Program Type	2018 Expenditures (USD)	2018 Expenditures (CAD)
Commercial & Industrial	Mixed Offerings	$ 105,127,150	$ 140,344,745
Commercial	Prescriptive – Lighting	$ 45,431,687	$ 60,651,303
Industrial	Custom – Industrial or Agriculture Processes	$41,599,927	$55,535,903
Cross Sector	Other	$ 27,650,718	$ 36,913,709
Low Income	–	$ 26,357,123	$ 35,186,760

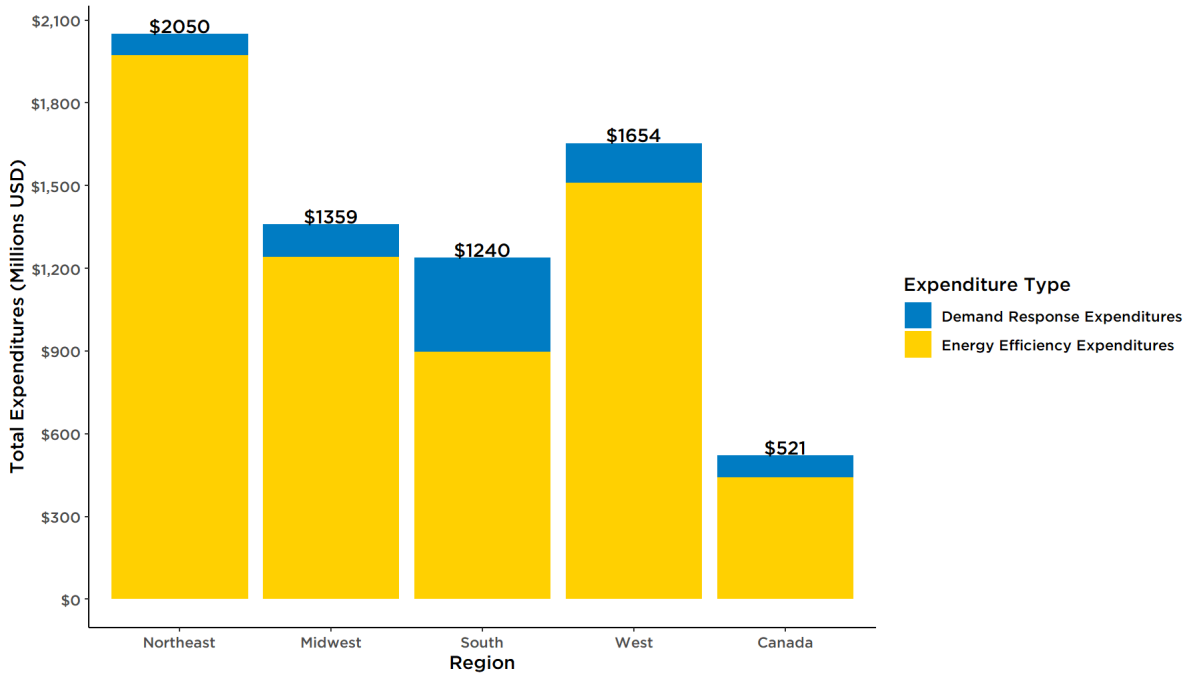
For a full disclosure of the Canadian electric energy efficiency program expenditures provided by survey respondents, please refer to List of US and Canadian Electric Energy Efficiency Program Category Expenditures.

3.6.3 Canadian Electric Demand Response

The Canadian electric program administrators captured in this study spent just under $80 million USD, or around $107 million CAD, on their demand response programs in 2019, returning to demand response expenditures levels similar to those reported for 2016, when demand response expenditures were around $87 million USD ($115 million CAD). The demand response expenditures for 2017 and 2018 captured in the study totaled less than $10 million; we believe this to be the result of missing data in those years from some key Canadian program administrators and the dramatic increase in expenditures is unlikely to represent any real significant change in the Candian DSM program landscape.[44] Demand response accounted for about 15 percent of total Canadian electric DSM expenditures (see Figure 14).

[44] See footnote 40 in 3.6 section for discussion of efforts to expand the Canadian panel in 2020.

Figure 17. **US and Canadian Electric DSM Expenditures by Region, 2019**



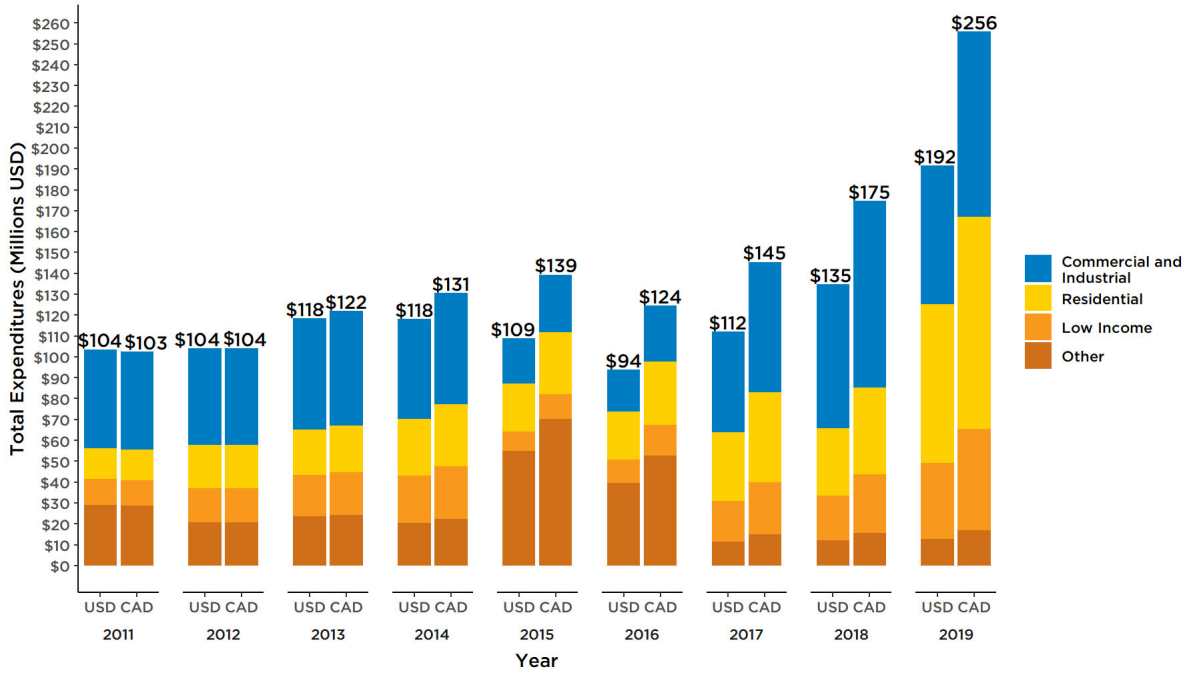
Similar to the 2019 report, Canadian demand response expenditures could not be broken out by program type in this year. See Electric Demand Response Program Expenditures for more information. [45]

3.6.4 Canadian Natural Gas Trends

In 2019, Canadian natural gas program expenditures (in CAD) increased by 42 percent compared to 2018 expenditures. 0 indicates that Canadian program administrators reported 2019 expenditures of $192 million USD, or $256, million CAD.

[45] In 2013, CEE modified the demand response program categories to align with those used by FERC. (See Section 2.4 for more information.)

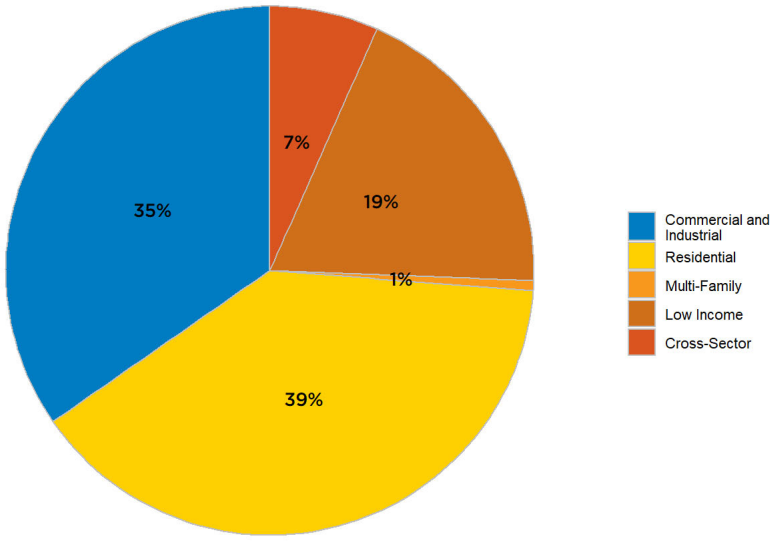
Figure 18. **Canadian Natural Gas Expenditures 2010-2019**



For ease of comparison between years, note that for 2013 onwards 0 combines the commercial and industrial sectors into one "commercial and industrial" customer class and the residential and multifamily sectors into one "residential" customer class, as these categories weren't broken out prior to 2013.

0 shows that unlike 2017 and 2018, where commercial and industrial programs continue to accounted for the largest share of Canadian natural gas efficiency program expenditures, residential program expenditures accounted for the largest share (39 percent) in 2019. Commercial and industrial expenditures accounted for the second largest proportion (35 percent) followed by low-income (19 percent), cross-sector (seven percent), and multi-family (one percent) program expenditures. For ease of comparison with previous years' reports and with a concurrent report by AGA, we did not break commercial and industrial into separate classes in 0 and0, but multifamily expenditures are separated from residential expenditures in 0.

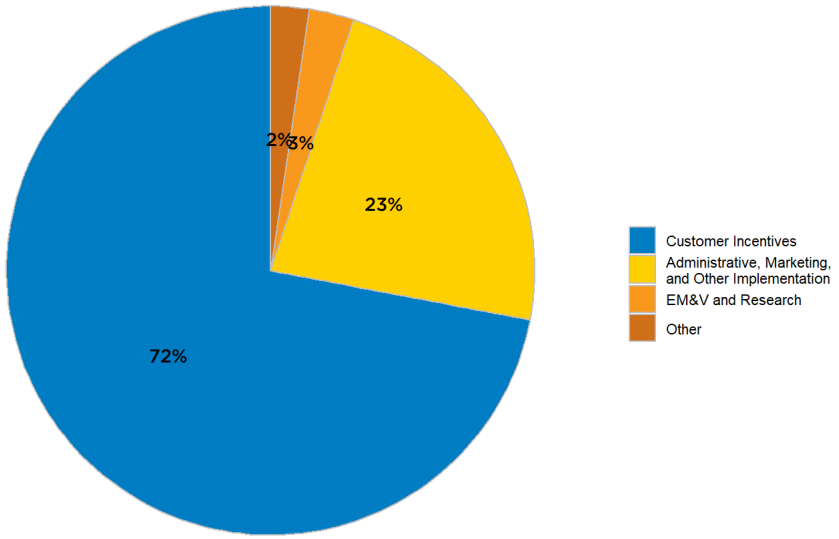
Figure 19. **2019 Canadian Natural Gas Expenditures by Customer Class**



In 0, Canadian gas expenditure data are broken out into slightly different cost categories than those used in the electric data sections of this report.[46]

[46] The electric and gas surveys request this information in ways that are similar, though not identical.

Figure 20. **2019 Canadian Natural Gas Expenditures by Category**



As in previous reports, the year-to-year category breakdown of Canadian natural gas expenditures remained similar, with customer incentives representing almost three-quarters of expenditures in 2019 (72 percent, up two percent from 2018). This increase was offset largely by slight decreases in EM&V and research, and other implementation (from four percent in both categories 2018 to three and two percent in 2019, respectively). administratrive, marketing and other implementation expenditures accounted for 23 percent of spending, the same proportion as 2018.

Canadian natural gas program administrators budgeted $182 million (approximately $249 million CAD) for programs in 2020, which is an increaseof almost 30 percent as compared to 2018.

4 Evaluation, Measurement and Verification

CEE, along with AGA, asked survey respondents to report spending on research and EM&V in 2019. Respondents to the electric survey were asked to provide the percentage of their total 2019 energy efficiency expenditures allocated to EM&V, whereas respondents to the gas survey were asked to provide the dollar amount.[47] Figures 21 and 22 below present the 2019 EM&V

[47] As in the past five years, electric EM&V expenditures in this report exclude demand response.

expenditures for electric and gas energy efficiency programs in the United States and Canada.[48]

Figure 21. **US and Canadian Electric EM&V Expenditures**

Country	2019 EM&V Expenditures (Millions USD)	Total 2019 Energy Efficiency Expenditures (Millions USD)	EM&V % of Total Expenditures
United States	134	6,125	2%
Canada	16	441	3%
Total	151	6,566	2%

Note: This table includes estimates of EM&V expenditures for electric EE programs that were derived by multiplying total reported expenditures (from all sources) by an EM&V percentage reported by respondents. Total 2019 expenditures only include data from those respondents who provided a percentage breakout of expenditures by category and are therefore smaller than total EE expenditures listed earlier in the report.

Figure 22. **US and Canadian Natural Gas EM&V Expenditures**

Country	2019 EM&V Expenditures (Millions USD)	Total 2019 Energy Efficiency Expenditures (Millions USD)	EM&V % of Total Expenditures
United States	31	1,578	2%
Canada	5	192	3%
Total	36	1,770	2%

Not all respondents allocate funding for evaluation purposes on an annual basis, and some respondents simply did not respond to this portion of the survey. Among those program administrators that broke out their energy efficiency expenditures by category, 60 percent of US and Canadian electric energy efficiency program administrators and 66 percent of US and Canadian gas program administrators indicated 2019 EM&V expenditures. EM&V expenditures comprised between two and three percent of 2019 energy efficiency expenditures in the United States and Canada, which is roughly consistent with the proportions of between two and five percent reported in between 2016 and 2018.[49]

[48] Please note, however, that the total electric expenditures in these figures only include data from program administrators who provided expenditure breakouts by category, so they may be smaller than the expenditure totals presented earlier in this report.
[49] "Energy Efficiency Program Impact Evaluation Guide," State and Local Energy Efficiency Action Network, State & Local Energy Efficiency Action Network's Evaluation, Measurement, and Verification Working Group, last modified December, 2012, https://www4.eere.energy.gov/seeaction/system/files/documents/emv_ee_program_impact_guide_0.pdf, 7-14.

Since programs and their evaluation procedures do not necessarily occur at the same time, CEE urges caution when comparing program expenditures to expenditures allocated for EM&V activities in any given year.

5 Estimated Program Savings and Environmental Impacts

CEE collected data on energy efficiency savings from gas and electric program administrators in 2019. In order to help respondents report their savings consistently across states and provinces, CEE used the Energy Information Administration (EIA) definitions of incremental savings. According to EIA Form EIA-861, incremental savings include all energy savings that accumulated in 2019 from new 2019 participants in existing energy efficiency programs and from all participants in new 2019 programs.

CEE collected two different categories of savings values in the survey: net incremental savings and gross incremental savings.[50,51] In keeping with previous reports, this report focuses on gross incremental savings. We emphasize gross incremental savings because they are the most widely tracked savings in the industry. Gross incremental savings are also the most comparable across the United States and Canada because they contain the fewest assumptions embedded in them. In addition, gross savings provide the most useful metric for energy system planners because they include all the savings that occur, regardless of whether they were directly caused by the particular program being evaluated. On the other hand, evaluators and regulators often use net savings to measure against savings goals or to plan subsequent programs because they include only those savings that resulted directly from the program under evaluation. In all tables, CEE intended to only aggregate gross savings figures, but because program administrators do not always report gross savings values in the survey, CEE uses net savings where gross savings were not available.[52]

[50] Gross savings generally include all savings claimed by a program, regardless of the reason for participation in the program.
[51] Net savings exclude whatever is typically excluded in the jurisdictions of reporting organizations. This often includes, but is not limited to, free riders, savings due to government mandated codes and standards, and the "natural operations of the marketplace," such as reduced use because of higher prices and fluctuations in weather or business cycles. Also depending on the jurisdiction, net savings sometimes incorporate additional savings resulting from spillover and market effects, which may outweigh the factors noted above and result in values that are greater than gross savings.
[52] CEE worked closely with our collaborator AGA to collect savings information from survey participants. This includes collection of "annual" savings, which are incremental savings plus savings in the current year from measures that were implemented in previous years but are expected to still achieve savings. In some cases, AGA has elected to emphasize different savings data collected jointly through this effort than what CEE has chosen to emphasize. For more information on what AGA has published specifically and why, please refer to the reports that are publicly available on their website.

Although CEE worked with survey respondents to ensure they reported savings data as consistently as possible, many organizations calculate and report savings according to requirements in their states or provinces, which may not align exactly with EIA definitions. Not all organizations adjust their estimates to reflect EIA definitions. Finally, due to the timing of the request and differing evaluation cycles across organizations and jurisdictions, savings were often reported prior to evaluation and are subject to change.

5.1.1 Ratepayer Funded Electric Energy Efficiency Program Savings

Ratepayer funded energy efficiency programs save energy and reduce the amount of greenhouse gases emitted in the United States and Canada. As such, energy efficiency is well positioned as a cost-effective tool for meeting carbon dioxide reduction targets at both the state and national level. Reporting electric efficiency programs in the United States and Canada estimated incremental electricity savings of approximately 40,805 GWh in 2019 (see Figure 23). This is equivalent to over 28.8 million metric tons of avoided CO_2 emissions.[53]

As noted in Section 2.2 above, this report focused only on ratepayer funded programs in previous years. Since 2013, CEE and our collaborators have collected information on electric programs derived from all funding sources in order to provide a more comprehensive picture of the DSM industry. Figure 23 and 0 below show all electric energy efficiency savings by sector and totals for both ratepayer funded programs and for programs that received funding from other sources.

Figure 23. **US and Canadian Gross Incremental Electric Energy Efficiency Savings, 2019 (GWh): Ratepayer and All Sources Totals***

	Residential	Low Income	C & I	Other	No Breakout	Ratepayer Total	All Sources Total
United States**							
Northeast	1,708	65.9	1,916	53	913	4,655	5,483
Midwest	2,029	74.5	2,740	69	7,174	12,087	12,164
South	2,016	92.8	1,626	28	655	4,418	4,431
West	2,451	192	3,121	2,126	215	8,105	8,105
US Subtotal ** *	**10,086**	**425**	**11,012**	**2,276**	**8,957**	**32,755**	**33,672**
Canada****	**161**	**25.4**	**910**	**0**	**5,584**	**7,083**	**7,133**

[53] Calculated using the EPA Greenhouse Gas Equivalencies Calculator, epa.gov/energy/greenhouse-gas-equivalencies-calculator. April 2019.

Binational Total	10,274	450	11,922	2,679	14,541	39,839	40,805

* Based on estimated total of all energy savings that accumulated from new participants in existing programs and all participants in new programs in 2019.

** One hundred (100) percent of electric survey respondents in the United States that reported EE programs reported a value for incremental energy savings. Of those that reported a value for incremental energy savings, 94 percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

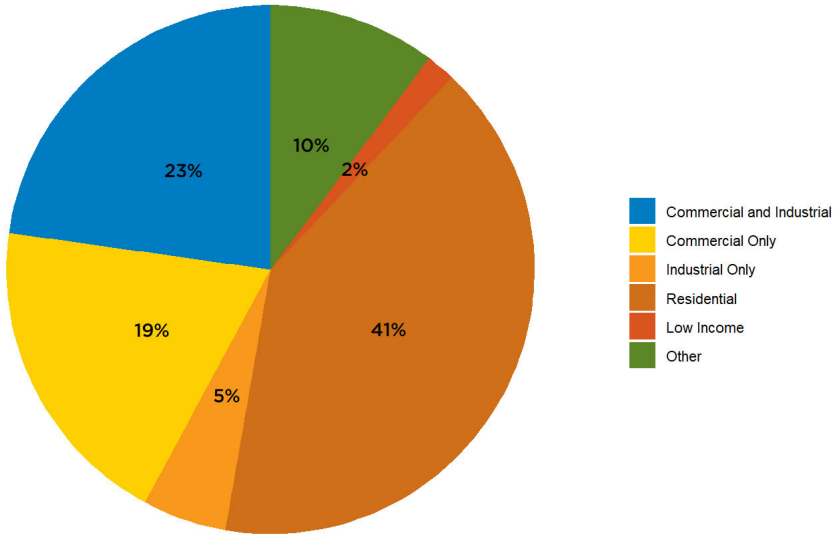
*** The US subtotal includes savings from program administrtaors that were not assigned to a region during data collection. These program administrators represent very small programs that were summed and entered into the data together as one line without specific regional or other firmographic identification information. Therefore, the sum of the preceeding regional breakouts is not equivalent to the sum presented here in the US subtotal.

*** One hundred (100) percent of electric survey respondents in Canada that reported EE programs reported a value for incremental energy savings. Of those that reported a value for incremental energy savings, fifty-eight (58) percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

Figure 24 shows that across the United States and Canada, commercial and industrial electric programs together accounted for about half of the total energy savings (47 percent), followed by residential (41 percent), and low income (two percent). This breakdown is similar to that of US and Canadian electric energy efficiency expenditures, with the exception that the low income customer class makes up a smaller percentage of savings (two percent) than of expenditures (eight percent) and that the residential customer class makes up a larger percentage of savings (41 percent) than of expenditures (30 percent). These findings are also reasonably consistent with the last five years of survey results, reinforcing these relative relationships of savings and expenditures by sector. Low-income programs are generally mandated for the public benefit, and while they may not result in high savings, they may result in significant benefits for program administrators in the form of reduced arrearages and for customers in the form of lower energy bills and higher disposable income. This likely explains the difference in the proportions of expenditures and savings represented by low income programs.

As noted in Section 2.4, respondents to the survey may interpret the categories differently, and not all respondents broke their information out by customer class. Therefore, Figure 24 represents only those savings reported at the customer class level and does not include the savings reported as "No Breakout" in Figure 23.

Figure 24. **2019 US and Canadian Gross Incremental Electric Energy Efficiency Savings by Customer Class**



Based on the gross incremental savings figure for electric efficiency programs provided in Figure 23 above, in 2019 the value of electric energy efficiency savings across the United States and Canada was over $4.1 billion.[54,55]

[54] US electric retail values were calculated based on the average retail price of electricity to ultimate customer by end use sector across the United States in 2019 using data from the Electric Power Monthly December 2019 issue, which contains YTD 2019 data. Average electric rates used: $ 0.1268 per kWh (residential), $0.1032 (commercial), and $0.0638. (industrial). The residential retail rate was used for low income program savings. The rate for combined C&I programs was determined by taking the average of the commercial and industrial retail rates. The rate for "other" programs was determined by taking the average of the residential, commercial, and industrial retail rates. "Electric Power Monthly: Table 5.3. Average Price of Electricity to Ultimate Customers," Energy Information Administration, last modified March 2019, accessed April 2019, eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_03.

[55] Canadian electric retail values were calculated based on the average rate per kWh across major Canadian cities in 2019 using data from an analysis maintained by Hydro Quebec titled "Comparison of Electricity Prices in Major North American Cities." Average electric rates used: $ 0.1304 CAD per kWh (residential), $0.0934 CAD per kWh (large energy customers). The large energy customer rate was used for commercial, industrial, and C&I savings. The residential retail rate was used for low income program savings. The rate for "other" programs was determined by taking the average of the residential and the large energy customer retail rates. The residential figure is an average of the rates for 12 major cities in Canada, and commercial and industrial figures an average of those for the associate utilities of those cities and may not reflect the average electricity price for Canada as a whole. "Comparison of Electricity Prices in Major North American Cities," Hydro Quebec, accessed June 2021, https://www.hydroquebec.com/data/documents-donnees/pdf/comparison-electricity-prices.pdf.

Beginning in 2013, CEE asked respondents to provide estimates of capacity savings from their energy efficiency programs. Capacity savings estimates are depicted below in 0.

Figure 25. **2019 US and Canadian Electric EE Gross Incremental* Capacity Savings (MW)**

	Residential	Low Income	C & I	Other	No Breakout	Ratepayer Total	All Sources Total
United States**							
Northeast	44	8	105	44	648	**849**	**847**
Midwest	362	16	434	9	795	**1,616**	**1,616**
South	219	15	252	0	262	**748**	**707**
West	608	52	441	7	727	**1,836**	**1,835**
US Subtotal	**2,091**	**91**	**2,282**	**61**	**2,433**	**6,957**	**6,912**
Canada***	702	30	469	445	1,121	2,767	2,767
Binational Total	**2,794**	**121**	**2,751**	**506**	**3,554**	**9,725**	**9,680**

* Based on estimated total of all capacity savings that accumulated from new participants in existing programs and all participants in new programs in 2019.

** Eighty-four (84) percent of electric survey respondents in the United States that reported energy efficiency programs reported a value for incremental capacity savings. Of those that reported a value for incremental energy savings, 95 percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

*** Elghty-three (83) percent of respondents in Canada that reported energy efficiency programs reported a value for incremental capacity savings. Of those that reported a value for incremental savings, 60 percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

Unlike energy savings, which are reported in kilo-, mega-, or gigawatt hours and measure the amount of energy saved over time, capacity savings are measured in kilo-, mega-, or gigawatts and represent reductions in demand forecast to occur at a particular time, generally during hours of peak demand. The capacity savings that result from energy efficiency programs can be very valuable, particularly in areas with constrained transmission capacity or high summer or winter peaks.

5.1.2 Electric Demand Response Program Savings

Beginning in 2015, CEE asked demand response program administrators to report the number of events called for each of their demand response programs, the average savings per event, and each program target (summer peak, winter peak, another peak, or "non-peak," which refers to a target other than a peak). Survey respondents could designate their programs as having more than one target.[56] Respondents only reported eleven "other peak" programs and eight "non-peak" programs, and the majority of programs in each of these categories were identified as having multiple targets. Thus, the

[56] Note that program target is separate from program type, for example, direct load control. Savings by program type are not analyzed here.

savings for "other peak" and "non-peak" programs reported below are likely overestimates at the expense of summer and winter peak programs. CEE may consider soliciting more information on "other peak" and "non-peak" programs in the future in order to better estimate the associated savings.

For 2019, we report both the total number of events run and average MW savings per event below, grouped by region and program target. As in 2018 and 2019, in 2020 CEE did not ask respondents for their peak duration and therefore could not calculate total MWh savings from the total savings below. Together, CEE believes the number of events and average MW reductions per event provide a reasonable indicator of program activity in the industry. However, CEE also acknowledges that as demand response activity continues to shift with the evolution of the energy industry, we may need to revisit which metrics are most representative of demand response activity.

Figure 26. **Number of DR Events Called by US and Canadian Electric Program Administrators by Program Target and Region**

	Summer	Winter	Other Peak	No Peak	All
Northeast	-	136	-	-	**136**
Midwest	50	137	11	7	**205**
South	25	272	-	-	**297**
West	98	511	-	3	**612**
Canada	-	-	-	-	**-**
Total	**173**	**1056**	**11**	**10**	**1,250**

As shown in Figure 26, US and Canadian demand response programs called a total of 1,250 events in 2019.[57] The large majority of events occurred in the West and South regions, with 49 percent of events occurring in the programs in the West and 24 percent in the South. EIght-five percent of peaks observed in 2019 occurred in the winter,and 14 percent in the summer. Please note that CEE asks respondents to include programs run within their service territories and to exclude any programs run solely by or within the wholesale markets.[58]

Figure 27. **US and Canadian Electric Demand Response Average MW Savings by Region and Program Target**

	Summer	Winter	Other Peak	No Peak	MW Subtotals

[57] For reference, FERC reported that in 2014 the potential peak reduction from all retail demand response programs in the United States was 31,191 MW. "Demand Response & Advanced Metering Staff Report," Federal Energy Regulatory Commission, ferc.gov/legal/staff-reports/2016/DR-AM-Report2016.pdf, 14.

Northeast	-	5,151	-	-	5,151
Midwest	2,606	4,053	212	18.7	6,889.7
South	980	8,500	-	-	9,480
West	17,738	68,068	-	371	86,177
Canada	-	-	-	-	-
Totals	21,324	85,722	212	389.7	107,697.7

Figure 27 presents average MW savings by region and target. Demand response programs in the United States and Canada saved on average 86 MW per event in 2019.[59] In the United States, the West saved the most on average per event, 140.81 MW. Further, reported summer programs saved the most on average per event, 123.26 MW.

5.1.3 Ratepayer Funded Natural Gas Program Savings

Figure 28 indicates that natural gas efficiency programs in the United States and Canada resulted in estimated gross incremental savings of approximately 500 million therms of gas in 2019. This is equivalent to approximately 2.5 million metric tons of avoided CO_2 emissions.[60]

Figure 28. **2019 US and Canadian Incremental Natural Gas Savings (MDth)**

		Residential	Low Income	Multifamily	C & I	Other	No Breakout	Ratepayer Total
United States **								
	Northeast	3,760	758	544	4,233	25	-	9,320
	Midwest	3,109	440	394	6,396	64	-	10,404
	South	483	44	0	418	-	-	945
	West	3,373	224	165	2,378	5,173	-	11,313
US Subtotal		10,725	1,466	1,103	13,425	5,262	-	31,982

[59] To get a sense of magnitude for average US and Canadian demand response capacity savings, 20 MW represents roughly a sixth of the peak capacity of a natural gas combined cycle generating unit in the United States, according to 2015 EIA Form 860, Schedule 3 data. In addition, using 2019 EIA Form 860, Schedule 3 data, the "total" DR savings of 107,698 MW is roughly equivalent to the combined net summertime capacity of the 98 largest power plants in the United States (or at least the ones that responded to the EIA data request). Data accessed at "Form EIA-860 detailed data," Energy Information Administration, accessed June 2020, eia.gov/electricity/data/eia860/.

[60] Calculated using the EPA Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator. June 2021.

Canada ***	2,025	920	2	15,030	1	-	17,976
Binational Total	23,476	3,852	2,207	41,881	10,525	-	49,958

Notes:

* Based on estimated total of all energy savings that accumulated from new participants in existing programs and all participants in new programs in 2019.

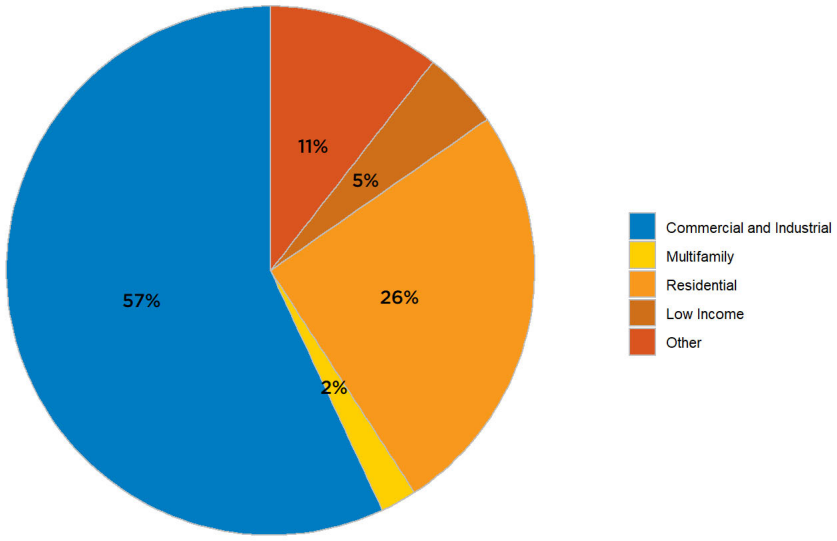
** Ninety (90) percent of all gas respondents in the United States that reported gas programs reported a value for incremental savings. Of those that reported a value for incremental savings, 91 percent reported gross incremental savings. For respondents that did not report gross incremental savings, CEE used net incremental savings in calculating totals.

** Eight-six (86) percent of all gas respondents in Canada that reported gas programs reported a value for incremental savings. Of those that reported a value for incremental savings, 83 percent reported gross incremental savings.

0 depicts gross incremental savings for US and Canadian natural gas programs broken out by customer class. Commercial and industrial programs accounted for the majority of energy savings (57 percent), followed by residential programs (26 percent), and "other" programs (11 percent). Low income programs represented five percent of savings, while multifamily programs represented two percent. This breakdown is somewhat different from that of US and Canadian gas energy efficiency expenditures, in which residential programs accounted for 39 percent of expenditures, commercial and industrial programs accounted for 35 percent, and low income programs accounted for 19 percent. These findings are similar to those from the last several years' surveys. This result may indicate high savings per dollar spent in the C&I sector, but it may also reflect a difference in reported savings type—gross or net—between program administrators with high residential and high C&I expenditures.[61]

[61] See the opening paragraphs of Section 5 for more information on the savings accounting scheme used in this report.

Figure 29. **2019 US and Canadian Gross Incremental Natural Gas Savings by Customer Class**



Based on the natural gas gross incremental savings provided in Figure 28 and the savings breakout in 0, in 2019 the value of natural gas energy efficiency savings across the United States and Canada totaled approximately $383 million.[62]

[62] Natural gas retail values for the United States and Canada were calculated based on the average retail price per thousand cubic feet across the United States in 2019 using data from the Energy Information Administration. Average natural gas prices used: $10.51 per Mcf (residential), $7.61 per Mcf (commercial), and $3.90 per Mcf (industrial). The residential retail rate was used for low income and multifamily program savings. The rate for combined C&I programs was determined by taking the average of the commercial and industrial retail rates. The rate for "other" programs was calculated by taking the average of the residential, commercial, and industrial retail rates. "Natural Gas Prices," Energy Information Administration, last modified May 2021, accessed June, 2021, https://www.eia.gov/naturalgas/monthly/pdf/table_03.pdf.

Appendix A Electric Energy Efficiency Program Categories

Respondents who could provide data for individual programs were asked to select a customer class and then a program type for each program they identified. If it was not possible to provide data on the program level, respondents were asked to provide rough percentage breakdowns of their budgets, expenditures, and savings into customer classes and then to provide further percentage breakdowns by common program types (again, if possible). This appendix provides the title and definition for each program type, grouped by customer class. CEE slightly modified some program categories in 2014 based on feedback from respondents and discussions with Lawrence Berkeley National Laboratory; similar modifications may occur in future years for the purposes of the CEE research effort.

Residential Programs

Appliance recycling: Programs designed to remove less efficient appliances, typically refrigerators and freezers, from households.

Behavior, online audit, feedback: Residential programs designed around directly influencing household habits and decision-making on energy consumption through quantitative or graphical feedback on consumption, sometimes accompanied by tips on saving energy. These programs include behavioral feedback programs in which energy use reports compare a consumer's household energy consumption with those of similar consumers; online audits that are completed by the consumer; and in-home displays that help consumers assess their use in near real time. This program category does not include on-site energy assessments or audits.

Consumer product rebate for appliances: Programs that incentivize the sale, purchase and installation of appliances, e.g. refrigerators, dishwashers, clothes washers, and dryers, that are more efficient than current standards. Appliance recycling and the sale, purchase, and installation of HVAC equipment, water heaters, and consumer electronics are accounted for separately.

Consumer product rebate for electronics: Programs that encourage the availability and purchase or lease of more efficient personal and household electronic devices, including but not limited to televisions, set-top boxes, game consoles, advanced power strips, cordless telephones, PCs and peripherals specifically for home use along with chargers for phones, smart phones, and tablets. A comprehensive efficiency program to decrease the electricity use of consumer electronics products includes two foci: product purchase and product use. Yet not every consumer electronics program seeks to be comprehensive. Some programs embark on ambitious promotions of multiple electronics products, employing upstream, midstream, and

downstream strategies with an aggressive marketing and education component. At the other end of the continuum, a program administrator may choose to focus exclusively on consumer education.

Consumer product rebate for lighting: Programs aimed specifically at encouraging the sale, purchase, and installation of more efficient lighting in the home. These programs range widely from point-of-sale rebates to CFL mailings or giveaways. Measures tend to be CFLs, fluorescent fixtures, LED lamps, LED fixtures, LED holiday lights, and lighting controls, including occupancy monitors and switches.

Financing: Programs designed to provide or facilitate loans, credit enhancements, or interest rate reductions and buy downs. As with other programs, utility costs are included, such as the costs of any inducements for lenders, e.g. loan loss reserves, interest rate buy downs, etc. Where participant costs are available for collection, these ideally include the total customer share, i.e. both principal meaning the participant payment to purchase and install measures and interest on that debt. Most of these programs are directed towards enhancing credit or financing for residential structures.

Multifamily: Multifamily programs are designed to encourage the installation of energy efficient measures in common areas, units, or both for residential structures of more than four units. These programs may be aimed at building owners or managers, tenants, or both.

New construction: Programs that provide incentives and possibly technical services to ensure new homes are built or manufactured to energy performance standards higher than applicable code, e.g. ENERGY STAR® Homes. These programs include new multifamily residences and new or replacement mobile homes.

Prescriptive HVAC: Programs designed to encourage the distribution, sale, purchase, and proper sizing and installation of HVAC systems that are more efficient than current standards. Programs tend to support activities that focus on central air conditioners, air source heat pumps, ground source heat pumps, and ductless systems that are more efficient than current energy performance standards, as well as climate controls and the promotion of quality installation and quality maintenance.

Prescriptive insulation: Programs designed to encourage the sale, purchase and installation of insulation in residential structures, often through per square foot incentives for insulation of specific R-values versus an existing baseline. Programs may be point-of-sale rebates or rebates to insulation installation contractors.

Prescriptive pool pump: Programs that incentivize the installation of higher efficiency or variable speed pumps and controls, such as timers, for swimming pools.

Prescriptive water heater: Programs designed to encourage the distribution, sale, purchase and installation of electric or gas water heating systems that are more efficient than current standards, including high efficiency water storage tank and tankless systems.

Prescriptive windows: Programs designed to encourage the sale, purchase, and installation of efficient windows in residential structures.

Prescriptive other: Residential programs that provide or incentivize a set of preapproved measures not included in, or distinguishable from, the other residential program categories, e.g. direct install, HVAC, lighting. For example, if a residential program features rebates for a large set of mixed, preapproved offerings, e.g. insulation, HVAC, appliances, and lighting, yet the relative contribution of each measure to program savings is unclear or no single measure accounts for a large majority of the savings, then the program should be classified simply as a residential prescriptive program.

Whole home audits: Residential audit programs provide a comprehensive, standalone assessment of a home's energy consumption and identification of opportunities to save energy. The scope of the audit includes the whole home, although the thoroughness and completeness of the audit may vary widely from a modest examination and development of a simple engineering model of the physical structure to a highly detailed inspection of all spaces, testing for air leakage or exchange rates, testing for HVAC duct leakage, and highly resolved modeling of the physical structure with benchmarking to customer utility bills.

Whole home direct install: Direct install programs provide a set of preapproved measures that may be installed at the time of a visit to the customer premises or provided as a kit to the consumer, usually at modest or no cost to the consumer and sometimes accompanied by a rebate. Typical measures include CFLs, low flow showerheads, faucet aerators, water heater wrap, and weather stripping. Such programs also may include a basic, walk-through energy assessment or audit, but the savings are principally derived from the installation of the provided measures. Education programs that supply kits by sending them home with school children are not included in this program category; they are classified as education programs.

Whole home retrofit: Whole home energy upgrade or retrofit programs combine a comprehensive energy assessment or audit that identifies energy savings opportunities with whole house improvements in air sealing, insulation and, often, HVAC systems and other end uses. The HVAC improvements may range from duct sealing to a tune-up to full replacement of the HVAC systems. Whole home programs are designed to address a wide

variety of individual measures and building systems, including but not limited to: HVAC equipment, thermostats, furnaces, boilers, heat pumps, water heaters, fans, air sealing, insulation of attic, wall, or basement, windows, doors, skylights, lighting, and appliances. As a result, whole home programs generally involve one or more rebates for multiple measures. Whole home programs generally come in two types: comprehensive programs that are broad in scope, and less comprehensive, prescriptive programs sometimes referred to as "bundled efficiency" programs. This category addresses all of the former and most of the latter, but it excludes direct install programs that are accounted for separately.

Other: Programs designed to encourage investment in energy efficiency activities in residences but are so highly aggregated, e.g. existing homes programs that include retrofits, appliances, and equipment, etc., and undifferentiated that they cannot be sorted into the residential program categories that are detailed above.

Low Income

Low income programs are efficiency programs aimed at lower income households, based upon some types of income testing or eligibility. These programs most often take the form of a single family weatherization, but a variety of other program types are also included in this program category, e.g. multifamily or affordable housing weatherization, low income direct install programs.

Commercial Programs

Custom audit: Programs in which an energy assessment is performed on one or more participant commercial or industrial facilities to identify sources of potential energy waste and measures to reduce that waste.

Custom retrocommissioning: Programs aimed at diagnosing energy consumption in a commercial facility and optimizing its operations to minimize energy waste. Such programs may include the installation of certain measures, e.g. occupancy monitors and switches), but program activities tend to be characterized more by tuning or retuning, coordinating and testing the operation of existing end uses, systems and equipment for energy efficient operation. The construction of new commercial facilities that includes energy performance commissioning should be categorized as "New Construction". The de novo installation of energy management systems with accompanying sensors, monitors and switches is regarded as a major capital investment and should be categorized under "Custom - Other".

Custom other: Programs designed around the delivery of site-specific projects typically characterized by an extensive onsite energy assessment and identification and installation of multiple measures unique to that facility. These measures may vary significantly from site to site. This category is intended to capture "whole building" approaches to commercial sector efficiency opportunities for a wide range of building types and markets, e.g. office or retail and a wide range of measures.

Financing: Programs designed to provide or facilitate loans, credit enhancements, or interest rate reductions and buy downs. As with other programs, utility costs are included, such as the costs of any inducements for lenders, e.g. loan loss reserves, interest rate buy downs, etc.. Where participant costs are available for collection, these ideally include the total customer share, i.e., both principal meaning the participant payment to purchase and install measures and interest on that debt. Most of these programs are directed toward enhancing credit or financing for commercial structures.

Government, nonprofit, MUSH: Government, nonprofit, and MUSH (municipal, university, school and hospital) programs cover a broad swath of program types generally aimed at public and institutional facilities and that include a wide range of measures. Programs that focus on specific technologies, e.g. HVAC and lighting have their own commercial program categories. Examples include incentives or technical assistance to promote energy efficiency upgrades for elementary schools, recreation halls, and homeless shelters. Street lighting is accounted for as a separate program category.

New construction: Programs that incentivize owners or builders of new commercial facilities to design and build beyond current code or to a certain certification level, e.g. ENERGY STAR® or LEED®.

Prescriptive grocery: Grocery programs are prescriptive programs aimed at supermarkets and are usually designed around indoor and outdoor lighting and refrigerated display cases.

Prescriptive HVAC: Commercial HVAC programs encourage the sale, purchase and installation of heating, cooling, or ventilation systems at higher efficiency than current energy performance standards, across a broad range of unit sizes and configurations.

Prescriptive IT and office equipment: Programs aimed at improving the efficiency of office equipment, chiefly commercially available PCs, printers, monitors, networking devices, and mainframes not rising to the scale of a server farm or floor. Programs for data centers are included in the industrial sector, under the “Custom Data Centers” category.

Prescriptive lighting: Commercial lighting programs incentivize the installation of higher efficiency lighting and controls. Typical measures might include T8 or T5 fluorescent lamps and fixtures; CFLs and fixtures; LEDs for lighting; displays, signs, and refrigerated lighting; metal halide and ceramic lamps and fixtures; occupancy controls; daylight dimming; and timers.

Prescriptive performance contract or DSM bidding: Programs that incentivize or otherwise encourage energy services companies (ESCOs) and participants to perform energy efficiency projects, usually under an energy performance contract (EPC), a standard offer, or another arrangement that involves ESCOs or customers offering a quantity of energy savings in response to a competitive solicitation process with compensation linked to achieved savings.

Prescriptive other: Prescriptive programs that encourage the purchase and installation of some or all of a specified set of preapproved measures besides those covered in other measure-specific prescriptive programs, e.g. HVAC and lighting.

Small commercial custom: Custom programs applied to small commercial facilities. See the commercial "Custom" categories above for additional detail.

Small commercial prescriptive: Prescriptive programs applied to small commercial facilities. See the commercial "Prescriptive" categories above for additional detail. Such programs may range from a walk-through audit and direct installation of a few preapproved measures to a fuller audit and a fuller package of measures. Audit only programs have their own category.

Street lighting: Street lighting programs include incentives or technical support for the installation of higher efficiency street lighting and traffic lights than current baseline.

Other: Programs not captured by any of the specific industrial or commercial categories but that are sufficiently detailed or distinct to not be treated as a General C&I program. For example, an energy efficiency program aimed specifically at the commercial subsector but is not clearly prescriptive or custom in nature might be classified as Commercial Other.

Industrial or Agricultural Programs

Custom audit: Programs in which an energy assessment is performed on one or more participant industrial or agricultural facilities to identify sources of potential energy waste and measures to reduce that waste.

Custom data centers: Data center programs are custom designed around large-scale server floors or data centers that often serve high tech, banking, or academia. Projects tend to be site specific and involve some combination of

lighting, servers, networking devices, cooling chillers, and energy management systems and software. Several of these may be of experimental or proprietary design.

Custom industrial or agricultural processes: Industrial programs that deliver custom designed projects that are characterized by onsite energy and process efficiency assessment and a site specific measure set focused on process related improvements that may include, for example, substantial changes in a manufacturing line. This category includes all energy efficiency program work at industrial or agricultural sites that is focused on process and not generic (such programs belong in the custom category) and not otherwise covered by the single measure prescriptive programs, e.g. lighting, HVAC, and water heaters).

Custom refrigerated warehouses: Warehouse programs are typically aimed at large-scale refrigerated storage facilities and often target end uses such as lighting, climate controls, and refrigeration systems.

Custom other: Programs designed around the delivery of site specific projects typically characterized by an extensive onsite energy assessment and identification and installation of multiple measures unique to that facility. These measures may vary significantly from site to site. This category is intended to capture whole facility approaches to industrial or agricultural sector efficiency opportunities for a wide range of building types and markets.

Financing: Programs designed to provide or facilitate loans, credit enhancements, or interest rate reductions and buy downs. As with other programs, utility costs are included, such as the costs of any inducements for lenders, e.g. loan loss reserves, interest rate buy downs, etc.. Where participant costs are available for collection, these ideally include the total customer share. i.e., both principal meaning the participant payment to purchase and install measures and interest on that debt. Most of these programs are directed toward enhancing credit or financing for industrial or agricultural structures.

New construction: Programs that incentivize owners of builders of new industrial or agricultural facilities to design and build beyond current code or to a certain certification level, e.g. ENERGY STAR® or LEED®.

Prescriptive agriculture: Farm and orchard agricultural programs that primarily involve irrigation pumping and do not include agricultural refrigeration or processing at scale.

Prescriptive motors: Motors programs usually offer a prescribed set of approved, higher efficiency motors, with industrial motors programs typically getting the largest savings from larger, high powered motors, >200 hp.

Prescriptive other: Prescriptive programs that encourage the purchase and installation of some or all of a specified set of preapproved measures besides those covered in other measure specific prescriptive programs on this list.

Self direct: Industrial programs that are designed to be delivered by the participant, using funds that otherwise would have been paid as ratepayer support for all DSM programs. These programs may be referred to as "opt out" programs, among other names.

Other: Programs not captured by any of the specific industrial or agricultural program categories but that are sufficiently distinct to the industrial and agricultural sector to not be treated as a C&I program, e.g. programs aimed specifically at an industrial subsector, but that are not clearly prescriptive or custom in nature.

C&I Programs

Audit: Programs in which an energy assessment is performed on one or more participant facilities to identify sources of potential energy waste and measures to reduce that waste.

Custom: Programs designed around the delivery of site-specific projects typically characterized by an extensive onsite energy assessment and identification and installation of multiple measures unique to that facility. These measures may vary significantly from site to site. This category is for programs that address both the commercial and industrial sectors and cannot be relegated to one sector or another for lack of information on participation or savings.

Mixed offerings: Programs that cannot be classified under any of the specific commercial or industrial program categories and that span a large variety of offerings aimed at both the commercial and industrial sectors.

New construction: Programs that incentivize owners or builders of new commercial or industrial facilities to design and build beyond current code or to a certain certification level, e.g. ENERGY STAR® or LEED®. This category should be used sparingly for those programs that cannot be identified with either the commercial or industrial sector on the basis of information available about participation or the sources of savings.

Prescriptive: Prescriptive programs that encourage the purchase and installation of some or all of a specified set of preapproved industrial or commercial measures but which cannot be differentiated by sector based upon the description of the participants or the nature or source of savings.

Self direct: Generally large commercial and industrial programs that are designed and delivered by the participant, using funds that otherwise would

have been paid as ratepayer support for all DSM programs. This category is to be used for self direct or opt out programs that address both large commercial and industrial entities but that cannot be differentiated between these sectors because the nature and source of the savings is not available or is also too highly aggregated.

Other: Programs not captured by any of the specific industrial or commercial categories and are sufficiently distinct to the industrial and commercial sectors but cannot be differentiated by individual sector.

Cross Sector

Codes and standards: In codes and standards programs, the program administrator may engage in a variety of activities designed to advance the adoption, application or compliance level of building codes and end use energy performance standards. Examples might include advocacy at the state or federal level for higher standards for HVAC equipment; training of architects, engineers, builders, and developers on compliance; and training of building inspectors in ensuring the codes are met.

Market transformation: Programs that encourage a reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects that is likely to last after the intervention has been withdrawn, reduced, or changed. Market transformation programs are gauged by their market effects, e.g. increased awareness of energy efficient technologies among customers and suppliers; reduced prices for more efficient models; increased availability of more efficient models; and ultimately, increased market share for energy efficient goods, services, and design practices. Example programs might include upstream incentives to manufacturers to make more efficient goods more commercially available and point-of-sale or installation incentives for emerging technologies that are not yet cost-effective. Workforce training and development programs are covered by a separate category. Upstream incentives for commercially available goods are sorted into the program categories for those goods, e.g. consumer electronics or HVAC.

Marketing, education, and outreach: Includes most standalone marketing, education, and outreach programs, e.g. statewide marketing, outreach, and brand development. This category also covers in-school energy and water efficiency programs, including those that supply school children with kits of prescriptive measures such as CFLs and low flow showerheads for installation at home.

Multisector rebates: Multisector rebate programs include those providing incentives for commercially available end use goods for multiple sectors, e.g. PCs, HVAC.

Planning, evaluation, other program support: These programs are separate from marketing, education, and outreach programs and include the range of activities not otherwise accounted for in program costs, but that are needed for planning and designing a portfolio of programs and for otherwise complying with regulatory requirements for DSM activities outside of program implementation. These activities generally are focused on the front and back end of program cycles, in assessing prospective programs; designing programs and portfolios; assessing the cost-effectiveness of measures, programs, and portfolios; and arranging for, directing, or delivering reports and evaluations of the process and impacts of those programs where those costs are not captured in program costs.

Research: These programs are aimed generally at helping the program administrator identify new opportunities for energy savings, e.g. research on emerging technologies or conservation strategies. Research conducted on new program types or the inclusion of new, commercially available measures in an existing program are accounted for separately under cross cutting program support.

Shading and cool roofs: Shading and reflective programs include programs designed to lessen heating and cooling loads through changes to the exterior of a structure, e.g. tree plantings to shade walls and windows, window screens, and cool roofs. These programs are not necessarily specific to a sector.

Voltage reduction transformers: Programs that support investments in distribution system efficiency or enhance distribution system operations by reducing losses. The most common form of these programs involve the installation and use of conservation voltage regulation or reduction or optimization systems and practices that control distribution feeder voltage so that utilization devices operate at their peak efficiency, which is usually at a level near the lower bounds of their utilization or nameplate voltages. Other measures may include installation of higher efficiency transformers. These programs generally are not targeted to specific end users but typically involve changes made by the electricity distribution utility.

Workforce development: Workforce training and development programs are a distinct category of market transformation program designed to provide the underlying skills and labor base for deployment of energy efficiency measures.

Other: This category is intended to capture all programs that cannot be allocated to a specific sector (or are multisectoral) and cannot be allocated to a specific program type.

Appendix B List of US and Canadian Electric Energy Efficiency Program Category Expenditures

Figure B-1. **US Electric Energy Efficiency Program Category Expenditures (in USD)**

Customer Class	Program Type	2019 Expenditures
Residential	Other	512,370,507.11
Low Income	Low Income	505,899,670.40
Commercial and Industrial	Custom	424,293,642.17
Commercial and Industrial	Mixed Offerings	362,467,528.86
Commercial and Industrial	Other	304,430,165.65
Commercial and Industrial	Prescriptive	292,546,180.84
Commercial	Other	244,543,406.66
Residential	Consumer Product Rebate - Lighting	228,000,097.83
Commercial	Other (Cannot Categorize)	173,470,201.99
Commercial	Prescriptive - Lighting	173,369,745.05
Cross Sector	Other	130,054,446.27
Residential	Consumer Product Rebate - Appliances	117,677,479.65
Residential	Prescriptive - Other	113,775,478.74
Commercial	Small Commercial - Prescriptive	103,693,050.06
Residential	Whole Home - Retrofit	93,373,390.44
Residential	Other (Cannot Categorize)	91,441,619.76
Residential	Whole Home - Audits	89,782,435.21
Residential	Prescriptive - HVAC	86,984,987.48
Residential	Behavioral/Online Audit/Feedback	86,943,616.36
Commercial and Industrial	New Construction	82,112,903.88
Industrial	Self Direct	69,500,463.00
Cross Sector	Planning/Evaluation/Other Program Support	57,268,343.13
Residential	New Construction	57,167,672.64
Residential	Appliance Recycling	46,890,966.03
Residential	Whole Home - Direct Install	44,168,426.53
Cross Sector	Marketing, Education, Outreach	42,699,780.45
Cross Sector	Multi-Sector Rebates	42,150,945.19
Commercial	Prescriptive - Other	39,155,678.42
Industrial	Other (Cannot Categorize)	37,169,595.08
Industrial	Custom - Industrial or Agricultural Processes	36,610,195.49
Residential	Multifamily	35,077,160.23
Commercial	Govt./Nonprofit/MUSH	32,862,613.25

Cross Sector	Codes & Standards	29,779,521.26
Commercial	New Construction	28,914,208.69
Commercial	Custom - Other	28,228,956.41
Other	Other	23,427,527.81
Commercial	Custom - Retrocommissioning	22,638,377.50
Commercial	Street Lighting	16,863,246.02
Commercial and Industrial	Audit	16,511,292.56
Cross Sector	Other (Cannot Categorize)	16,084,069.50
Cross Sector	Market Transformation	14,862,822.00
Commercial	Prescriptive - HVAC	13,545,880.45
Commercial and Industrial	Other (Cannot Categorize)	11,017,530.59
Commercial	Custom - Audit	9,506,778.95
Commercial and Industrial	Self Direct	9,040,009.41
Cross Sector	Research	7,799,755.27
Commercial	Small Commercial - Custom	6,672,856.00
Cross Sector	Workforce Development	6,267,801.83
Residential	Prescriptive - Insulation	5,793,808.33
Industrial	Custom - Audit	5,124,480.31
Residential	Consumer Product Rebate - Electronics	3,151,524.34
Industrial	Prescriptive - Agriculture	2,641,728.01
Industrial	Other	2,319,143.29
Residential	Prescriptive - Water Heater	2,118,753.62
Commercial	Prescriptive - Grocery	1,873,694.00
Industrial	Custom - Data Centers	1,793,142.67
Cross Sector	Shading/Cool Roofs	1,455,250.63
Commercial	Prescriptive - Performance Contracting or DSM Bidding	1,187,171.00
Cross Sector	Voltage Reduction/Transformers	1,090,316.60
Industrial	Custom - Other	1,042,467.00
Industrial	Prescriptive - Other	641,839.00
Commercial	Financing	565,539.00
Residential	Prescriptive - Pool Pump	465,356.00
Residential	Financing	72,133.00

Figure B-2: **Canadian Electric Energy Efficiency Program Category Expenditures (in USD and CAD)**

Customer Class	Program Type	2019 Expenditures USD	2019 Expenditures CAD
Commercial and Industrial	Mixed Offerings	105,127,149.57	140,344,744.68
Commercial	Prescriptive - Lighting	45,431,687.45	60,651,302.75
Industrial	Custom - Industrial or Agricultural Processes	41,599,927.09	55,535,902.66
Cross Sector	Other	27,650,718.32	36,913,708.95
Low Income	Low Income	26,357,123.24	35,186,759.53
Residential	Whole Home - Retrofit	22,091,833.64	29,492,597.90
Industrial	Other (Cannot Categorize)	19,050,685.00	25,432,664.47
Cross Sector	Planning/Evaluation/Other Program Support	15,556,287.46	20,767,643.75
Residential	Other (Cannot Categorize)	13,186,865.25	17,604,465.10
Commercial	Custom - Retrocommissioning	11,975,301.73	15,987,027.81
Cross Sector	Other (Cannot Categorize)	11,554,695.90	15,425,519.02
Residential	Behavioral/Online Audit/Feedback	10,322,181.82	13,780,112.73
Commercial	Prescriptive - HVAC	8,810,568.17	11,762,108.51
Residential	Whole Home - Audits	8,704,169.64	11,620,066.47
Residential	Consumer Product Rebate - Lighting	8,480,387.64	11,321,317.50
Commercial and Industrial	New Construction	8,150,088.27	10,880,367.84
Residential	New Construction	7,338,346.11	9,796,692.05
Commercial	Other (Cannot Categorize)	7,233,078.23	9,656,159.44
Commercial	Other	5,882,087.25	7,852,586.47
Commercial	Small Commercial - Prescriptive	5,370,730.04	7,169,924.60
Commercial and Industrial	Self Direct	5,288,568.31	7,060,238.69
Industrial	Self Direct	5,243,622.97	7,000,236.66
Cross Sector	Codes & Standards	4,255,929.09	5,681,665.34
Residential	Whole Home - Direct Install	4,187,300.65	5,590,046.36
Cross Sector	Research	3,406,787.08	4,548,060.76
Commercial	Street Lighting	3,233,949.26	4,317,322.26
Residential	Other	3,052,339.90	4,074,873.76
Residential	Consumer Product Rebate - Appliances	2,910,210.75	3,885,131.35

Residential	Prescriptive - HVAC	2,602,996.12	3,474,999.82
Commercial	New Construction	2,471,993.68	3,300,111.57
Residential	Appliance Recycling	2,452,577.53	3,274,191.00
Residential	Consumer Product Rebate - Electronics	2,419,557.45	3,230,109.20
Industrial	Custom - Audit	1,957,819.00	2,613,688.36
Commercial and Industrial	Audit	1,797,813.59	2,400,081.14
Commercial	Small Commercial - Custom	1,518,892.98	2,027,722.12
Residential	Prescriptive - Insulation	1,326,861.34	1,771,359.88
Industrial	Prescriptive - Motors	1,008,573.42	1,346,445.52
Cross Sector	Marketing, Education, Outreach	893,938.84	1,193,408.35
Commercial	Custom - Other	637,368.69	850,887.20
Commercial	Custom - Audit	371,358.02	495,762.96
Cross Sector	Multi-Sector Rebates	226,358.21	302,188.22
Industrial	Prescriptive - Agriculture	211,047.58	281,748.53
Commercial and Industrial	Prescriptive	205,116.30	273,830.26
Commercial and Industrial	Custom	179,781.36	240,008.11
Commercial	Prescriptive - Grocery	138,682.25	185,140.81
Commercial	Prescriptive - Other	104,896.49	140,036.81

Appendix C Electric Demand Response Program Expenditures

In 2013, CEE modified the demand response program categories to align with those used by FERC. FERC defines several demand response program types and groups them into two major categories:

- Incentive-based programs, which tend to involve incentives for contracting with utilities to curtail load when necessary.
- Time-based programs, which generally employ graduated pricing schemes that incent customers to reduce load during system peaks.

US Electric Demand Response Program Category Expenditures

Seventy percent of 2019 demand response program expenditures went to incentive-based programs, as shown in Figure C-1 below. Of those expenditures, one third (33 percent), went to direct load control programs, followed by interruptible load at 20 percent, emergency demand response at seven percent, and load as a capacity resource at four percent. "Other" incentive-based programs, or those that couldn't be categorized, accounted for 36 percent of expenditure (See Figure C-2.) Relative rankings within incentive-based program are similar to last year's with the exception that the proportion spent on Direct Load Control programs decreased from about half (46 percent) to about one third, with the difference shifting to tinterruptible load, emergency demand response, and other incentive-based programs. Interruptible load programs were 31 percent of reported expenditures in 2016, 25 percent in 2017, and 18 percent in 2018; it seems the proportion of expenditures on this program may have stabilized after having declined for the previous three years. For the second year in a row, the proportion of "other" incentive-based programs increased, from 10 percent of reported expenditures in 2016, 20 percent in 2017, 31 percent in 2018, to 36 percent in 2019. This is likely driven by program administrators more frequently being unable to break out incentive-based program expenditures.

Three percent of demand response expenditures went to time-based programs, about the same level as last year's results (four percent in 2017 and 2018). Of this spending, 60 percent was allocated to peak time rebate programs, 22 percent to critical peak pricing, 14 percent to real time pricing, and five percent to time-of-use pricing.

Figure C-1.

2019 US Electric Demand Response Expenditures: General Categorization

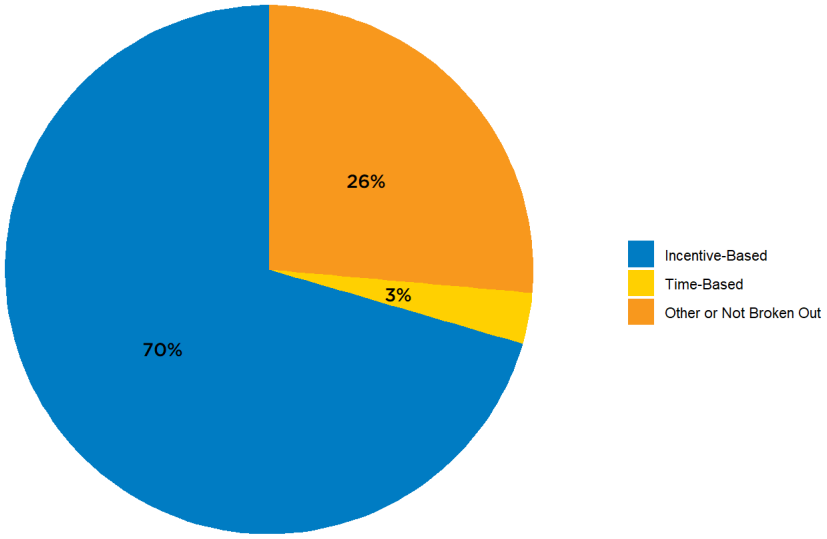


Figure C-2.

2019 US Electric Demand Response Expenditures: Incentive-Based Programs

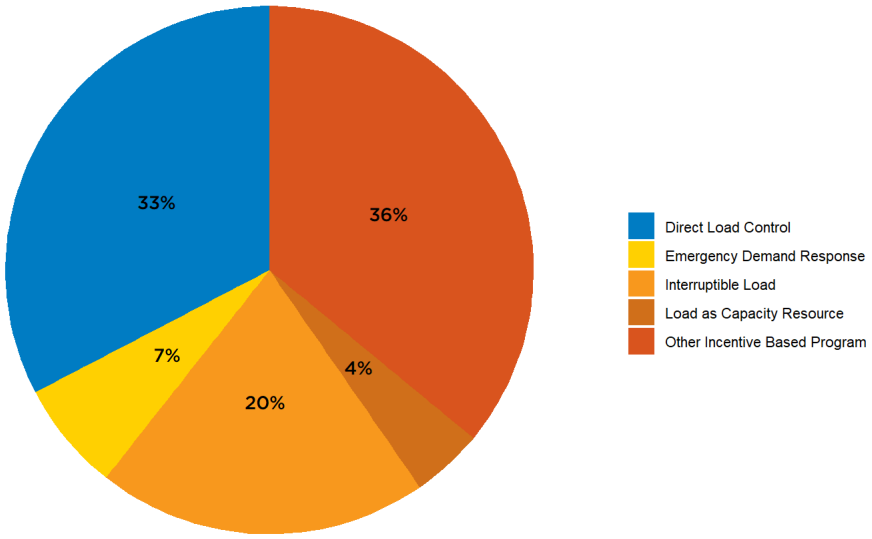
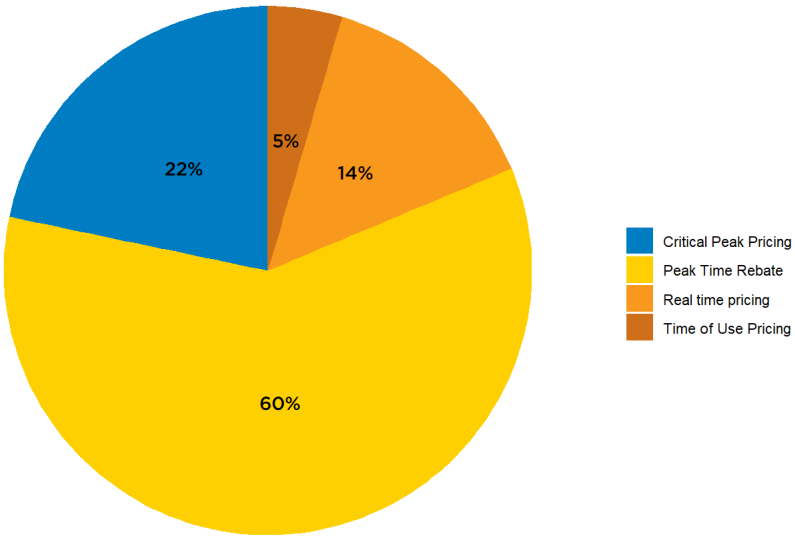


Figure C-3.

2019 US Electric Demand Response Expenditures: Time-Based Programs



ENBRIDGE GAS INC.

Undertaking Response to Vulnerable Energy Consumers Coalition (VECC)

Undertaking

Tr: 110

With reference to Exhibit I.6.EGI.VECC.7, to provide the total final 2021 FTE count.

Response:

The actual 2021 FTE amount for EGI DSM resources is 144.8.

ENBRIDGE GAS INC.

Undertaking Response to Vulnerable Energy Consumers Coalition (VECC)

Undertaking

Tr: 114

With reference to the table in response to I.10a EGI.VECC 14, to be updated to include a column that shows 2021 actuals, with the caveats that have been described.

Response:

Please see table below:

Residential Offering Name	2015 Participants (Actual*)	2020 Participants (Actual*)	2021*** Participants (Draft Actual)	2023 Participants (Forecast)	2027 Participants (Forecast)	2023 Average Participant Incentive Assumption ($)	2023 Average **Net** Participant NG Savings Assumption (m3)
Whole Home	8,175	21,632	20,406	14,850	16,131	$1,910	7,759,125
Single Measure	0**	0**	0**	6,260	6,800	$568	826,549
Smart Home	0**	30,140	34,855	34,750	37,748	$80	5,052,192****

*Whole Home specific targets have been provided along with verified metric achievement for actual/forecast participation rates. Actual participation rates may be higher since some homes were not eligible to be claimed for the participant metric but the savings from those homes would be included in the m3 savings achieved.
**The Smart Thermostat offering launched in 2016 for Legacy Enbridge Gas Distribution, and 2019 for Legacy Union Gas. Thus, participation for 2015 is not available. The Single Measure offering is new for 2023, thus no historical participation is available.
***Subject to finalization of draft claim. Unaudited.
**** Value has been revised to account for updated evidence filed on February 18, 2022.

ENBRIDGE GAS INC.

Undertaking Response to Vulnerable Energy Consumers Coalition (VECC)

Undertaking

Tr: 114

With reference to Exhibit I.10b.EGI.VECC 24, to provide the data in the table regarding the 2023 average participant incentive dollar value for the home winter proofing program and the affordable housing program.

Response:

Based on the data provided in Exhibit I.5.EGI.GEC.7, Attachment 1, the forecasted Low Income 2023 incentive per project or unit can be found under the column “Budget Incentive Cost Per Unit ($/unit)”. For the home winter proofing program and the affordable housing program they are as follows:

- Home Winterproofing – HWP Insulation measure = $3,095
- Home Winterproofing – Adaptive Thermostats – Prescriptive measure = $292
- Home Winterproofing – Basic Measures - Prescriptive= $12
- Affordable Housing Multi-Residential program offering = $37,677*

*Incentive varies based on the measure mix that a participant receives which can be a combination of custom and/or prescriptive measures.

ENBRIDGE GAS INC.

Undertaking Response to Vulnerable Energy Consumers Coalition (VECC)

Undertaking

Tr: 116

To provide a response to Exhibit 1.5, EGI LIEN 2, part f.

Response:

f) Enbridge Gas did not complete any research regarding upfront costs as Enbridge Gas does not currently delivery, nor has the Company proposed in the Plan, any residential low income measures or programs with upfront costs. If there is an opportunity to introduce a new measure or program with an upfront cost, Enbridge Gas will conduct research, a comprehensive review and conduct stakeholdering to provide rationale behind the opportunity.

   The existing response for Exhibit I.5.EGI.LIEN.2 f) should be labeled as g).

ENBRIDGE GAS INC.

Undertaking Response to Low-Income Energy Network (LIEN)

Undertaking

Tr: 117

With reference to LIEN 1, to add 2021 to table 1 and 2 of the 2021 data.

Response:

Table 1 - Low Income Budget Transfers - Union Rate Zones

Transfers To/(From) - Low Income Program	2015	2016	2017	2018	2019	2020	2021*
Low-Income Single Family - Home Weatherization	-	-	-	-	-	-	24,589
Low-Income Single Family - Indigenous	-	-	-	-	-	.	-
Low-Income Single Family - Furnace End of Life	-	-	-	-	-	-	(24,589)
Low-Income Multi Family	-	-	-	-	-	-	-
Low-Income Evaluation	152,852	(58,395)	(59,115)	(70,023)	76,617	(71,758)	-
Low-Income Administration	(192,388)	-	(456,102)	(439,138)	(601,894)	(746,211)	-
Net Transfer To/(From) Low Income Program	**(39,536)**	**(58,395)**	**(515,217)**	**(509,161)**	**(525,277)**	**(817,969)**	**-**
Net Transfer Source/(Endpoint)							
Residential Program Costs	-	-	-	-	-	746,211	-
Residential Evaluation Costs	-	58,395	515,217	509,161	525,277	71,758	-
Portfolio Evaluation Costs	(152,852)	-	-	-	-	-	-
Portfolio Administration	192,388	-	-	-	-	-	-
Net Transfer Endpoint/(Source)	**39,536**	**58,395**	**515,217**	**509,161**	**525,277**	**817,969**	**-**

Table 2 - Low Income Budget Transfers - EGD Rate Zone

Transfers To/(From) - Low Income Program	2015	2016	2017	2018	2019	2020	2021*
Home Winterproofing	(516,703)	(56,934)	(1,750,580)	-	316,759	(373,198)	81,508
Low-Income Multi-Residential Affordable Housing	(241,470)	(56,934)	(652,290)	-	(611,063)	(1,019,665)	(493,878)
Low-Income New Construction	-	(335,009)	(41,044)	-	294,304	262,424	84,306
Low Income Overheads	65,369	(139,603)	(15,905)	-	(105,711)	(134,091)	(94,233)
Net Transfer To/(From) Low Income Program	**(692,804)**	**(588,480)**	**(2,459,819)**	**-**	**(105,711)**	**(1,264,530)**	**(422,297)**
Net Transfer Source/(Endpoint)							
Residential Program Costs	692,804	571,488	1,714,499	-		1,264,530	422,297
Market Transformation Program Costs	-	16,992	745,320	-			
Collaboration & Innovation Fund	-	-	-		105,711		
Net Transfer Endpoint/(Source)	**692,804**	**588,480**	**2,459,819**	**-**	**105,711**	**1,264,530**	**422,297**

* Based on pre-audit, pre-deferral values

ENBRIDGE GAS INC.

Undertaking Response to School Energy Coalition (SEC)

Undertaking

Tr: 133

To provide an estimate of the costs that are allocatable to DSM on a fully allocated basis, that are actually in base rates.

Response:

Costs that are directly attributable to DSM and not included in the DSM budget are those costs for pension and benefits. Based on 169 FTEs in DSM, this is estimated at approximately $7.2M.

There are also general overhead related costs for facilities, information technology and other common costs. These costs are largely fixed in nature and would not fluctuate on an FTE basis. Without undergoing a cost study the exact amount of these costs attributable to DSM cannot be determined however the Company estimates that it would be approximately $35,000-$50,000 per FTE.

ENBRIDGE GAS INC.

Undertaking Response to Energy Probe Research Foundation

Undertaking

Tr: 140

With reference to the table in ED 22, to advise the participants, the average rebates, and the totals for 2021, unaudited and not final data.

Response:

	Attic Insulation	Basement Insulation	Exterior Wall Insulation	Air Sealing	Furnace	Boiler	Water Heater	Window/ Door/ Skylight
2021 Incentives Paid*	$11,012,799	$2,948,181	$1,720,520	$2,123,200	$2,347,250	$496,000	$1,697,200	$1,164,000
2021 Participants*	17,215	3,057	1,188	19,887	7,146	498	4,658	3,974
2021 Avg. Measure Incentive**	$640	$964	$1,448	$107	$328	$996	$364	$293

* Subject to finalization of 2021 results. Unaudited.

** Where rebates have been updated over time the participant incentive is based on the offer rebates available at the time of the initial home energy assessment.

ENBRIDGE GAS INC.

Undertaking Response to Energy Probe Research Foundation

Undertaking

Tr: 145

To explain why a 20 percent baseline is a minimum (b) to explain why R23 specified in the table is appropriate; (c), to confirm code levels; (d) to confirm whether that applies to the whole wall or is there a difference between the upper and lower four feet of wall.

Response:

a) The requirement to upgrade a minimum of 20 per cent was established to ensure homeowners are influenced to upgrade a material portion of their basement exterior wall area to qualify for a rebate and to meet the deep savings objective of the Whole Home offering.

b) The Whole Home offering insulation category of adding at least R23 was originally modeled on the Government of Canada's ecoENERGY program structure. The amount of insulation added to a home in a retrofit offering such as Whole Home is influenced by factors such as wall cavity space and existing insulation, and the stepped nature of incentives is intended to support a higher level of efficiency adoption. The stepped incentive structure to R23 recognizes considerations in different physical characteristics in the cavity wall and the higher cost often experienced by a homeowner in enhancing their insulation to this level.

c) The Ontario Building Code SB-12[1] updated July 7, 2016, specifies basement wall insulation in new construction must meet one of the compliance paths below. It should be noted that these specifications are for new construction and do not apply to retrofit applications.

[1] Ministry of Municipal Affairs – Building and Development Branch, MMA Supplementary Standard SB-12 Energy Efficiency For Housing (July 7, 2016 update).

Zone 1

Table 3.1.1.2.A (IP)
ZONE 1 - Compliance Packages for Space Heating Equipment with AFUE ≥ 92%
Forming Part of Sentence 3.1.1.2.(1)

Component	Thermal Values[8]	Compliance Package					
		A1	A2	A3	A4	A5	A6
Ceiling with Attic Space	Min. Nominal R[1]	60	60	50	60	50	60
	Max. U[2]	0.017	0.017	0.020	0.017	0.020	0.017
	Min. Effective R[2]	59.22	59.22	49.23	59.22	49.23	59.22
Ceiling Without Attic Space	Min. Nominal R[1]	31	31	31	31	31	31
	Max. U[2]	0.036	0.036	0.036	0.036	0.036	0.036
	Min. Effective R[2]	27.65	27.65	27.65	27.65	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31	31	35	31	35	31
	Max. U[3]	0.034	0.034	0.031	0.034	0.031	0.034
	Min. Effective R[3]	29.80	29.80	32.02	29.80	32.02	29.80
Walls Above Grade	Min. Nominal R[1]	22	19 + 5 ci	14 + 7.5 ci	22 + 5 ci	19 + 5 ci	22 + 5 ci
	Max. U[3]	0.059	0.049	0.054	0.047	0.049	0.047
	Min. Effective R[3]	17.03	20.32	18.62	21.40	20.32	21.40
Basement Walls[6]	Min. Nominal R[1]	20 ci	12 +10 ci	20 ci	20 ci	12 + 5 ci	20 ci
	Max. U[4]	0.047	0.048	0.047	0.047	0.063	0.047
	Min. Effective R[4]	21.12	20.84	21.12	21.12	15.96	21.12
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal R[1]	—	—	—	—	—	—
	Max. U[4]	—	—	—	—	—	—
	Min. Effective R[4]	—	—	—	—	—	—
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10	10	10
	Max. U[4]	0.090	0.090	0.090	0.090	0.090	0.090
	Min. Effective R[4]	11.13	11.13	11.13	11.13	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.28	0.28	0.25	0.28	0.28	0.28
	Energy Rating	25	25	29	25	25	25
Skylights	Max. U[5]	0.49	0.49	0.49	0.49	0.49	0.49
Space Heating Equipment	Min. AFUE	96%	96%	94%	96%	94%	92%
HRV	Min. SRE	75%	75%	81%	75%	70%	65%
Domestic Water Heater[7]	Min. EF	0.80	0.70	0.67	0.67	0.80	0.80
Column 1	2	3	4	5	6	7	8

Notes to Table 3.1.1.2.A (IP):
(1) The values listed are minimum Nominal R-Values for the thermal insulation component only.
(2) U-Value and effective R value shall include entire ceiling assembly components, from interior air film to vented space air film above insulation.
(3) U-Value and effective R value shall include entire exposed floor or above grade wall assembly components, from interior air film to exterior air film.
(4) U-Value and effective R value shall include entire basement wall or slab assembly components and interior air film.
(5) U-Value is the *overall coefficient of heat transfer* for a window assembly, sliding glass door assembly or skylight assembly expressed in Btu/(h•ft²•F).
(6) In the case of *basement* wall assemblies, where R20 ci is required R12 + 10 ci is permitted to be used or vice versa; or where R12 + 5 ci is required, R15 ci is permitted to be used or vice versa.
(7) If an EF of a water tank is not indicated in a compliance package, there is no EF requirement for water tank for that specific compliance package.
(8) Nominal and effective R values are expressed in (h•ft²•F)/Btu. U-Values are expressed in Btu/(h•ft²•F).

Zone 2

Table 3.1.1.3.A (IP)
ZONE 2 - Compliance Packages for Space Heating Equipment with AFUE ≥ 92%
Forming Part of Sentence 3.1.1.3.(1)

Component	Thermal Values[8]	Compliance Package					
		A1	A2	A3	A4	A5	A6
Ceiling with Attic Space	Min. Nominal R[1]	60	50	60+HH	60	60	50
	Max. U[2]	0.017	0.020	0.016	0.017	0.017	0.020
	Min. Effective R[2]	59.22	49.23	59.90	59.22	59.22	49.23
Ceiling Without Attic Space	Min. Nominal R[1]	31	31	31	31	31	31
	Max. U[2]	0.036	0.036	0.036	0.036	0.036	0.036
	Min. Effective R[2]	27.65	27.65	27.65	27.65	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31	35	31	31	31	35
	Max. U[3]	0.034	0.031	0.034	0.034	0.034	0.031
	Min. Effective R[3]	29.80	32.02	29.80	29.80	29.80	32.02
Walls Above Grade	Min. Nominal R[1]	19 + 5 ci	19 + 10 ci	22 + 5 ci	22 + 7.5 ci	19 + 10 ci	22 + 7.5 ci
	Max. U[3]	0.049	0.040	0.047	0.042	0.040	0.042
	Min. Effective R[3]	20.32	25.32	21.40	23.90	25.32	23.90
Basement Walls[6]	Min. Nominal R[1]	20 ci	20 ci	20 ci	20 ci	20 ci	20 ci
	Max. U[4]	0.047	0.047	0.047	0.047	0.047	0.047
	Min. Effective R[4]	21.12	21.12	21.12	21.12	21.12	21.12
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal R[1]	—	—	5	—	10	7.5
	Max. U[4]	—	—	0.163	—	0.090	0.116
	Min. Effective R[4]	—	—	6.13	—	11.13	8.63
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10	10	10
	Max. U[4]	0.090	0.090	0.090	0.090	0.090	0.090
	Min. Effective R[4]	11.13	11.13	11.13	11.13	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.21	0.28	0.28	0.21	0.25	0.25
	Energy Rating	34	25	25	34	29	29
Skylights	Max. U[5]	0.49	0.49	0.49	0.49	0.49	0.49
Space Heating Equipment	Min. AFUE	96%	96%	98%	96%	94%	92%
HRV	Min. SRE	81%	70%	65%	65%	65%	75%
Domestic Water Heater[7]	Min. EF	0.70	0.80	0.80	0.67	0.67	0.70
Column 1	2	3	4	5	6	7	8

e_4

Notes to Table 3.1.1.3.A (IP):

The following definition applies: HH = 10 inch high heel

(1) The values listed are minimum Nominal RSI-values for the thermal insulation component only.
(2) U-Value and effective R value shall include entire ceiling assembly components, from interior air film to vented space air film above insulation.
(3) U-Value and effective R value shall include entire exposed floor or above grade wall assembly components, from interior air film to exterior air film.
(4) U-Value and effective R value shall include entire *basement* wall or slab assembly components and interior air film.
(5) U-Value is the *overall coefficient of heat transfer* for a window assembly, sliding glass door assembly or skylight assembly expressed in Btu/(h•ft²•F).
(6) In the case of *basement* wall assemblies, where R20 ci is required R12 + 10 ci is permitted to be used or vice versa; or where R12 + 5 ci is required, R15 ci is permitted to be used or vice versa.
(7) If an EF of a water tank is not indicated in a compliance package, there is no EF requirement for water tank for that specific compliance package.
(8) Nominal and effective R values are expressed in (h•ft²•F)/Btu. U-Values are expressed in Btu/(h•ft²•F).

d) The Ontario Building Code SB-12 dated 2016 does not specify differentiation at the 4-foot mark.

ENBRIDGE GAS INC.

Undertaking Response to Pollution Probe

Undertaking

Tr: 161

To advise the cost inputs, including the carbon price, used in the Posterity model.

Response:

This undertaking was requested of Posterity Group, and as such has been responded to by Posterity Group.

Weighted Average Avoided Costs by Year

The following table shows the weighted average avoided costs for natural gas, as used in the mirror model to calculate TRC values for the measures.

Year	Weighted Average Avoided Costs ($/m3)
2019	0.255
2020	0.248
2021	0.253
2022	0.257
2023	0.261
2024	0.263
2025	0.267
2026	0.270
2027	0.272
2028	0.275
2029	0.277
2030	0.280
2031	0.283
2032	0.285
2033	0.287
2034	0.289
2035	0.292
2036	0.295
2037	0.297
2038	0.300

Derivation of The Avoided Cost Values

Posterity Group used the measure input values provided to EGI by Navigant/ Guidehouse, such as the installed costs, useful life, savings, and TRC values, to back-calculate the cost per m3 that would provide the same TRC values for the same set of input assumptions. No attempt was made to determine how much of the cost per m3 was commodity cost and how much was carbon cost.

ENBRIDGE GAS INC.

Undertaking Response to Green Energy Coalition (GEC)

Undertaking

Tr: 200

With reference to 7.STAFF.3, to provide the evidentiary citation for the 55 percent increase from 2018 to 2022 in electric budgets and the 44 percent increase over the same period; then the 44 percent in gas budgets over the same four-year period; the first three bullets.

Response:

This response was requested of First Tracks and as such as been responded to by First Tracks.

The first three bullets are restated below, with clearer references to the data sources for each budget item. Regarding the 44% reference in both the Consumers natural gas spending increase (i.e., second bullet) and the Eversource electric spending increase (i.e., third bullet), this value is coincidentally the same for both companies.

- Consumers Energy (Michigan) electric budgets, which increased around 55% over the four-year period from 2018 to 2022.
  - 2018 budgets (from 2018-2021 Energy Waste Reduction Plan, Table ES-4, electronic page 131 or page 8 of 251 of the Plan itself): https://mi-psc.force.com/sfc/servlet.shepherd/version/download/068t0000001UWrKAAW
  - 2022 budgets (from 2022-2025 Energy Waste Reduction Plan, Table 1-3, electronic page 46 or page 13 of 246 of the Plan itself): https://mi-psc.force.com/s/contentdocument/related/069t000000QQFwpAAH/ContentVersions
- Consumers Energy (Michigan) natural gas budgets, which increased around 44% over the four-year period from 2018 to 2022. (See references above for Consumers electric.)
- Eversource New Hampshire electric budgets, which doubled in spending in two successive plan cycles, phasing in increases over the three years of each cycle. See for example their latest settlement agreement, which plans 2023 spending at 44% above 2021 levels.
  - 2021 and 2023 budgets (from 2021-2023 New Hampshire Statewide Energy Efficiency Plan, Table 1.9, electronic page 33 or page 27 of the Plan itself): https://www.google.com/url?client=internal-element-cse&cx=014785670202365837767:yfmvvb7zlpa&q=https://www.puc.nh.gov/Regulatory/Docketbk/2020/20-092/LETTERS-MEMOS-TARIFFS/20-092_2021-01-19_EVERSOURCE_REV_PLAN_NARRATIVE_INCORPORATE_SETTLEMENT_TERMS.PDF&sa=U&ved=2ahUKEwiB_LejuLr2AhWWLTQIHQavDikQFnoECAgQAg&usg=AOvVaw3Ex5weVPn9qDfD-sD_3Z12