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Ontario Gas Demand Side Management 2016-2020 Plan Review

Prepared for Ontario Energy Board Staff

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1. INTRODUCTION AND PURPOSE

In 2014, the Ontario Energy Board (OEB or Board) established a Demand Side Management (DSM) Framework and corresponding Filing Guidelines for natural gas utilities (Ontario Energy Board, 2014a, 2014b). The Board's new Framework is designed to reduce natural gas consumption throughout Ontario, and includes the Board's policies on all elements of the gas utilities' DSM activities. The ultimate goal is to ensure that resource savings are achieved in an efficient manner and that customers receive the greatest and most meaningful opportunities to lower their bill by reducing consumption.

As a result of the Framework, on April 1, 2015, Enbridge Gas Distribution Inc. (Enbridge) (EB-2015-0049) and Union Gas Limited (Union) (EB-2015-0029) applied for the Board's review and approval of their 2015-2020 gas DSM program plans (Enbridge Gas Distribution, 2015a; Union Gas Limited, 2015a). These applications will be heard in a combined proceeding occurring May through September 2015.

The OEB is charged with assessing the gas utilities' applications to determine if they meet the goals and targets set out in the Framework, and also to identify possible improvements based on comparisons to emerging natural gas DSM programs from other regions. To assist in their review of the plans, the Board Staff hired Synapse Energy Economics (Synapse) to analyze the gas DSM program plans for the years 2016-2020, submitted by Enbridge and Union.

Synapse has reviewed key aspects of the 2016-2020 DSM program plans, and is providing through this report our recommendations for improvements to the plans. Our review focused on the proposed evaluation plans (Chapter 4), program designs (Chapter 5), shareholder incentive mechanisms (Chapter 6), coordination between gas and electric efficiency programs (Chapter 7), customer financing options (Chapter 8), the applied input assumptions (Chapter 9), and efficiency assumptions used in gas infrastructure planning (Chapter 10). Within each of these areas, we focused on topics that are at issue and ripe for improvement, rather than highlighting the aspects that are already consistent with best practices. A summary of all our recommendations is provided in Appendix A.

Our recommendations center on best practices in leading jurisdictions. Best practices refer to energy efficiency practices that produce superior results when compared to other energy efficiency practices used to address a similar situation, market, or process. Such best practice should be practical and achievable when adopted by program administrators in other jurisdictions, such as Ontario.

We constructed our recommendations using our expert experience and a detailed literature review. Synapse has extensive experience analyzing costs, energy savings, avoided costs, cost-effectiveness, potential studies, rate and bill impacts, and the regulatory policies used to promote and support energy efficiency resources. We have identified best practices while working in jurisdictions that are leaders in DSM implementation, such as Massachusetts, Vermont, California, and Rhode Island. We have also learned how sub-optimal policies can hinder energy efficiency growth through our work in jurisdictions where energy efficiency is still developing or is not supported by regulations or utilities.

Further, while analyzing the Ontario programs, we conducted a comprehensive literature review of best practices and discussion papers that address the fields identified above. We surveyed reports from leading energy efficiency research institutions, such as the American Council for an Energy Efficient Economy (ACEEE), SEEAction, Lawrence Berkley National Laboratory (LBNL), the Regulatory Assistance Project (RAP), and the U.S. Department of Energy (DOE).

Our recommendations also consider the OEB's Filing Guidelines to the DSM Framework, and any other province-specific circumstances, such as electric Conservation and Demand Management (CDM) programs and the Board's DSM policies.

Lastly, as Ontario's gas DSM programs are subject to a budget guideline maximum, as set out in the OEB's DSM framework, we recommend the utilities take a cautious and balanced approach when considering adopting our recommendations so that new changes would not push the utilities' programs over the current proposed budgets.[1] Some of our recommendations (such as improving program design and adding new measures) would increase program participation, which would result in an increase in incentive amounts and budget. On the other hand, other recommendations (such as reducing free-ridership, eliminating unnecessary measures, and providing financing) would decrease program budgets. In summary, both utilities should consider and balance potential improvements on participation rates, energy savings, cost-effectiveness, and a potential increase or decrease in budget from each recommendation, and determine which recommendations to adopt within their constraints.

[1] The utilities' proposed budgets are effectively at the budget guideline maximum.

2. HIGHLIGHTS

A general theme from our review and research is that Enbridge and Union should coordinate with each other to implement similar programs, and to track and report data comprehensively and consistently. The utilities present customers with different programs and offerings that provide different incentives for different sets of measures. Such an approach creates confusion among customers, makes it difficult to review the programs, and is likely not maximizing efficiencies across the companies and program designs.

The utilities should also provide plans and reports that are organized in a similar manner, and should provide comprehensive data using a common format. It was difficult to obtain data for our review, especially at the offering level. This data included costs by costs categories (marketing, incentive, evaluation, administration, and performance incentive), savings and benefits by fuel type (gas, electricity, water, non-energy benefits), cost-effectiveness (total costs, benefits, net benefits, and benefit-cost ratios), and performance incentives (maximum incentive and target incentive). Such information should be readily available in plans and reports in a transparent format that is consistent across the utilities.

Overall the programs proposed by the utilities are highly cost-effective, with Enbridge's 2016-2020 Total Resource Cost (TRC) Plus test benefit-cost ratio at 2.4, and Union's 2016 TRC benefit-cost ratio at 2.0. The programs are especially cost-effective with the Program Administrator Cost (PAC) Test, with Enbridge's 2016-2020 benefit-cost ratio at 4.0, and Union's 2016 benefit-cost ratio at 5.2. The numbers indicate the programs will result in substantial savings, with Enbridge's 2016 annual saving at 0.63 percent of 2016 projected sales at a cost of $0.07 per cubic meter ($m^3$), and Union's 2016 annual saving at 0.47 percent of 2014 actual sales[2] at a cost of $0.05 per m^3.[3]

Table 1. Highlights from Enbridge and Union's 2016-2020 Plans

Metric	Enbridge	Union
TRC Plus Test Benefit-Cost Ratio	2.4 (2016-2020)	2.0 (2016)
PAC Test Benefit-Cost Ratio	4.0 (2016-2020)	5.2 (2016)
2016 Savings as Percent of Sales	0.63% (2014 Sales)	0.47% (2016 sales)
2016-2020 Cost of Saved Energy (m^3)	$0.07	$0.05

Our review identified several key issues common to both Enbridge's and Union's program and offering evaluation plans. These issues include the impact evaluation plans in general, savings verification

[2] Union's 2016 projected sales were not available for this analysis.

[3] Throughout this report, all monetary amounts are in Canadian dollars unless otherwise indicated. All USD to CAD conversions in this report use a 25 June 2015 exchange rate of $1CAD to $0.81USD.

activities, gross impact evaluation approaches, evaluation study schedules, timing of process evaluation studies, process evaluation methods, evaluation budgets, and cross-offering evaluation studies. In general, neither utility provides sufficient information in these areas for most of the offerings proposed in the filings. For example, our review found the descriptions of process and impact evaluation methods proposed by the two utilities are insufficient and do not meet the industry best practices. Our review also found several offerings for which no impact or process evaluation studies are planned. Both utilities should develop impact and process evaluation plans for most of their offerings so that evaluation studies can address and resolve any issues in program designs and estimates of energy savings. This will allow them to make modifications as early as possible. Neither utility provides information on evaluation study schedules, except a few offerings for which Union indicated just the start years. The evaluation start year for such offerings is either the second year or the third year. However, our review of best practices found that both impact and process evaluations should be conducted in the first year of the program cycle. Early evaluation activities could identify problems sooner, which then could be addressed, and used to improve program designs earlier. Finally, we found neither utility proposes any cross-offering evaluation studies such as measure baseline studies, market characterization studies, free-ridership and spillover studies, measure life studies, and market potential studies.

During our review of the offerings, certain program design issues repeatedly arose, indicating areas where the utilities could make improvements. The most frequently cited issue relates to incentives provided to customers through the programs. This includes how the incentives are designed (i.e., prescriptive or custom) and whether the overall incentives are sufficient to motivate customers to invest in energy efficiency technology. Our review also found that commercial and industrial (C&I) offerings that tend to have free-ridership issues (e.g., C&I custom and retro-commissioning) have no mechanism in place to reduce free-ridership. Other areas could be improved within each offering, as discussed in more detail in Chapter 5. Assessment of Programs and Offerings, include the customer market targeted for participation, the types of measures offered through the programs, how the measures and incentives are delivered to participants, and how the programs are marketed throughout their service territories. Overall, the utilities should ensure they are sufficiently addressing through the proposed programs the market, financial, and educational barriers that are limiting greater customer participation. In particular, Enbridge could more clearly indicate how it expects to address barriers through its program implementation.

Our review of the proposed shareholder incentive mechanisms found that they will likely continue to motivate the utilities to save energy and increase customer participation in the DSM programs. The Board should consider requiring the utilities to develop shareholder incentive metrics or other mechanisms that focus on program cost-effectiveness. Such a metric would ensure that the utilities keep costs low while achieving significant energy savings.

Regarding the target adjustment mechanisms the utilities proposed for the shareholder incentive purposes, the Board should reject the utilities' proposals: The overall five-year savings goal targets that the utilities are required to achieve should not be adjusted during the course of the plan. Further, the Board should thoroughly investigate whether the initial goals (and therefore shareholder incentive

targets) established during this planning process are appropriately aggressive to ensure the utilities remain motivated to achieve savings throughout the plan term.

Our review of the gas utilities' program coordination activities with electric distribution companies' conservation and demand management (CDM) programs found that the gas utilities are currently engaged in collaborative efforts with the electric utilities, but these efforts are limited, and not streamlined at present. Enbridge is participating in a number of working groups with the electricity distributors and has undertaken utility-to-utility discussions with key LDCs. Union has now joined the CDM Working Groups with the goal of identifying potential areas of collaboration, and has discussed coordination and integration of CDM and DSM with 12 electricity distributors. Union has also presented a list of collaboration activities for each of its proposed programs. These ad hoc approaches are likely to lead to inefficient and inconsistent coordination efforts. Considering the best practices in this area, and the history and the current structure of the electric CDM programs, the gas companies could take a more pro-active role to lead the way for more electricity and gas program coordination. This would include three different elements (a) coordinating among themselves; (b) identifying those programs that are most suited to electricity and gas coordination; and (c) offering standard program design templates that electric utilities could select from. These three elements combined would lead to a much more consistent, transparent, and efficient approach than what has been proposed by the gas companies.

Regarding customer financing, neither Enbridge nor Union is proposing offering any low-cost financing options in the current plan, despite the Board's conclusion that on-bill financing is a key priority and that financing presents cost mitigation opportunities. As a result, we recommend that a third party establish and lead a finance working group. This working group would research how well existing financing offerings meet the needs of customers in each program including low income, multi-family, and Aboriginal groups, identify opportunities to design new offerings and investigate funding sources.

We considered how updated input assumptions should be treated during planning and reporting activities, and determined that the best, most up-to-date information available—including recent evaluation updates—should be used for (a) reliability needs, (b) regulatory plans and program design, and (c) regulatory reporting, including achieved performance incentives and Lost Revenue Adjustment Mechanisms (LRAM).[4] We also recommend that the Board require evaluations be completed for free-ridership and spillover (including participant and non-participant spillover) on a more frequent, regular basis.

Finally, with regard to infrastructure planning, the utilities should investigate the role that demand response and new construction programs can play in addressing infrastructure needs. The utilities should also develop their first integrated resource plans (IRPs) in a timely fashion, and should allow time for stakeholder feedback and input. These IRPs should incorporate best practices from electricity sector IRPs in its gas IRP study, as appropriate.

[4] An LRAM is a rate structure that allows utilities to collect revenue from the sales that have been eroded as a result of DSM savings. It removes a utility's disincentive to implementing DSM programs.

3. OVERVIEW AND ASSESSMENT OF THE PLANS

3.1. Key Program Metrics

Enbridge and Union expect to provide substantial savings and benefits to customers through ratepayer-funded energy efficiency programs. This section highlights the costs, savings, cost of saved energy, and cost-effectiveness of the proposed programs over the five-year term of the plans.

Program participation is also an important key metric to consider, however it is not included in the analysis below. Participation rates indicate the number of customers served through the utilities programs, which is helpful for designing programs and for assessing rate and bill impacts. The data provided by Union and Enbridge were insufficient to fully examine program participation rates. In future plan filings as well as in annual reporting, the utilities should be required to provide more complete data on participation, including: the number of participants per program; how a participant is defined for the program (number of units, number of homes, etc.); and the number of customers that are eligible to participate in the programs.

3.1.1 Budget, Savings, and Cost of Saved Energy

Table 2 and Table 3 below summarize Enbridge's and Union's proposed utility costs, lifetime savings, cost of saved energy, as well as the allocation of costs and savings to each program over the five-year term of the plans.

Enbridge expects to spend $381 million dollars from 2016 through 2020, with annual spending averaging about $76 million per year, excluding shareholder incentives. The majority of Enbridge's costs are allocated to the Resource Acquisition program (59%), followed by the Market Transformation program (23%), the Low Income program (18%), and other costs (5%). Enbridge plans to save approximately 5.6 billion m^3 of gas over the lifetime of measures installed during the five-year plan term. The overwhelming majority of savings (90%) will come from the Resource Acquisition program. The Guidelines note that while market transformation programs generally promote the energy efficiency message, their savings may be indirect (Ontario Energy Board, 2014a, p. 14). Therefore, by design, Enbridge's savings allocation to Market Transformation programs (2%) is not consistent with the cost allocation to this program (23%). The Low Income program will contribute 9% to overall savings. Finally, Enbridge's cost of saved energy is lowest for the Resource Acquisition program ($0.04 per m^3), followed by the Low Income program ($0.13 per m^3), and then by the Market Transformation program ($0.86 per m^3). Given that, by design, the Market Transformation program results in indirect savings, the cost of saved energy for this program appears higher than the other programs.

Table 2. Enbridge 2016-2020 Budget, Savings, and Cost of Saved Energy by Program

ENBRIDGE 2016-2020 TOTAL					
Program / Sector	**Total Utility Costs ($)**	**% of Total Costs**	**Lifetime Savings (M3)**	**% of Total Savings**	**Cost of Saved Energy ($/M3)**
Resource Acquisition	**212,640,669**	**59%**	**5,008,542,112**	**90%**	**0.0425**
Residential	91,473,258	25%	1,064,112,690	19%	0.0860
C&I	94,111,593	26%	3,944,429,422	71%	0.0239
Overhead	27,055,818	8%			
Market Transformation	**83,135,650**	**23%**	**96,340,405**	**2%**	**0.8629**
Residential	53,969,332	15%			
C&I	18,578,867	5%			
Overhead	10,587,451	3%			
Low Income	**64,930,471**	**18%**	**484,752,590**	**9%**	**0.1339**
Low Income	56,634,483	16%	484,752,590	9%	0.1168
Overhead	8,295,988	2%			
Portfolio Subtotal	**360,706,790**	**95%**	**5,589,635,107**	**100%**	**0.0645**
Other Costs	20,508,892	5%	-		
Portfolio Total	***381,215,682***	***100%***	***5,589,635,107***	***100%***	***0.0682***

Source: (Enbridge Gas Distribution 2015a, Exh. B, Tab 1., Sch. 4, pp. 3-5, 19-21, 27, 29; Exh. B, Tab 2, Sch. 3, pp. 3-7).

Union expects to spend $302 million dollars from 2016 through 2020, with annual spending averaging about $60 million per year, excluding shareholder incentives. The majority of Union's costs are allocated to the Resource Acquisition program (58%), followed by the Low Income program (22%), the Performance Based program (1.4%), the Large Volume program (1.3%), and the Market Transformation program (0.3%), with 16.5% of the budget covering other costs and inflation. Union plans to save approximately 6.2 billion m^3 of gas over the lifetime of measures installed during the five-year plan term. The overwhelming majority of savings (94%) will come from the Resource Acquisition program, followed by the Low Income program (5%), the Performance Based program (1%), and the Market Transformation and Large Volume programs are not expected to provide savings. Finally, Union's cost of saved energy is lowest for the Resource Acquisition program ($0.03 per m^3), followed by the Performance Based program ($0.07 per m^3), then the Low Income program ($0.23 per m^3).

Table 3. Union 2016-2020 Budget, Savings, and Cost of Saved Energy by Program

UNION 2016-2020 TOTAL					
Program / Sector	**Total Utility Costs ($)**	**% of Total Costs**	**Lifetime Savings (M3)**	**% of Total Savings**	**Cost of Saved Energy ($/M3)**
Resource Acquisition	**176,550,000**	**58%**	**5,816,035,539**	**94%**	**0.0304**
Residential	81,032,000	27%	653,283,929	11%	0.1240
C&I Total	95,518,000	32%	5,162,751,610	84%	0.0185
Market Transformation	**1,042,000**	**0.3%**	**-**	**0%**	
Residential	1,042,000	0.3%	-	0%	
Low Income	**66,182,000**	**22%**	**282,123,495**	**5%**	**0.2346**
Low Income	66,182,000	22%	282,123,495	5%	0.2346
Performance Based Total	**4,365,000**	**1.4%**	**60,000,000**	**1%**	**0.0728**
C&I	4,365,000	1.4%	60,000,000	1%	0.0728
Large Volume	**3,985,000**	**1.3%**	**-**	**0%**	
C&I	3,985,000	1.3%	-	0%	
Portfolio Subtotal	**252,124,000**	**83.5%**	**6,158,159,034**	**100%**	**0.0409**
Other Costs	34,803,000	12%	-		
Inflation	14,977,000	5%	-		
Portfolio Total	***301,904,000***	***100%***	***6,158,159,034***	***100%***	***0.0490***

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, pp. 6, 12, 20, 26, 30, 32, 36; Exh. A, Tab 3, App. A, pp. 14-15, 23-24, 41-43, 48-52, 59-60, 62-63, 71, 87-89, 96-98, 105).

When comparing Enbridge's and Union's plans, Enbridge has higher costs but lower savings, which results in a higher cost of saved energy ($0.07 per m^3) than that of Union ($0.05). At the program level, Union's cost of saved energy is lower for the Resource Acquisition program ($0.03 per m^3 for Union, $0.04 per m^3 for Enbridge), but higher for the Low Income Program ($0.23 per m^3 for Union, $0.13 per m^3 for Enbridge).

Many of the program differences, including the differences in the cost of saved energy, can be explained by looking at the proposed programs from a customer sector point of view, as summarized below in the Program Mix by Customer Sector section.

3.1.2 Cost-Effectiveness

The Board requires the utilities to use the Total Resource Cost Plus (TRC Plus) test as the primary cost-effectiveness test, with the Program Administrator Cost (PAC) test as a secondary reference tool, to assist with prioritizing which programs deliver the most effective results. Pursuant to the Framework, the TRC test measures the energy-related benefits and costs of DSM programs experienced by both the gas utility system and program participants for as long as those benefits and costs persist. The TRC Plus test builds on the TRC test to include a 15 percent adder to account for the non-energy benefits associated with energy efficiency programs, such as environmental, economic, and social benefits. The PAC test measures the gas utilities' avoided costs and the costs of DSM programs experienced by the gas utility system. (Ontario Energy Board, 2014b, pp. 32–33). Therefore, the primary difference in the tests is that the TRC Plus test accounts for participant costs and benefits while the PAC test does not.

Table 4 and Table 5 present Enbridge's and Union's cost-effectiveness test results using the TRC Plus test, while Table 6 and Table 7 present cost-effectiveness test results using the PAC test. As the tables show, the proposed programs are robustly cost-effective over the plan term.[5]

With the TRC Plus test, Enbridge and Union demonstrate similar results. Overall, Enbridge's benefit-cost ratio is 2.4 while Union's is 2.0. The Resource Acquisition and Low Income programs are relatively consistent across the utilities, and the programs are within a healthy cost-effectiveness range. Generally speaking, benefit-cost ratios of 2.0 or greater are considered acceptable. For the Resource Acquisition program, Enbridge has a benefit-cost ratio of 2.6 and Union's is at 2.3. For the Low Income program, Enbridge has a benefit-cost ratio of 1.3 and Union has a benefit-cost ratio of 1.0. Enbridge has significantly greater net benefits ($664 million) than Union ($140 million).

Table 4. Enbridge 2016-2020 Total Resource Cost Plus Test Results by Program

Enbridge 2016-2020 TRC Plus Test				
Program / Sector	**Costs**	**Benefits**	**Net Benefits**	**BCR**
Resource Acquisition	401,877,141	1,046,995,678	645,118,537	2.605
Low Income Total	67,468,057	86,670,854	19,202,797	1.285
Portfolio Total	***469,345,198***	***1,133,666,532***	***664,321,334***	***2.415***

Source: (Enbridge Gas Distribution 2015a, Exh. B, Tab 2, Sch. 3, pp. 3-7).

Table 5. Union 2016 Total Resource Cost Plus Test Results by Program

Union 2016 TRC Plus Test					
Program / Sector	**TRC Plus Costs**	**Unassigned Costs**	**Benefits**	**Net Benefits**	**BCR**
Resource Acquisition	117,426,427	12,714,231	270,415,947	140,275,289	2.303
Low Income Total	7,981,140	4,106,838	12,227,629	139,651	1.012
Portfolio Total	***125,407,567***	***16,821,069***	***282,643,576***	***140,414,940***	***1.987***

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, App. A, pp. 23-24, 48-52, 62-63, 96-98).

With the PAC test, Enbridge's and Union's results are again similar to each other. For the Resource Acquisition program, Enbridge has a benefit-cost ratio of 4.8, and Union has 6.8. For the Low Income program Enbridge has a benefit-cost ratio of 1.4 while Union's is 0.9. Union's Low Income program does not appear to be cost-effective using the PAC test, partially due to the fact that the PAC test does not capture some of the significant benefits that low income program participants experience. These benefits are captured in the TRC Plus test. At the portfolio level, Union shows a 5.2 and Enbridge a 4.0. Enbridge has significantly greater net benefits ($852 million) than Union ($176 million).

[5] Union has only provided cost-effectiveness information for 2016 due to its performance incentive target adjustment mechanism. For more information, refer to Chapter 6 on shareholder incentives.

Table 6. Enbridge 2016-2020 Program Administrator Cost Test Results by Program

Enbridge 2016-2020 PAC Test				
Program / Sector	**Costs**	**Benefits**	**Net Benefits**	**BCR**
Resource Acquisition	219,895,981	1,046,995,678	827,099,697	4.761
Low Income Total	62,023,802	86,670,855	24,647,053	1.397
Portfolio Total	***281,919,783***	***1,133,666,533***	***851,746,750***	***4.021***

Source: (Enbridge Gas Distribution 2015a, Exh. B, Tab 2, Sch. 3, pp. 3-7).

Table 7. Union 2016 Program Administrator Cost Test Results by Program

Union 2016 PAC Test					
Program / Sector	**PAC Costs**	**Unassigned Costs**	**Benefits**	**Net Benefits**	**BCR**
Resource Acquisition	18,110,862	12,714,231	208,874,135	178,049,042	6.776
Low Income Total	7,299,019	4,106,838	9,791,947	- 1,613,910	0.859
Portfolio Total	***25,409,881***	***16,821,069***	***218,666,082***	***176,435,132***	***5.178***

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, App. A, pp. 23-24, 48-52, 62-63, 96-98).

3.2. Program Mix by Customer Sector

Before considering the allocation of DSM programs to customer sectors, it can be helpful to understand the size and allocations of sales and customers within Enbridge's and Union's service territory. Table 8 and Table 9 below summarize the number of customers and their sales within the residential and C&I customer sectors for Enbridge and Union. For both utilities, 92% of customers are residential consumers, while the remaining 8% are C&I consumers. However, Union's C&I customers comprise a much larger percentage of sales (77%) than Enbridge's C&I customers (59%). Therefore, the average Union C&I customer uses over twice as much gas (91,013 m^3 per year) as the average Enbridge C&I customer (40,761 m^3 per year).

Table 8. Enbridge 2016 Customer Sector Profile

Enbridge 2016 Customer Sectors					
Customer Sector	Customers	% of Customers	Sales (million M3)	% of Sales	Usage per Customer (M3)
Residential	1,968,960	92%	4,709	41%	2,392
C&I	162,927	8%	6,641	59%	40,761
Total	2,131,887	100%	11,350	100%	5,324

Source: (Enbridge Gas Distribution 2015a, Exh. B, Tab 2, Sch. 4, p. 5)

Table 9. Union 2014 Customer Sector Profile

Union 2014 Customer Sectors					
Customer Sector	Customers	% of Customers	Sales (million M3)	% of Sales	Usage per Customer (M3)
Residential	1,299,273	92%	3,270	23%	2,517
C&I	119,755	8%	10,934	77%	91,302
Total	1,419,028	100%	14,204	100%	10,010

Source: (Union Gas Limited 2015a, Exh. A, Tab 1, App. A, Sch. 4-5).

Regarding the DSM program allocations to customer sectors, Table 10 and Table 11 below provide similar cost and saving information as summarized in the Key Program Metrics section above, but present information at the customer sector level rather than at the program level. Enbridge's residential and C&I budget allocation is 53% / 30%, respectively, while Union's is 49% / 34%, respectively. As a result, both utilities are consistent with the Board's general approach of spending approximately 40% on residential programs.[6]

For the Low Income program, Union has a higher budget allocation (22%) than Enbridge (15%), although Enbridge has a lower cost of saved energy. This results in higher savings from that sector for Enbridge (9%) as compared to Union (5%). Both of the utilities' budget allocations to the low income sector are consistent with the Board's historical requirement to spend at least 15% of the budget on the low income sector.[7] Other jurisdictions also require that a certain percentage of program funding is spent on

[6] The Board provided general guidelines to the utilities for designing program budgets, including the maximum annual budget levels and the maximum residential bill impacts. The development of these budget guidelines assumed a general program mix where 40 percent of the ratepayer funding for DSM activities is dedicated to the residential sector. (Ontario Energy Board, 2014b, pp. 18–19).

[7] For the 2012-2014 DSM plans, the Board indicated that the annual low income DSM budget should be no less than 15% of the natural gas utilities' total DSM budgets. (Ontario Energy Board, 2011, p. 26). For the current DSM Framework, the OEB indicated that the expansion of low income programs will be a key priority (Ontario Energy Board, 2014b, p. 26).

low income programs. For example, Massachusetts requires that 20% of program budgets are spent on the low income sector. (Massachusetts General Laws, 2008, c. 25, § 19(c)).

Table 10. Enbridge 2016-2020 Budget, Savings, and Cost of Saved Energy by Customer Sector

ENBRIDGE 2016-2020 TOTAL					
Program / Sector	**Total Utility Costs ($)**	**% of Total Costs**	**Lifetime Savings (M3)**	**% of Total Savings**	**Cost of Saved Energy ($/M3)**
Residential	**145,442,590**	**38%**	**1,160,453,095**	**21%**	**0.1253**
Resource Acquisition	91,473,258	24%	1,064,112,690	19%	0.0860
Market Transformation	53,969,332	14%	96,340,405	2%	0.5602
Commercial & Industrial	**112,690,460**	**30%**	**3,944,429,422**	**71%**	**0.0286**
Resource Acquisition	94,111,593	25%	3,944,429,422	71%	0.0239
Market Transformation	18,578,867	5%		0%	
Low Income Total	**56,634,483**	**15%**	**484,752,590**	**9%**	**0.1168**
Low Income	56,634,483	15%	484,752,590	9%	0.1168
Portfolio Subtotal	**314,767,533**	**83%**	**5,589,635,107**	**100%**	**0.0563**
Overhead Costs	45,939,257	12%		0%	
Other Costs	20,508,892	5%		0%	
Portfolio Total	***381,215,682***	***100%***	***5,589,635,107***	***100%***	***0.0682***

Source: (Enbridge Gas Distribution 2015a, Exh. B, Tab 1., Sch. 4, pp. 3-5, 19-21, 27, 29; Exh. B, Tab 2, Sch. 3, pp. 3-7).

Table 11. Union 2016 Budget, Savings, and Cost of Saved Energy by Customer Sector

UNION 2016-2020 TOTAL					
Program / Sector	**Total Utility Costs ($)**	**% of Total Costs**	**Lifetime Savings (M3)**	**% of Total Savings**	**Cost of Saved Energy ($/M3)**
Residential	**82,074,000**	**27%**	**653,283,929**	**11%**	**0.1256**
Resource Acquisition	81,032,000	27%	653,283,929	11%	0.1240
Market Transformation	1,042,000	0%	-	0%	
Commercial & Industrial	**103,868,000**	**34%**	**5,222,751,610**	**85%**	**0.0199**
Resource Acquisition	95,518,000	32%	5,162,751,610	84%	0.0185
Performance Based	4,365,000	1%	60,000,000	1%	0.0728
Large Volume	3,985,000	1%	-	0%	
Low Income Total	**66,182,000**	**22%**	**282,123,495**	**5%**	**0.2346**
Low Income	66,182,000	22%	282,123,495	5%	0.2346
Portfolio Subtotal	**252,124,000**	**84%**	**6,158,159,034**	**100%**	**0.0409**
Other Costs	34,803,000	12%	-		
Inflation	14,977,000	5%	-		
Portfolio Total	***301,904,000***	***100%***	***6,158,159,034***	***100%***	***0.0490***

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, pp. 6, 12, 20, 26, 30, 32, 36; Exh. A, Tab 3, App. A, pp. 14-15, 23-24, 41-43, 48-52, 59-60, 62-63, 71, 87-89, 96-98, 105).

In other jurisdictions, the amount of costs and savings allocated to each customer sector can vary depending on the composition of the customers within a utility's service territory, the policy requirements in the jurisdiction (such as a certain percentage towards low income programs), the cost

of saved energy within each sector, and the markets the utility chooses to focus on. National Grid's gas programs in Massachusetts are summarized below in Table 12 as an example.

In general, costs should be allocated to each sector in proportion to how the costs are collected from the sectors. However, such an approach may not be appropriate or transparent in Ontario, where the rate structure is determined by volume of use by a customer rather than the type of customer.

Table 12. Massachusetts National Grid Gas 2013 Sales and 2014 Energy Efficiency Spending and Savings

Massachusetts National Grid Gas						
Customer Sector	2013 Sales (M3)	% of Sales	2014 Spending	% of Spending	2014 Annual Savings (therms)	% of Savings
Residential & Low Income	85,257,601	57%	79,113,578	82%	31,467,257	71%
Commercial & Industrial	65,599,313	43%	17,686,906	18%	13,046,687	29%
Total	150,856,914	100%	96,800,484	100%	44,513,944	100%

Source: (National Grid, 2015; U.S. Energy Information Administration, 2015).

The allocation of costs and savings to each customer sector as proposed in the utilities' plans is relatively consistent with historical costs and spending. In 2012, Enbridge spent approximately 40% on the residential and low income sectors resulting in about 10% of the total savings, and the C&I sector made up the difference with Enbridge spending 60% of the budget on 90% of the savings. For Union in 2012, 23% of the budget was spent on residential and low income programs resulting in about 5% of the overall savings, and the C&I program comprised 77% of the budget to obtain 95% of the savings. (Ontario Energy Board, 2014a, p. 10, 2014b, p. 14).

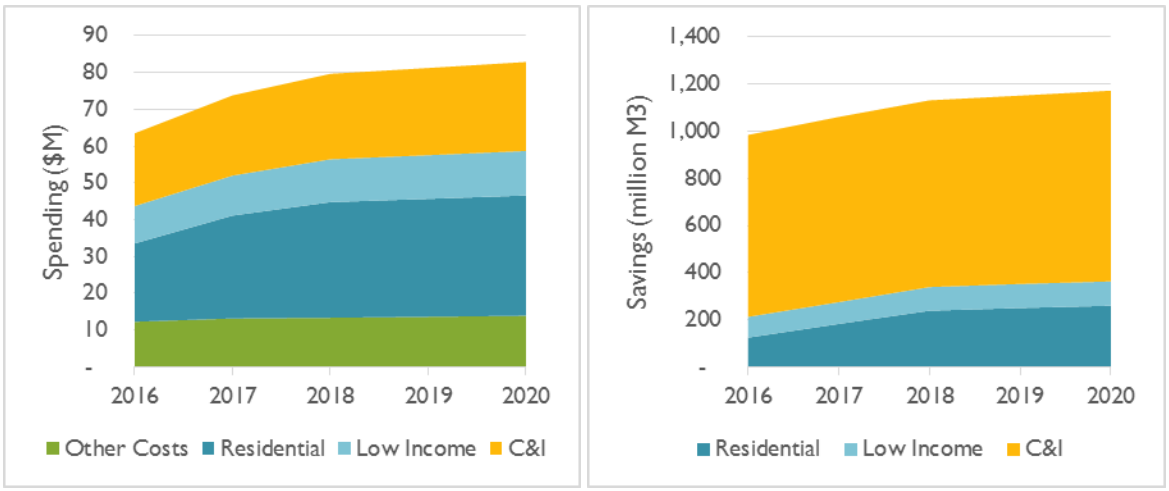
The allocations of costs proposed in the 2016-2020 plans shift more funding to residential programs. For Enbridge, spending on residential and low income as compared to C&I is 53% / 30% respectively, while for Union the split in costs is 49% / 34%. This is a particularly significant shift for Union, as the residential program budget is more than doubling in 2016 as compared to 2012. Such a shift in spending is more consistent with Enbridge's programs, will allow for a more distributed allocation of services across the customer sectors, and ensures that this customer sector is provided with more comprehensive programs.

As a result of the shift in spending, there is a corollary shift in the savings allocation. The savings allocation between residential and low income as compared to C&I for Enbridge is 29% / 71%, while for Union it is 15% / 85%. The majority of savings are still provided by the C&I sector, with Union achieving a greater overall portion of savings from C&I due to its lower cost of saved energy for C&I programs ($0.02 per m^3) as compared to Enbridge ($0.03 per m^3), and because Union continues to allocate more of its budget to C&I than Enbridge.

In addition, the overall amount that the utilities plan to spend in this plan relative to the past has increased. In 2012, each utility spent approximately $30 million (excluding shareholder incentives) for all customer sectors (2015-2020 DSM Framework Report, p 14). In the plans, for Enbridge, spending starts

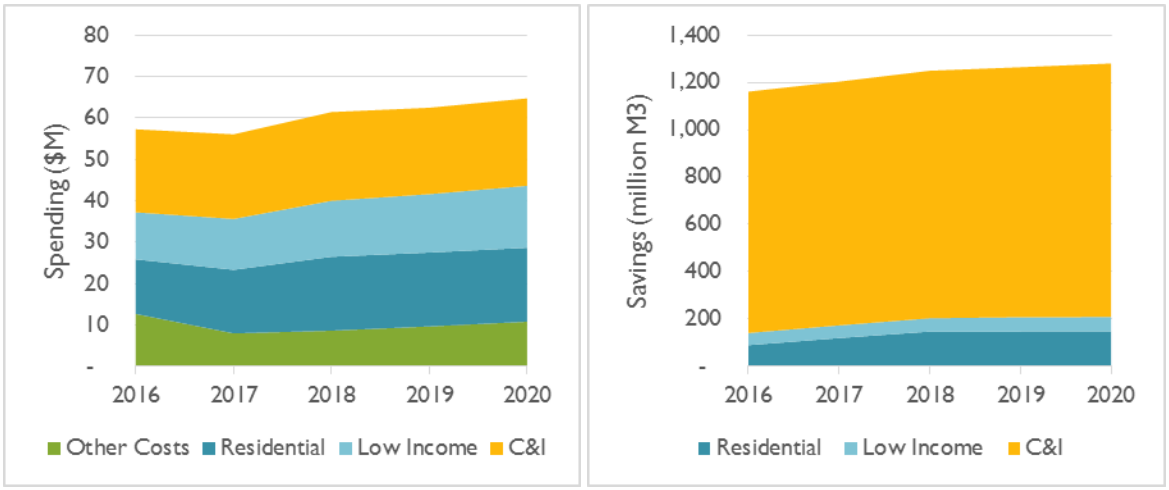
at $64 million in 2016 (excluding shareholder incentives), and increases in 2017 (16% over 2016) and 2018 (8% over 2017) before leveling out in 2019 (2% over 2018) and 2020 (2% over 2019). For Union, spending starts at $57 million in 2016 (excluding shareholder incentives), then decreases in 2017 (-2% over 2016), and increases in 2018 (10% over 2017), 2019 (2% over 2018), and 2020 (4% over 2019). By 2020, Enbridge will be spending almost three times as much as 2012 levels. By 2020, Union will be spending over twice as much as 2012 levels. This analysis is summarized in Figure 1 through Figure 4 below.

Figure 1 and Figure 2. Enbridge Annual Spending and Savings by Customer Sector, 2016-2018



Source: (Enbridge Gas Distribution 2015a, Exh. B, Tab 1., Sch. 4, pp. 3-5, 19-21, 27, 29; Exh. B, Tab 2, Sch. 3, pp. 3-7).

Figure 3 and Figure 4. Union Annual Spending and Savings by Customer Sector, 2016-2018



Source: (Union Gas Limited 2015a, Exh. A, Tab 3, pp. 6, 12, 20, 26, 30, 32, 36; Exh. A, Tab 3, App. A, pp. 14-15, 23-24, 41-43, 48-52, 59-60, 62-63, 71, 87-89, 96-98, 105).

3.3. Recommendations

1. The utilities should coordinate with each other to track and report data comprehensively and consistently. It was difficult to obtain data for this analysis at the offering -level, including costs by costs categories (marketing, incentive, evaluation, administration, and performance incentive), savings and benefits by fuel type (gas, electricity, water, non-energy benefits), cost-effectiveness (total costs, benefits, net benefits, and benefit-cost ratios), and performance incentives (maximum incentive and target incentive). Such information should be readily available in plans and reports in a transparent format that is consistent across the utilities.

2. Participation should be planned for and reported in detail, including the number of participants expected to be served, definitions of what a participant represents in each program (number of units, houses, etc.), and the number of customers that are eligible to participate in each program. This data should be provided for each year of the plan and during annual reporting.

4. ASSESSMENT OF EVALUATION PLANS

We identified various issues in Enbridge's and Union's program and offering evaluation plans that are in several common key subjects. Such key subjects are: impact evaluation plan in general, savings verification activities, gross impact evaluation approach, evaluation study schedule, process evaluation method, timing of process and impact evaluation study, evaluation budget, and cross offering evaluation studies. Below we discuss each of these subjects in detail and present best practices. This chapter is used as a guide to review the utilities' evaluation plan for each offering discussed in the following chapter along with program designs, and is referred for a discussion of evaluation plan for each offering where relevant.

It is our understanding that the utilities are responsible for developing all necessary evaluation plans regarding their proposed programs, but the OEB is in charge of overseeing impact evaluation, and hiring an independent auditor who would hire engineering evaluation firms to conduct impact evaluation studies.(Ontario Energy Board, 2014a, p. 15, 16). As such, in this chapter as well as in the following chapter, our recommendations on impact evaluation are directed toward the OEB or generally indicate that the utilities' plans should provide any necessary information regarding the planning of impact evaluation, rather than recommending that the utilities should undertake certain impact evaluation activities. For any other evaluation activities including process evaluation, our recommendations are directed toward the gas utilities.

4.1. Impact Evaluation Plan

In its 2012 report titled "Energy Efficiency Program Impact Evaluation Guide," the State and Local Energy Efficiency Action Network (SEE Action) defines impact evaluation planning document as follows:[8]

> "The evaluation planning documents should clearly present the evaluation efforts and details of the actions to be undertaken during the evaluation activity, as well as consideration of regulatory (reporting) requirements. A plan is a stand-alone decision document, meaning it must contain the information the evaluator and others need to understand what is to be undertaken, why, when, and how."(SEE Action, 2012, p. 8-13)

[8] SEE Action is a state- and local-led effort facilitated by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) to take energy efficiency to scale that builds on the foundation of the National Action Plan for Energy Efficiency. SEE Action is composed of more than 200 leaders from state and local governments, associations, businesses, non-government organizations, and their partners working toward a goal of achieving all cost-effective energy efficiency by 2020. SEE Action offers knowledge resources and technical assistance to state and local decision makers as they seek to advance energy efficiency policies and programs in their jurisdictions. More information is available at https://www4.eere.energy.gov/seeaction/

In this same report, SEE Action lists several key evaluation activities that need to be included in a portfolio cycle impact evaluation plan as follows:

1) List of evaluation objectives and how they support program goals,
2) List of which metrics will be reported (e.g., annual m^3, annual CO_2),
3) Description of measure installation verification activities,
4) Version of the Technical Reference Manual (TRM) to be used and/or any TRM development/review activities,
5) Gross and net impact evaluation approaches selected for determining energy savings,
6) Methodology for calculating non-energy benefits such as avoided emissions, as appropriate,
7) List of primary factors that will be considered in analysis of gross and net savings (e.g. , weather, occupancy, free riders, spillovers) as well as a list of major assumptions,
8) Description of how program impact results will be combined to report portfolio impacts, addressing the need for adjustments such as program overlap (e.g., behavioral program),
9) Expectations for overall certainty of savings estimates,
10) Assumptions concerning availability of data and other information, such as relative roles of evaluator and administrator/implementer,
11) Budget and schedule summary, and
12) Listing of evaluators (if known) or evaluator selection method.

Both utilities provide lists of evaluation objectives (for the evaluation activity #1) and budget (for part of the evaluation activity #11).

Regarding the evaluation activity #3, Enbridge provides metrics that will be reported in its evaluation studies, while Union does not. Thus, Union should provide this information (e.g., annual or lifetime m^3 of natural gas).

Regarding the evaluation activity #4, Union provides detail on input assumptions for gross savings estimates for a number of its offerings, while Enbridge does not mention it at all in its evaluation plan. Thus, Enbridge should mention the use of input assumptions for specific offerings where appropriate.

Regarding the evaluation activity #5 on net impact evaluation, Union describes how it intends to estimate net savings impacts for the majority of its offerings, while Enbridge does not. Thus, Enbridge should indicate how it plans to estimate net energy savings impacts.

Regarding the evaluation activity #9 on expectations for overall certainty of savings estimates, neither company provides any information in its evaluation plan. Expectations for overall certainty of savings

estimates represent a measure of risk in savings results. (SEE Action, 2012, p. 8-6). They are also referred to as "confidence and precision of results". As an example, a 2013 evaluation plan by Massachusetts program administrators specifies that the evaluation on prescriptive gas measures will have ±20 percent precision for natural gas savings at an 80 percent confidence level. If an average verified savings is 10 percent of consumption, these metrics imply that the true program energy savings are between 8 percent and 12 percent of baseline energy use, with 80 percent probability. Where possible, both companies should provide this information in their plans.

Regarding the evaluation activity #12 on the listing of evaluators, neither company provides any information on the name of evaluators or how it plans to select evaluators. The Massachusetts evaluation plan mentioned above lists the name of a contact person and their company name for each proposed evaluation study.(Massachusetts Program Administrators, 2014). In light of this example and SEE Action's recommendation, we suggest both companies provide information about any evaluators already selected by the OEB.

Other key evaluation activities worth discussing are #3 on verification activities, #5 on gross impact evaluation, and #11 on evaluation schedule summary. These will be discussed in detail below.

4.2. Measure Verification Activities

SEE Action defines measure verification as:

> [A]n independent assessment that the program has been implemented per the program design. For example, the objectives of measure installation verification are to confirm (1) the installation rate, (2) that the installation meets reasonable quality standards, and (3) that the measures are operating correctly and have the potential to generate the predicted savings. Verification activities are generally conducted during on-site surveys of a sample of projects. *Project site inspections, participant phone and mail surveys, and/or implementer and consumer documentation review are typical activities associated with verification* (emphasis added)(SEE Action, 2012, p. A-16).

As an example of the verification activity, Massachusetts program administrators' 2013 evaluation plan provides the following description as their data gathering and analysis activity for the 2013 impact evaluation of their Custom Gas Installation program:

> Data collection will include physical inspection and inventory, interviews with facility personnel, observation of site operating conditions and equipment, short-term metering of usage, billing data and EMS trends. At each site, evaluators will perform a facility walk-through to verify the post-retrofit or installed conditions of each energy conservation measure (ECM). On-site evaluation procedures and site analysis will be presented in a site report for each sampled site. DNV KEMA will apply the model- assisted stratified ratio estimation methodology to aggregate the site results, and expand to the program population."(Massachusetts Program Administrators, 2014).

In contrast to these best practices, Enbridge and Union provide no or limited information on their measure verification activities for most of the offerings. For example, Enbridge's evaluation plan provided just one or two of the following statements for most of its offerings without further details: (a) ensure accurate tracking of offering participants and installed measures; (b) verification of installation of select measures; (c) ensure project files are complete, accurate, and substantial (d) assess the validity of natural gas savings claims among sample of participants; or (e) verify savings claims for the vast majority of the offerings.[9] All of these descriptions beg the question of how measure installations are verified. Similarly, Union's plan defines its verification activities poorly. Union proposes to conduct "engineering review of custom project savings" for the Low Income multi-family and C&I Custom offerings, and "desk review of project files" for the RunSmart offering (retro-commissioning) and the Strategic Energy Management offering. However, it does not provide any further details. For most of the remaining offerings, Union does not provide any description of its verification activities. On the other hand, Union's verification plan on the Energy Savings Kit offering looks reasonable in that the company plans to conduct phone surveys to verify installation rates and continued usage of the measures promoted under this offering (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 14). We recommend both companies provide detailed information on measure verification activities in their evaluation plans by following the best practices discussed above.

4.3. Gross Impact Evaluation Approach

Gross energy savings impacts refer to the change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. Gross impact estimates also account for factors associated with actual measure installations and operations verified though evaluation activities (e.g., data errors, installation and persistence rates, and hours of use). Technically speaking, such estimates are called adjusted gross impacts, but are referred to here as gross savings for simplicity. Gross impacts do not account for free riders, spillovers or market effects, while net savings account for these effects (See a discussion of these factors in Chapter 9).

There are three types of gross impact evaluation approaches: deemed savings approach, project specific measurement and verification (M&V) approach, and large-scale consumption data analysis. These methods are described in SEE Action (2012), and are also consistent with the Evaluation, Measurement and Verification (EM&V) Protocols V2.0 established by the Ontario Power Authority.(Ontario Power Authority, 2015).[10]

[9] Such offerings include Custom C&I, C&I Direct Install, C&I Prescriptive, Home Energy Conservation, Residential Adaptive Thermostats, Low Income Multi-family, Home Winterproofing, Low Income New Construction.

[10] The same three methods are described in Technical Guide 5: Gross Energy Savings Guidelines in Part 2 of the EM&V Protocols V2.0 document.

4.3.1 Deemed Savings Approach

The deemed savings approach is the equivalent of the input assumptions that have been used in Ontario or the Technical Reference Manual that is currently under development. According to SEE Action, this approach is most commonly used for programs that involve simple new construction, or for retrofit energy efficiency measures with well-defined applications and savings calculations that have been verified with data.(SEE Action, 2012, p. 4-12)

4.3.2 Project Specific M&V Approach

The project-specific M&V approach is used for various types of programs that involve relatively complex retrofits or new construction projects subject to more variation in savings than the type of projects or measures suitable for deemed savings. It is generally applied to only a sample of projects in a program, and often used when other approaches are not applicable (e.g., when no deemed savings exist) or per-project savings are needed. (SEE Action, 2012, p. 4-12). This approach uses one or more methods that can involve measurement, engineering calculations, billing regression analyses, and/or computer simulation modeling. These different methods are described in the International Performance Measurement and Verification Protocols (IPMVP). The M&V approach also typically accompanies field activities dedicated to collecting site information, including equipment counts, observations of field conditions, building occupant or operator interviews, measurements of parameters, and metering and monitoring. (SEE Action, 2012, p. 4-12). Information and data collected through field activities are essential for measuring and verifying savings.

According to the California Evaluation Framework, which method to use depends largely on the following factors:

- Program size
- Market event (e.g., new construction, renovation, etc.)
- Expected impacts as a fraction of total billing
- Program strategy (e.g., prescriptive, upstream incentive, direct installation)
- Data collection costs and available budget
- Program evaluation history (verify/triangulate with another method, questions posed from past evaluations, etc.) (TechMarket Works, 2004, p. 101,p. 480)

Billing analysis is an analytic methodology used to determine project or program energy savings based on the use of the energy consumption data contained in consumer billing data. Billing analysis is often preferred when (a) both pre- and post-retrofit billing data are available; (b) anticipated program impacts can be expected to be observed in a billing analysis (i.e., usually savings at or above 10 percent is a recommended threshold); and (c) the analysis of a program with larger numbers of participants that are more homogenous. (TechMarket Works, 2004, p. 101).

Engineering analysis tends to be used when (a) no pre-measure billing data is available; (b) expected impacts are too small to measure in a billing analysis; (c) the program has a small number of participants or unique measures, e.g., with industrial process improvements; (d) the program has significant investments in engineering methods within the program that can provide cost savings for a similar evaluation (e.g., programs that include substantial engineering M&V or building energy simulation modeling). (TechMarket Works, 2004, p. 101). Building energy simulation is one type of engineering analysis. It is often used for measuring savings for new construction, because new construction involves various energy efficiency measures and does not have any pre-retrofit billing data.

4.3.3 Large-scale Consumption Data Analysis

Lastly, large-scale consumption data analyses are conducted for programs that have many participants sharing common characteristics, such as single-family detached homes in a particular community with residents of similar economic demographics. (SEE Action, 2012, p. 4-13). This approach is often used for evaluating behavior programs with peer comparison feedback mechanisms. This type of analysis can take two different approaches: (1) a randomized controlled trials (RCT) approach and (2) a quasi-experimental approach along with a panel data model that compares the change in energy use for the treatment group to the change in energy use for the control group. SEE Action recommends the RCT approach over the quasi-experimental approach because RCT will result in robust, unbiased estimates of program energy savings. (SEE Action, 2012, p. 7-24).

4.3.4 Highlights of Gross Impact Evaluation Plans

Enbridge provides reasonable gross impact savings measurement approaches for its residential new construction offerings (i.e., Residential Savings by Design offering) and custom offerings (i.e., Commercial and Industrial Custom offerings). However, it provides no or little descriptions on savings measurement approaches for the remaining offerings.

Union provides a reasonable level of information on gross impact evaluation approaches for most of its offerings. However, the proposed approaches for residential and commercial retrofit-related offerings (i.e., Home Reno, Home Weatherization, and Aboriginal) are not appropriate, and the approaches for the RunSmart and the SEM are insufficient. Details of these deficiencies for both Enbridge and Union are discussed in the section on evaluation plans for specific offerings below.

4.4. Evaluation Study Schedule

A best practice for developing an evaluation plan for both impact and process evaluation is to provide an evaluation activities timeframe in the plan. According to a SEE Action, a portfolio cycle M&V plan should describe which major evaluation activities will be conducted during the evaluation cycle at a high level, and list all the planned major evaluation activities with a schedule for when they are to be conducted (SEE Action, 2012). The majority of the evaluation plans provided by Enbridge and Union do not provide any schedules. Thus, we recommend both companies provide at minimum rough estimates of the start and end of the scheduled evaluation activities. They should also consider developing more detailed,

potential evaluation schedules for key evaluation activities. The table below presents an example of an evaluation activities timeframe for an evaluation plan for assessing net to gross rations included in a 2013 Massachusetts statewide 2013 – 2014 evaluation plan (Massachusetts Program Administrators, 2014).

Table 13. Example Evaluation Timeframe

Task	2013						2014					
	Oct		Nov		Dec		Jan		Feb		Mar	
Task 1: Assessment of Planning and Implementation												
Review documentation												
In-depth interviews												
Review shelf stocking data												
Task 2: Develop NTG												
Provide draft report											D	
Provide final report												F

4.5. Process Evaluation Approach

Process evaluation is a system assessment of an energy efficiency program and consists of in-depth examination of the design, delivery, and operations of energy programs. Its aim is to improve the ability of the program to achieve energy savings and accomplish other program goals. Process evaluation also provides a vehicle for sharing program design and operational improvements with other professionals in the field so that they can assess the relevance of the evaluation findings and recommendations to their policies, programs, and program portfolios (TechMarket Works, 2004, p. 206).

According to the California Evaluation Framework, some of the key issues that need to be evaluated include, but are not limited to:

a. Program design and operational systems;

b. Program tracking and information management systems;

c. Program delivery organization and staffing;

d. Skill levels needed to implement the program (i.e, who are the key market actors, and do they have sufficient knowledge and skills on energy efficiency? Are training or technical assistance sufficient or insufficient?);

e. The methods and procedures used to target the outreach efforts;

f. The marketing materials used to promote the program;

g. Program operational efforts and their relationship to the program theory and logic model;

h. The outreach efforts and the structure and content of these efforts (i.e., what delivery/contact/information channels have been most effective in getting customer responses and participation? Trade allies, account managers, and trade shows?);

i. Early program satisfaction and customer service experiences (TechMarket Works, 2004, p. 214).

In addition, one of the key Ontario DSM guidelines, the potential coordination between electric and gas energy efficiency programs can be investigated in a process evaluation study.

Process evaluation activities include, but are not limited to the following:

a. Reviews and tests of records, materials, tools, etc.;

b. Interviews and discussions with program management and staff, implementing contractors, subcontractors, and field staff;

c. Interviews and discussions with policy makers, key stakeholders, and market actors;

d. Interviews, discussions, surveys and/or focus groups with participants and nonparticipants;

e. Collection and analysis of relevant data available from third-party sources (e.g. equipment vendors);

f. Field observations, measurements, and examinations; and

g. Other activities as needed to address researchable issues (TechMarket Works, 2004, p. 216).

In general, Union does a better job describing their process evaluation than Enbridge. However, neither Enbridge nor Union provides sufficient information for its evaluation activities for most of its offerings. For example, neither utility proposes to conduct a desk review and test of program records, materials, or tools for any of their offerings. Review of program records and materials provides a valuable insight as to how the program is implemented in practice and allows for testing of the content and the accuracy of program records. Part of this assessment includes a review of a sample of customer files to test for content and accuracy of the information collected, and to assess the effects of incomplete, inaccurate, or uncollected information on the ability to effectively manage and operate the program. This assessment also includes an examination of program electronic tracking records and reports, which helps the evaluator assess the strengths and weaknesses of the program operations as well as how the tracking system and system reports can be improved (TechMarket Works, 2004, p. 216). As an example, Massachusetts program administrators planned to conduct the following task for its 2013 process evaluation plan for direct install programs:

> DNV KEMA may review program materials such as marketing materials, training documents, and tracking databases. Some specific perspectives we may examine include: consistency, electricity/gas integration, selling energy efficient solutions, and opportunities to streamline (Massachusetts Program Administrators, 2014).

Another issue particularly prevalent in Enbridge's evaluation plan is that proposed surveys mainly target program participants, and ignore other key program players. These can include implementation contractors and program administrator staff members. Program staff can be a valuable source of information to evaluate the program design and operations, as they typically know the program better than anyone. In some cases, it may also be useful to interview some of the program staff members who are responsible for program databases and the processing of incentive payments (TechMarket Works, 2004, p. 217-218).

4.6. Timing of Impact and Process Evaluation Study

4.6.1 Impact Evaluation

Both the California Evaluation Framework and SEE Action call for an early start for impact evaluation well before the end of the first year of the program implementation. SEE Action states that "[a]n ideal evaluation schedule begins before the start of the program implementation (to collect any baseline data and set up the overall evaluation infrastructure) and continues for some time after the program is completed to analyze persistence of savings. Evaluation could be delayed in the first year… One approach in this situation is to accept the late start of an evaluation for the current year and conduct a more limited effort than desired, but then move the evaluation cycle and the program/portfolio cycle into better alignment within one or two years (SEE Action, 2012, p. 8-11)." The California Evaluation Framework suggests that the initial evaluation activities could start in the middle of the first year of a new program and involve data collection activities such as measure installation, field data collection, on-site surveys, metering and monitoring, billing data collection and preparation (TechMarket Works 2004, p. 84). We recommend both Enbridge and Union's evaluation plans include these best practices.

4.6.2 Process Evaluation

A 2007 paper that compiled lessons learned from 30 years of the process evaluation history in North America discussed the timing of the process evaluation as follows:

> Process evaluations should begin when a program concept is being developed, as part of the research support for the program, along with market research. Early activities can include testing the program response as it is rolling out in pilot phases or early implementation (Peters, 2007).

We suggest that both Enbridge and Union consider initiating the process evaluation in the first year for all new offerings, and also for existing offerings that have significant program design changes such as incentive designs, because early evaluation activities could identify problems sooner. This would enable earlier improvements to program designs.

We also recommend that both Enbridge and Union consider hiring and working with evaluation contractors during the early program development and implementation period. As discussed in detail in the 2004 California Evaluation Framework document, this approach offers two advantages. First, the

evaluation staff can help identify potential problems associated with early program designs or operational practices. Second, the process evaluation contractors can work with program designers and managers to set up data management and operational systems that can more readily provide necessary reporting and evaluation data (TechMarket Works, 2004, p. 213).

4.7. Evaluation Budget

SEE Action states that "[w]hile it is difficult to generalize, common practice suggests that a reasonable spending range for evaluation (impact, process, and market) is 3% to 6% of a portfolio budget." SEE Action examined the Consortium for Energy Efficiency's (CEE's) 2011 annual industry database on total EM&V spending for program administrators in the United States and Canada, and found that, for natural gas and electricity programs, the average percentage of program budget spent on EM&V in 2011 was about 3.6 percent (SEE Action, 2012, p. 7-14).

Both Enbridge and Union plans to spend about 2 percent of their total program budget on EM&V activities (Enbridge Gas Distribution, 2015a, Exh. B, Tab 1, Sch. 4, p. 3-5; Union Gas Limited, 2015a, Exh. A, Tab 3, p. 6). This level of proposed budget on evaluation may be insufficient. SEE Action (2012) notes that the 3 to 6 percent range is only a rough guideline because evaluation needs and the relative EM&V roles of program administrators and independent third-party evaluators vary significantly between different jurisdictions and program administrators. Nevertheless, in light of our findings of evaluation plan gaps over the next five years, Enbridge and Union may need more budget on their evaluation activities.

4.8. Cross-Offering Evaluation Studies

Neither Enbridge nor Union propose any evaluation studies for multiple offerings, programs, or sectors—or for the entire jurisdiction or province. Such studies typically include measure baseline studies, market characterization studies, free-ridership and spillover studies, measure life studies, non-energy benefit studies, market potential studies, and benchmarking studies. It is not clear to us which entities are responsible for conducting such cross-offering evaluation studies. However, we note that the utilities are currently working with the Technical Evaluation Committee, which is currently developing the Technical Reference Manual (TRM), and conducting a few evaluation studies including a net-to-gross study and a new boiler base case study (Enbridge Gas Distribution 2015c, Exh. B, Tab 1, Sch. 2, p. 24, Exh. B, Tab 2, Sch. 2, p. 2; Union Gas Limited, 2015a, Exh. A, Tab 3, p. 46). The OEB has also indicated that a persistent study shall be conducted for large custom commercial and industrial DSM programs (Ontario Energy Board 2015, 7).

In any event, we recommend that either the gas utilities or the OEB should develop plans to conduct these studies. We also recommend any responsible entities consider conducting these studies together as joint studies initiated by the gas utilities or province-wide studies initiated by the OEB as much as possible. The subject issues in these studies are applicable across different offerings, sectors, and jurisdictions; and there is ample opportunity to reduce the costs of these studies with evaluators

conducting each study for both utilities. Among the studies listed above, measure baseline studies, market characterization studies, and measure life studies are measure-specific studies; thus the majority of study findings should be applicable to two jurisdictions. In contrast, different sector mixes in the two jurisdictions may require the utilities to use the results differently. As an example, California investor-owned utilities recently completed a joint baseline characterization study for their residential and small commercial HVAC programs (NMR Group, 2015).

4.9. Summary Recommendations

Below we provide a summary of the recommendations discussed in this chapter by key subjects.

4.9.1 Impact Evaluation Plan

Enbridge and Union

1. Both utilities should make sure that they provide in their evaluation plans key pieces of information recommended by SEE Action (2012).
2. Both utilities should provide information on their expectations on overall certainty of savings (i.e., confidence level and interval).
3. Both utilities should provide information on the name of current evaluators already selected by the OEB, if any.

Enbridge

1. Enbridge's evaluation plan should mention the use of input assumptions or the TRM for specific offerings where applicable.
2. Enbridge's evaluation plan should indicate how it plans to estimate net energy savings impacts.

Union

1. Union's evaluation plan should provide metrics that will be reported in its evaluation studies (e.g., annual or lifetime m^3 of natural gas).

4.9.2 Measure Verification Activities

We recommend both companies provide detailed information on measure verification activities in their evaluation plans including, but not limited to, typical verification activities such as project site inspections, participant phone and mail surveys, and/or implementer and consumer documentation review.

4.9.3 Gross Impact Evaluation Approach

Details of these deficiencies for both Enbridge and Union are discussed in the section on evaluation plans for specific offerings below.

4.9.4 Evaluation Study Schedules

The utilities' evaluation plans should provide at minimum rough estimates of the start and end of the scheduled evaluation activities, and consider developing more detailed, potential evaluation schedules for key evaluation activities.

4.9.5 Process Evaluation Approach

1. Both utilities should consider initiating process evaluation activities in the first year for all new offerings and also for existing offerings that have significant program design changes such as altered incentive designs and levels, because early evaluation activities could identify problems earlier.

2. Both utilities should consider hiring and working with evaluation contractors during the early program development and implementation period.

4.9.6 Timing of Impact and Process Evaluation Study

1. A plan to launch impact evaluation activities in the first year for each offering (or even before the start of program implementation depending on the offerings in order to collect any baseline data and set up the overall evaluation infrastructure) should be proposed), and should involve data collection activities such as measure installation, field data collection, on-site surveys, metering and monitoring, and billing data collection and preparation.

2. Both utilities should consider initiating the process evaluation earlier than they propose as early evaluation activities could identify problems sooner, which then could be used to improve program designs earlier.

3. Both utilities should consider hiring and working with process evaluation contractors during the early program development and implementation period.

4.9.7 Evaluation Budget

1. Both utilities should reevaluate their evaluation budget based upon our recommendations on various issues on their evaluation plans, in particular because our review of their evaluation plans identified a number of offerings for which no evaluation activities are proposed over the course of the next five years.

4.9.8 Cross-Offering Evaluation Studies

1. Both utilities, or the OEB, should develop their plans to conduct various other cross-offering evaluation studies such as a measure baseline study, a market characterization study, a free-ridership and spillover study, a measure life study, a non-energy benefit study, a market potential study, and a benchmarking study.

2. Cross-offering evaluation studies should be joint studies initiated by the gas utilities or province-wide studies initiated by the OEB.

5. ASSESSMENT OF PROGRAMS AND OFFERINGS

5.1. Overview

This chapter provides our assessment of each DSM offering by program proposed by Enbridge and Union in their 2015-2020 DSM plans. Both Enbridge and Union propose to offer programs for Resource Acquisition, Market Transformation, and Low Income; and Union also proposes a program for Large Volume Customers and a Performance Based program. Each of these programs includes two to five or more offerings. This chapter addresses the residential and C&I offerings of the Resource Acquisition and Market Transformation programs separately.

The chapter is divided into nine sections:

1. Overview
2. Cross Program Issues
3. Residential Resource Acquisition Programs
4. C&I Resource Acquisition Programs
5. Low Income Programs
6. Residential Market Transformation Programs
7. C&I Market Transformation Programs
8. Large Volume Customers Program
9. Performance-Based and Market Transformation Programs

5.2. Cross Program Issues

5.2.1 Multi-family Market Segment

Both Enbridge and Union's commercial offerings are available to real estate owners and developers who own or build multi-family buildings. However, both utilities indicate the split incentive barriers between renters and property owners for some of their offerings (e.g., Enbridge's C&I prescriptive and Custom Commercial offerings)

In buildings that are individually metered for one or more utilities, programs must encourage property owners to invest in energy efficiency measures that will save their tenants money

Overcoming split incentives, especially encouraging owners of individually metered buildings to invest in tenant spaces, has long been considered the primary barrier that energy efficiency programs for the multifamily sector must overcome.

Programs can also communicate the potential non-energy-related benefits to owners such as increasing property values, improving tenant comfort and satisfaction, and reducing operating and maintenance costs.

Some of the benefits cited by building owners and managers include increasing their property values and improving their tenants' ability to pay rent by lowering their energy costs.

However, given multi-family buildings have their own distinct market barriers to implementing energy efficiency, and are an underserved market segment, we recommend both companies consider developing an offering specifically targeting the multi-family building market segment similar to their low income multi-family offerings. Such an offering could include the following features:

- Free building energy assessments that examine overall building performance, including heating and cooling systems, domestic water heating, building envelope, lighting in common areas, individual living units, and additional building components.
- Free direct installation of water-saving showerheads and faucet aerators, pipe insulation, and compact fluorescent light bulbs (CFLs) in cooperation with electric utilities.
- Optional calculations of projected energy savings that provide potential ROI of efficiency projects. A small fee could be charged for this optional report, and could be reimbursed to the customer once the projects are complete.
- Prescriptive incentives for specific measures that are one-for-one replacements or substitutions for specific equipment.
- Incentives for custom projects that are specific to a building's needs.

Alternatively, both companies could develop a single point-of-contact or one stop shopping dedicated to the MF market segment so that customers interested in implementing energy efficiency measures for their multi-family buildings could explore various types of offerings and incentives through a single point-of-contact or one stop shopping. This will prevent customers from having to apply to different utility companies and different offerings. CNT Energy's Energy Savers program in Chicago, Illinois leverages this approach (Nowak, Kushler, Witte, & York, 2013).

5.2.2 New Construction Offerings

Union should develop a commercial new construction offering similar to Enbridge's new construction offering.

5.2.3 Financing

Both utilities should provide customers with zero or low interest financing to address lack of funding, one of the major barriers identified by Enbridge. As discussed in the Customer Financing section below, there are many jurisdictions in the United States and Canada that offer low-cost interest loans or on-bill financing to commercial buildings.

5.2.4 Residential Products

The offerings available to residential customers within the Resource Acquisition program include single-family retrofits and shallow energy efficiency measures (i.e., thermostats and hot water measures). The utilities do not provide an opportunity for customers to purchase heating or water heating measures such as furnaces, boilers, condensing water heaters, or tankless water heaters outside of the single-family retrofit offerings. A typical products program provides cash incentives to homeowners, or takes a mid-to-upstream approach by providing incentives directly to retailers, distributors or manufacturers of the equipment so that customers ultimately pay a lower price. This type of program is essential for homeowners just looking to replace their old space heating and hot water equipment, especially when the homeowners' HVAC equipment has failed or broken and they need to replace the equipment immediately. Without such a program, homeowners are more likely to purchase lower cost, standard efficiency equipment. This type of products program is typically offered in other jurisdictions, and should be included as part of the utilities' portfolio of programs.

5.2.5 Recommendations

Enbridge and Union

1. Both companies should consider developing an offering specifically targeting the multi-family building market segment similar to their low income multi-family offerings, or consider offering a single point-of-contact or one stop shopping dedicated to the multi-family market segment so that customers interested in implementing energy efficiency measures for their multi-family buildings could explore various types of offerings and incentives through a single point-of-contact.

2. Both utilities should provide customers with zero or low interest financing to address lack of funding, one of the major barriers identified by Enbridge.

3. Both utilities should develop a residential products offering to promote the installation of high efficiency space heating and water heating equipment. This type of program is essential especially when the homeowners' HVAC equipment has failed or broken and they need to replace the equipment immediately

Union

1. Union should develop a commercial new construction offering similar to Enbridge's new construction offering.

5.3. Residential Resource Acquisition Programs

5.3.1 Overview

The table below provides an overview of the offerings included in this program for each utility, and indicates whether those offerings are new or existing. Each of these offering types are discussed in more detail in the sections that follow.

Table 14. Residential Resource Acquisition Program Offerings

Offering Type	Enbridge		Union	
Single Family Retrofit	Home Energy Conservation	Existing	Home Reno Rebate	Existing
Residential Products	Adaptive Thermostats	New	Energy Savings Kit	Existing

5.3.2 Single-Family Retrofit

Overview

Enbridge: Home Energy Conservation (Existing). This offering delivers incentives for insulation improvements and heating system replacements in residential homes. It does this through home energy audits and a tiered incentive structure that is based on the amount of savings a customer achieves. (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 22-27).

Union: Home Reno Rebate (Existing). This offering delivers incentives for energy efficient building envelope improvements and products based on the amount and type of measures installed in residential homes through home energy audits. (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 3-8).

Discussion of Key Issues

The key issues for this offering for Enbridge and Union relate to the customer market targeted to receive the incentives, the incentive structures proposed by the utilities, and the mix of measures included in the offering. Each of these issues is discussed in detail below.

Target Market

Enbridge's offering stipulates that, in order for customers to be eligible for an incentive and participate in the offering, they must implement at least two DSM measures. The types of measures that customers are required to install are expensive and potentially large projects to complete – insulation, heating or water heating system replacement, or windows. Union's program description does not specify whether a customer is required to install two measures in order to participate in the program. However, Union does propose a "bonus rebate" of $250 for each measure installed beyond the first two measures.

While a requirement to install at least two DSM measures encourages a deeper-savings approach, some customers may only consider installing one measure at a time due to cost commitments or other

barriers. Such customers should not be turned away, as it decreases the likelihood that the customer will install the more efficient equipment, thereby resulting in lost opportunities for savings. For example, if a customer's furnace needs replacing but their insulation and other building envelope measures are sufficiently efficient, that customer may purchase a less efficient furnace if it cannot participate in Enbridge's offering.

While the Board has given direction that programs should provide a holistic approach to implementing DSM savings, a strict requirement that customers install at least two measures could be contrary to a number of the Board's Guiding Principles, such as Principals 1, 2, 5, and 6. Guiding Principles 1 and 2 address cost-effectiveness, and installing one measure can be cost-effective depending on the measure, even including the cost of the pre- and post-energy audits. Further, the Guidelines require that programs be screened for cost-effectiveness, not individual projects. While not every project that installs a single DSM measure may be cost-effective with the audit costs included, the aggregate of projects within the program should still provide cost-effective results with some customers installing single DSM measures. As demonstrated in Chapter 1 above, both Enbridge and Union's Resource Acquisition programs are already proposed to be sufficiently cost-effective, with benefit-cost ratios of 3.2 and 2.3, respectively.

Guiding Principle 5 encourages the utilities to achieve higher customer participation levels. Requiring two measures per customer could decrease participation as customers that are able or willing to install only one DSM measure are turned away from the program. Guiding Principle 6 addresses minimization of lost opportunities, and as discussed above, this program requirement could result in lost savings opportunities.

There are alternative ways to achieve a holistic approach without requiring that customers install two DSM measures at once. For example, the utilities could work with customers on a multi-year basis so that when a customer is ready to install additional measures, they can participate in the program at that time. In Massachusetts, customers are able to complete the work recommended from an audit in phases, meaning they can do one phase in one year and another phase in another year without the need for a new audit, provided nothing else has changed in the home or the in program. Union's approach of presenting a bonus incentive to customers for each additional measure could also be effective. To incorporate this approach, Enbridge would need to lower the minimum savings level from the current 15 percent.

Enbridge also requires that participants be homeowners, and does not appear to address renters. Union does not specify whether customers are required to be homeowners. The rental housing market is notoriously difficult to address with energy efficiency programs, given the split incentive of the tenant who is paying the heating bill and the landlord who owns the heating equipment. However, there are methods for serving rental customers, such as by conducting an audit that is specific to renters to collect information on DSM upgrades. That information could then be used in follow-up conversations with the landlord. While the rental target market certainly has its challenges, Enbridge and Union should not completely disregard an entire customer market with potential efficiency savings.

Finally, Enbridge's offering targets neighborhoods with "higher than average household income." (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, p. 24). Union does not specify the income level required to participate in the offering. Enbridge's offering should also aim to address moderate income homes, as those are the households that are likely to benefit more significantly from the utility's incentives.

Incentive

Enbridge stipulates that the maximum incentive available to customers is $2,000 per home. Starting in 2016, Union will increase the maximum rebate payment from $2,500 to $5,000. Given the types of measures required for installation, Enbridge's incentive may be too low to promote installation of two or more measures, and may not even be sufficient to promote installation of the first measure alone. Comparatively, the program that this offering is modeled on (Natural Resource Canada's ecoEnergy program) provided incentives of up to $10,000 per home.

Enbridge's incentives are tiered, based on the percent of savings achieved from the DSM measures a customer installs. By the nature of a step-function incentive, a customer achieving 15% savings will receive the same incentive as a customer achieving 25% savings, providing no additional incentive to achieve savings between 16% and 25%, or 27% to 49%, or above 51%. A sliding-scale incentive structure that increases incentive proportionally to the level of savings could address this issue. However, Enbridge should consider adopting different incentive structures as we recommend for Union below, because performance-based incentives require energy modeling. Energy modeling makes the project process complex for participants and in turn could discourage some customers from participating.

For Union, the incentives are prescriptive for each measure (e.g., $1,000 for adding at least R23 insulation to 100 percent of a home's basement). For some measures, such as insulation, a prescriptive approach creates an inequitable environment for projects of different scales, potentially discouraging larger projects. For example, a smaller house will receive the same incentive as a larger house for completely insulating the basement, even though the larger house will likely require more material and costs more to complete the job. The larger house will likely have higher savings relative to the smaller house.

For both utilities, it may be more effective to provide incentives for insulation or air sealing such that they are determined on a per-square-foot basis or on a percentage-of-total-project-cost basis, while maintaining Union's proposed prescriptive incentive structures for other measures such as space heating and hot water heating equipment. Such a structure for insulation incentives provides flexibility to the customer by allowing households of different sizes, shapes, and energy consumption to participate. This choice may also encourage a more holistic approach to savings than the incentive structure proposed by the utilities due to the flexible nature of the incentive. This is the approach used in Massachusetts, where utilities offer up to 75 percent of the costs for insulation projects. Massachusetts' programs also provide air sealing at no cost to the customer, as well as incentives for heating and water heating systems in addition to the insulation incentives. The incentive provided for

heating and water heating varies according to the type of unit installed, but typically ranges between $246 and $1,975 per unit.

For both Enbridge and Union, the incentive provided may not cover the full cost of the pre- and post-audits required for program participation. If the audits are required for participation, then the full cost of the audits should be covered by the utility incentive. Customers may be discouraged from participating in the offering if additional time and costs are required to participate (i.e., many customers will not conduct both a pre- and a post- audit on their own, and instead would simply replace the heating equipment). In other jurisdictions, utilities install instant savings measures as part of the audit, including faucet aerators, showerheads, and programmable thermostats. In some cases, such as in Massachusetts, the gas program administrators will also install electric measures such as lightbulbs or smartstrips (see the Measure Mix section below for more information). The savings from such instant savings measures will often exceed the cost of the audit, thereby ensuring cost-effectiveness. As another example, some states require the participant to cover part of the audit costs, but will waive the audit costs if the customer installs at least one of the major measures recommended through the audit. This provides additional motivation to customers to install more comprehensive measures.

Further, the initial audit is essentially a free marketing opportunity for the utilities to educate customers on energy efficiency savings. The post-DSM installation audit ensures that the equipment was installed according to the offering's requirements and standards, thereby providing the utility with an opportunity to maintain the offering's integrity and reputation. This post-audit can be completed using different methods with varying cost impacts, such as by a phone survey, a postcard, an email, or an actual site visit. While a site visit is the ideal way to ensure all equipment is properly installed, it may not be cost-effective to visit every site. Instead, the other methods can be used to assess the customer's satisfaction with the energy efficient measures and alert the utility to potential issues that may require a site visit, while keeping costs low.

Measure Mix

For Enbridge, this offering only focuses on envelope measures, as well as space heating and water heating equipment. Additional measures could also be installed as part of the offering, such as faucet aerators, showerheads, programmable or adaptive thermostats, lighting measures, or smart strips.[11] Such measures may not result in savings that are as significant as the savings achieved through insulation and heating system upgrades, but they can promote a more holistic approach to home savings and limit lost opportunities.

Both Union and Enbridge include similar measures in other offerings. However, such measures can easily be provided and installed during a home energy assessment while a contractor is already in a customer's home.

[11] Union allows customers to order the Energy Savings Kits online through the Home Reno Rebate offering. (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 13).

While some of the measures suggested for implementation save only electricity, some leading states provide incentives for all types of measures regardless of fuels, and allocate the costs and savings of the measures between the gas and electric utilities. Such an approach allows customers to interface with one utility, thereby limiting confusion and potential lost opportunities.

In Massachusetts' single-family retrofit program, for example, the gas and electric program administrators coordinate with the vendors installing the energy efficiency measures: the above measures are implemented regardless of the customer's primary heating fuel type. The lead vendor is generally determined based on the customer's primary fuel type. In a situation where a natural gas space heating customer requests an audit through the statewide phone line or website, the vendor for the gas program administrator takes the lead on assisting that customer. The vendor then invoices the gas program administrator for the natural gas measures and the audit. Measures that only save electricity are only invoiced to electric program administrators. The program administrators then claim savings depending on how they are invoiced. For more information on coordination between gas and electric programs, refer to Chapter 7 below.

Evaluation Plans

Impact Evaluation

Enbridge's evaluation plan states that it will "[a]ssess the validity of natural gas savings claims among a sample of participants." (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 2, p. 20). While it is unclear exactly what method Enbridge plans to take to measure and verify energy savings, Enbridge noted in its response to Board Staff's interrogatory #25 that it intends to conduct this impact evaluation using HOT2000 energy modeling software (Enbridge Gas Distribution 2015a). In contrast, Union provides detailed information within its evaluation plan as to how it conducts an impact evaluation study. Union proposes to conduct energy modeling analyses to measure and verify savings, and does not propose to analyze actual energy bills. (Union Gas Limited, 2015a).

An energy modeling approach is recommended for new construction mainly because new construction has no baseline for comparison, as discussed in Chapter 4. It is also easier to take various building parameters into energy models, as builders know the entire structure of the new construction buildings. In contrast, it is often a significant undertaking to find out details of existing building structures as well as their conditions, insulation levels, and equipment efficiency levels.

A best practice impact evaluation for comprehensive energy retrofits for residential buildings is to conduct a billing analysis, because historical consumption data exist and expected energy savings are likely to exceed 10 percent of total energy consumption. This method was recommended by the California Evaluation Framework (TechMarket Works, 2004) and discussed in the cross-program evaluation section. Thus, both Enbridge and Union should conduct a billing analysis.

Process Evaluation

Enbridge proposes a process evaluation, but its plan only states that it will "[s]urvey participants to determine effectiveness of offer" and "engage energy auditors to evaluate effectiveness of delivery process." (Enbridge Gas Distribution, 2015b). As discussed in the Assessment of Evaluation Plans section, this approach is not sufficient to fully determine effectiveness of incentives and offering delivery as it misses perspectives from other key players. In contrast, Union proposes a comprehensive survey approach following best practices. It proposes to conduct (a) phone surveys of a representative sample of participants and non-participants, (b) face-to-face interviews with service organization and contractor partners, and (c) face-to-face interviews with offering managers and administrative staff. (Union Gas Limited, 2015a, Exh. A, Tab 3, App, C, p. 7). Enbridge should adopt Union's survey approach for its process evaluation.

On the other hand, neither Enbridge nor Union propose to conduct any desk review of program records, data tracking systems, and materials such as marketing materials, training documents, and program manuals. Both utilities should identify areas for improvements in the program records, data tracking systems, and materials; because they are vital for running effective offerings.

Recommendations

Enbridge

2. Enbridge should remove the requirement that customers must install at least two DSM measures to participate in the offering. Customers seeking to install one DSM measure at a time should not be turned away from the program.

3. Enbridge should focus not just on higher income homes, but on moderate income homes as well.

4. Enbridge should increase the offering incentive cap to be greater than $2,000. For example, Enbridge could be consistent with Union's incentive cap of $5,000.

5. Enbridge should reconsider its tiered incentive structure, and consider offering a sliding-scale incentive structure that should start at a lower savings level than the current 15 percent savings. This would to accommodate some customers that could just install one measure at a time.

6. If Enbridge continues to offer a tiered incentive structure or offers a sliding-scale incentive, then it should lower the amount of savings required to achieve the various incentive levels or increase the level of incentives. As currently structured, a customer is required to achieve a significant reduction in usage in order to receive a relatively limited incentive amount.

7. Enbridge should consider providing incentives such that they are structured on a per-square-foot basis, or on a percentage-of-total-project-cost basis for insulation measures. In addition, it should provide prescriptive incentives for other measures similar to Union's incentive structures. Such a structure provides flexibility to the customer, thereby allowing households of different sizes, shapes, and energy consumption to participate.

8. Enbridge should provide the required home energy audits at no cost to the customer.

9. Enbridge should provide additional measures as part of this offering, such as faucet aerators, showerheads, programmable or adaptive thermostats, lighting measures, or smart strips. Such an offering ensures a holistic approach to program savings.

10. Enbridge should include in its impact evaluation plan a proposal to conduct a billing analysis for this offering.

11. Enbridge should adopt Union's survey approach for its process evaluation.

12. Enbridge should conduct any desk review of program records, data tracking systems, and materials such as marketing materials, training documents, and program manuals.

Union

1. Union should consider providing incentives such that they are structured on a per-square-foot basis, or on a percentage-of-total-project-cost basis. Such a structure provides flexibility to the customer, thereby allowing households of different sizes, shapes, and energy consumption to participate.

2. Union should provide the required home energy audits at no cost to the customer.

3. Union should provide additional measures as part of this offering, such as faucet aerators, showerheads, programmable or adaptive thermostats, lighting measures, or smart strips. Such an offering ensures a holistic approach to program savings.

4. Union should include in its impact evaluation plan a proposal to conduct a billing analysis for this offering.

5. Union should conduct any desk review of program records, data tracking systems, and materials such as marketing materials, training documents, and program manuals.

5.3.3 Residential Products

Overview

Enbridge: Adaptive Thermostats (New). This offering provides a $75 rebate to residential customers for installing adaptive thermostats. (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 27-29).

Union: Energy Savings Kit (Existing). This offering provides residential customers with a free kit through online orders and door-to-door delivery that includes instant water saving measures (showerhead, aerators, and pipe wrap) and a $25 rebate coupon for a programmable thermostat. (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 12-13).

Discussion of Key Issues

The key issues for this offering for Enbridge and Union relate to the incentive structures proposed by the utilities and the mix of measures included in the offering. Each of these issues is discussed in detail below.

Incentive

As part of the Adaptive Thermostat offering, Enbridge provides an incentive of $75 for a thermostat. Other program administrators offer higher incentives for comparable thermostats, including Massachusetts ($123), Direct Energy (no cost to customer), Hydro One ($125), and Cambridge and North Dumfries Hydro Inc. ($200), Hydro Ottawa ($150). (Hydro Ottawa, 2015; Massachusetts Program Administrators, 2015a; Nest, 2015). Given that the cost of an adaptable thermostat (around $250) is identified by Enbridge as a barrier to measure adoption, Enbridge should consider increasing the incentive to the equivalent of at least $100, especially given that this is an emerging technology. Concurrently, it should evaluate customer adoption rates for this type of measure and customer payback rates.

Further, Enbridge could consider partnering with electric utilities that offer incentives for similar measures, and ensure that the incentive amounts provided to customers are consistent between fuel types. Such coordination should minimize customer confusion or customer bias towards participating in one utility's program over another's program, and could result in cost efficiencies as the utilities share the cost of the measures while coordinating outreach efforts.

Measure Mix

Union provides a rebate only for programmable thermostats as part of their Energy Savings Kit offering. Standard programmable thermostats may not result in significant savings: some studies doubt the effectiveness of such measures, which has lead the U.S. Environmental Protection Agency to discontinue ENERGY STAR label for programmable thermostats. (Malinick, Wilairat, & Holmes, 2012). While Union could continue to offer a rebate for standard programmable thermostats, we recommend that Union work with the TEC as part of the TRM development to conduct a comprehensive literature review to determine whether to continue this offering. As this is related to impact evaluation and input assumptions, this task could be carried out by the OEB or the Technical Evaluation Committee (TEC) that is in charge of developing the TRM. Alternatively, it could propose a plan for the OEB to conduct a full impact evaluation study on this measure. Further, Union should provide an incentive for adaptive thermostats so that new technologies with higher savings potentials are available for customers looking to adopt them. Similarly to Enbridge, Union could consider partnering with electric utilities that offer incentives for similar measures and ensure that the incentive amounts provided to customers are consistent between fuel types. Such coordination should minimize customer confusion or customer bias towards participating in one utility's program over another's program.

Both Enbridge and Union should consider providing incentives for measures other than thermostats and instant hot water saving measures. For example, Massachusetts gas energy efficiency program

administrators offer hot water boilers, furnaces, select heating system controls including retrofit boiler reset controls, gas water-heating equipment, and heat recovery ventilator equipment. Even though such measures are included as part of the single-family retrofit offering, they could also be provided through a products program to ensure that all customers are served by a range of DSM technologies and to increase participation.

Evaluation Plans

Impact Evaluation

While Enbridge's evaluation plan states that it intends to verify savings claims, it is not clear how it intends to verify savings claims for adaptive thermostats. The term "savings claims" is also unclear. (Enbridge Gas Distribution 2015b, Exh. B., Tab 2, Sch. 2, p. 22). However, given that this is a prescriptive offering, it is likely that Enbridge plans to use a savings claim value for this measure that will be included in the TRM document that is expected to be finalized this year. (Enbridge Gas Distribution 2015b, Exh. B., Tab 2, Sch. 2, p. 2). If this is the case, we recommend that Enbridge clearly state its intention to use the TRM for the savings claim value.

The only specific plan regarding its impact evaluation is to "[c]onduct verification of a sample of participants to confirm eligibility criteria was met and qualified back up was received." This is not an impact evaluation study, but a measure installation verification activity. While this may be a reasonable approach if stakeholders can agree upon any stipulated savings values, an Ontario-specific impact evaluation study may be warranted because recent impact evaluation studies in other jurisdictions are finding a significant level of energy savings ranging from 10 percent to 12 percent of annual total heating consumption. (Nest Lab, 2015). For this offering with a relatively large number of expected participants and potentially large energy savings, a billing analysis would be appropriate for the impact evaluation study in which energy consumption of a treatment group and a control group is compared.

Union plans to conduct a survey of a sample of participants in order to verify installation rates and continued usage of qualified measures under its offering. (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 14). While this approach may be appropriate for most of the Energy Savings Kit measures with reliable deemed savings, Union may require an additional study on programmable thermostats given the doubts on the savings impacts mentioned above. We recommend Union propose a plan to conduct a literature review of standard thermostats and consider whether to discontinue this offering or conduct a full impact evaluation study on this measure if it still believes there might be some savings impacts. As this is related to impact evaluation and input assumptions, this task could be carried out by the OEB or the Technical Evaluation Committee. A billing analysis would be appropriate for the impact evaluation study in which energy consumption of a treatment group and a control group is compared.

Process Evaluation

Enbridge plans to survey participants to determine effectiveness of this offering. (Enbridge Gas Distribution 2015b, Exh. B., Tab 2, Sch. 2, p. 22). To follow best practices, Enbridge should also survey non-participants in order to identify reasons for not participating in the offering. To the extent that this

offering requires Enbridge program staff or contractors to interact with customers to promote and/or install adaptive thermostats, it is recommended that Enbridge also survey program staff and/or contractors.

Union does not plan to conduct a process evaluation study for this offering. However, it might be beneficial to conduct a limited scale process evaluation study by piggybacking on its savings verification efforts. It could ask additional process related questions such as a question regarding the penetration rates of Energy Savings Kit measures. A 2008 study for Ontario found that the market penetration rates of showerheads and aerators were very high. (Navigant, 2008). Thus, this additional question is particularly beneficial for determining whether it is time for Union to discontinue its Energy Savings Kit offering.

Per Section 6.2 of the DSM guideline which defines the role of a pilot program, both Union and Enbridge could conduct a pilot study to explore the reliability and cost-effectiveness of emerging measures suitable for the Energy Savings Kit offering that could replace any potentially obsolete efficiency technologies. For example, aerators and showerheads with a flow rate lower than 1.0 gpm are now available in the market, although it appears they are not yet promoted by the gas DSM programs. Further, Massachusetts program administrators are currently promoting a new type of showerhead "Evolve" with a thermostatic shut-off valve that prevents hot water waste during shower warm up. (Massachusetts Program Administrators, 2015b). Ontario's technical evaluation committee could also examine such emerging technologies, and suggest an inclusion of any promising technologies in the DSM programs.

Union could also explore any possibility of partnering with electric utilities that offer incentives for similar measures, and ensure that the incentive amounts provided to customers are consistent between fuel types.

Recommendations

Enbridge and Union

1. Both Enbridge and Union could conduct a pilot study to explore the reliability and cost-effectiveness of emerging measures suitable for the Energy Savings Kit offering that could replace any potentially obsolete efficiency technologies.
2. Both Enbridge and Union should investigate the reliability and cost-effectiveness of emerging showerheads, and consider incorporating such showerheads into their new pilot study or existing offerings.
3. Both Enbridge and Union should consider partnering with electric utilities that offer incentives for similar thermostat measures, and ensure that the incentive amounts provided to customers are consistent between fuel types.

Enbridge

1. Enbridge should consider increasing the Adaptive Thermostat incentive to the equivalent of at least $100 while evaluating both customer adoption rates for this type of measure and customer payback rates.

2. If Enbridge intends to use the TRM for its savings estimate claim, we recommend that Enbridge clearly states its intention in the plan.

3. Enbridge's evaluation plan should include an Ontario-specific impact evaluation study on adaptive thermostats as existing impact evaluation studies are finding a significant level of natural gas savings ranging from 10 percent to 12 percent of annual heating consumption.

4. Enbridge should also conduct a survey of non-participants in its process evaluation in order to find out reasons for not participating in the offering. To the extent this offering requires Enbridge program staff or contractors to interact with customers to promote and/or install adaptive thermostats, Enbridge should also survey program staff and/or contractors.

Union

1. Union should provide an incentive for adaptive thermostats so that new technologies with higher savings potentials are available for customers looking to adopt them.

2. Union should consider providing incentives for measures other than thermostats and instant hot water saving measures to ensure that all customers are served by a range of DSM technologies and to increase participation.

3. Union should conduct a literature review of standard thermostats and consider whether to discontinue this offering, or include a plan for the OEB to conduct a full impact evaluation study on this measure if it still believes there might be some savings impacts.

4. It might be beneficial to conduct a limited scale process evaluation study by piggybacking on Union's savings verification efforts and ask additional process related questions such as a question regarding the penetration rates of Energy Savings Kit measures.

5.4. C&I Resource Acquisition Programs

5.4.1 Overview

The table below provides an overview of the offerings included in this program for each utility, and indicates whether those offerings are new or existing. Each of these offering types are discussed in more detail in the sections that follow.

Table 15. C&I Resource Acquisition Program Offerings

Offering Type	Enbridge	Union
Prescriptive	Commercial & Industrial Prescriptive (Fixed) Incentive — Existing	C/I Prescriptive Offering — Existing

Offering Type	Enbridge		Union	
Custom	Custom Commercial	Existing	C/I Custom Offering	Existing
	Custom Industrial	Existing		
Small Business Direct Install	Commercial & Industrial Direct Install	New	Direct Install (Pilot)	New
Small Commercial New Construction	Small Commercial New Construction	New	n/a	n/a
Energy Leaders	Energy Leaders	New	n/a	n/a

5.4.2 C&I Prescriptive

Overview

Enbridge: Commercial & Industrial Prescriptive (Fixed) Incentive (Existing). This offering provides prescriptive incentives to commercial and industrial customers in new and existing buildings. This offering also targets smaller commercial and industrial customers in Rates 6, 110, 115, 135, and 145 (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 17-19).

Union: C/I Prescriptive Offering (Existing). This offering provides prescriptive incentives for DSM measures to C&I customers through various delivery channels. Program initiatives target space heating, water heating, ventilation, building controls, heat recovery, and efficient equipment (for cooking, cleaning and laundry) applications (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 27-30, 42-43).

Discussion of Key Issues

Eligible Measures

While Enbridge provides several examples of the types of measures eligible for an incentive through this offering, it does not provide a complete list of eligible measures. Enbridge should provide a list of all of eligible measures under its prescriptive offering.

Incentive Levels

To gain more participation in this offering, especially by smaller customers, Enbridge proposes to increase incentive levels to address financial barriers experienced by the targeted customers. We cannot comment on this proposed change to the incentive levels because the plan document does not provide information on the existing or the proposed incentive levels or payback analysis of this offering. We recommend Enbridge present the proposed incentives as well as its payback analyses for this offering.

Union also proposes to increase incentive levels for this offering, as it finds that the current incentives are comparatively lower than other jurisdictions. The increases in the incentive amounts are not available in the DSM plan, but the incentives appear to be reasonable given (a) the payback analysis provided on page 42 of the plan document show a payback of 3.8 years, and also (b) the incentive amount is significantly lower than the total incremental cost. However, we note that this observation

assumes that Union's estimates of incremental costs and savings represent the costs and benefits for the entire offering. Without further details, we cannot comment on this aspect. We recommend Union provide the proposed incentive levels and also provide more detailed information on its payback analysis for this offering.

Delivery and Incentive Mechanism

Union proposes to explore an upstream incentive to have greater influence on the target market by interacting at the supply chain level. We support this proposal and recommend that Union provide a more detailed description of the program offering. Union should pursue this option early in the plan cycle, as this approach can increase customer participation and energy savings. ACEEE also reported that upstream program aspects can lower administrative costs and multiply the impact of the incentives. (York et al., 2013, pp. 166–167). Examples of upstream program designs are summarized below.

- Pacific Gas & Electric offers an upstream commercial HVAC program and found that "some vendors [were] passing on part of the incentive funding to consumers in the form of lower prices, some increasing inventory, or [providing] bonuses to their sales force to sell more energy-efficient products (York et al., 2013, pp. 166–167)."

- Massachusetts energy efficiency program administrators launched an upstream HVAC program in April 2013. In just a year, nearly all manufacturers and distributors in Massachusetts signed up for this program. A 2014 paper describing this program indicated two major impacts of the upstream incentive on the HVAC market:

    - The availability of high efficiency equipment is one of the key barriers in the HVAC market. Upstream incentives provide a value proposition for distributors to stock and promote high efficiency equipment.

    - Roughly 80 percent of the sales activity is in the replacement-on-failure segment (Sondhi, Strong, & Arnold, 2014).

- The Energy Trust of Oregon (ETO) Existing Multifamily Program has adopted an upstream incentive approach by working with major equipment distributors in order to streamline its program application. The upstream incentives have made participation easier and quicker, increasing project volume and lowering transaction costs for property owners as well as for the program administrator. As a result, the upstream incentives helped ETO more than double the number of participating properties in 2012 compared to 2011 before the incentives were in place (Johnson, 2013, p. 14, 15).

Marketing

Union clearly states in its plan that it intends to promote the offering directly through Union's Account Management team, and indirectly through various delivery channels such as HVAC contractors, engineers, distributors, and manufactures, as well as through mass media, internet, and tradeshows. Unlike Union, Enbridge does not provide any information on its marketing strategy to promote its

prescriptive offering. Therefore, we recommend Enbridge provide detailed information on its marketing strategy similar to Union's filing.

Evaluation Plans

Impact Evaluation

Enbridge proposes an impact evaluation plan, while Union does not. Enbridge's plan consists of two tasks: (a) ensure accurate tracking of the offer participants and measures installed; and (b) on-site verification of installation by a third party of select measures. This evaluation plan by Enbridge is reasonable. Union should provide an impact evaluation plan similar to Enbridge's plan.

Process Evaluation

The proposed survey approaches for process evaluation by Enbridge and Union are reasonable, but there is some room for improvement for Enbridge. Union's proposed survey comprehensively targets participants and non-participants as well as service providers and offering staff. On the other hand, Enbridge's survey does not include non-participants as survey subjects. Thus we recommend Enbridge also include non-participants as part of their process evaluation.

On another issue, neither Enbridge nor Union have a plan to review program materials and records. It will be important to evaluate the effectiveness of program materials such as marketing materials for promoting adaptive thermostats and Energy Savings Kit measures. This will require not only a survey of participants and non-participants, but also a review of such program materials. Thus, Enbridge and Union should conduct a review of program materials and records.

As mentioned above, Union proposes to explore upstream incentive approaches. Thus, its process evaluation should include this new incentive approach as another key process evaluation topic and provide details for how Union plans to investigate the effectiveness of potential upstream incentive designs. In addition, if Union decides to explore upstream incentive approaches as we recommend, it should assess the effectiveness of this new approach as part of its process evaluation.

Union also proposes to evaluate possibilities of coordination with local distribution company (LDC) programs for its C&I Prescriptive offering. We recommend Enbridge also explore the coordination opportunity with LDCs.

Recommendations

<u>Enbridge</u>

1. Enbridge should provide a list of all of the eligible measures under its prescriptive offering.
2. Enbridge should present the proposed incentives as well as its payback analyses for this offering.

3. Enbridge should explore an upstream incentive option as proposed by Union. This approach is an emerging incentive structure that could potentially have a substantial impact on the uptake on C&I energy efficiency measures.
4. Enbridge should provide detailed information on its marketing strategy by emulating Union's filing.
5. As proposed by Union, Enbridge should also explore program coordination opportunities with LDCs as part of its process evaluation.
6. Enbridge should also include non-participants as part of their process evaluation.
7. Enbridge should conduct a review of program materials and records.

Union

1. Union should provide the proposed incentive levels and also provide more detailed information on its payback analysis for its offering.
2. Union's evaluation plan should include an impact evaluation plan similar to Enbridge's plan.
3. Union should conduct a review of program materials and records as part of their process evaluation.

5.4.3 C&I Custom

Overview

Enbridge: Custom Industrial (Existing). This existing offering provides technical assistance and financial incentives for customized natural gas reduction projects by industrial customers (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 8-11).

Enbridge: Custom Commercial (Existing). This existing offering provides technical assistance and financial incentives for customized natural gas reduction projects by commercial customers. Historically, this is the most popular commercial program, representing over 85 percent of the sector lifetime gas savings since 2008 (Union Gas Limited, 2015a, Exh. B, Tab 2, Sch. 1, pp. 11-14).

Union: C/I Custom (Existing). This existing offering provides technical expertise and incentives to C&I customers for their custom projects related to installing new capital equipment, retrofit (or replacement) equipment and optimization of energy savings measures (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 37-42).

Discussion of Key Issues

Incentive design

- **Enbridge (Custom Commercial)**: Historically Enbridge's Custom Commercial offering provided a flat incentive of \$0.10/ m^3 to a maximum of 50% of the project cost, or

$100,000 per customer per year. Beginning in 2016, Enbridge is proposing an increased, custom incentive structure tiered by the level of energy savings: $0.10/$m^3$ for 0-10% savings, $0.20/$m^3$ for 10-20% savings, and $0.30/$m^3$ for 20% and above. The initial cap remains the same. This proposed tiered incentive structure is one of the recent recommended best practices by ACEEE, as demonstrated by California's Savings by Design program (York et al. 2013; Kwatra and Essig 2014) and should effectively encourage customers go deeper in energy savings. However, Enbridge may be able to promote higher savings from participants if it sets the incentive tiers at a more granular scale. For example, it could increase the level of incentive for each 5% increase in savings or on a sliding scale, rather than for each 10% increase in savings. In addition, we suggest that Enbridge make it clear what the actual savings thresholds are between the tiers. As written, it is not clear what the level of incentive is for 10% energy savings.

- **Enbridge (Custom Industrial)**: Enbridge proposes two sets of incentive structures. For medium to large industrial customers with consumption above 340,000 m^3, the incentive is set at $0.10/$m^3$ for projected savings with a cap of 50% of the total project cost, to a maximum of $100,000 per project. For small industrial customers with less than 340,000 m^3 annual gas consumption, the incentive is set at $0.30/$m^3$ for projected savings with a cap of 50% of the project cost to a maximum of $100,000 per project. It is a sensible proposal to increase incentives per unit of energy savings for smaller size customers as they face higher barriers. While we suggest Enbridge keep differentiating the level of incentives by the size of customers, we also encourage Enbridge to consider a step-function incentive structure that increases incentive levels per unit of natural gas savings with the depth of total savings, in line with the best practices discussed above.

- **Union (C/I Custom)**: Union also proposes two sets of incentives depending on the customer type. For Contract customers, the incentives would be $0.10 per annual m^3 of natural gas saved, up to $100,000 or 50% of the high-efficiency upgrade cost, and for general service customers, the incentives would be $0.20 per annual m^3 of natural gas saved, up to $40,000 or 50% of the high-efficiency upgrade cost. Similar to our suggestion to Enbridge, we suggest Union keep differentiating the level of incentives by the size of customers and also suggest Union consider a step-function incentive structure that increases incentive levels per unit of natural gas savings with the depth of total savings, in line with the best practices discussed above.

Incentive Criteria

Enbridge and Union: All of the C&I custom offerings by Enbridge and Union have an incentive cap at 50% of the total project cost. This amount is a standard incentive cap for these types of customers. In addition to this cap, we recommend both utilities apply payback years as a factor to screen out free riders or very cost-effective projects that would be normally initiated by C&I customers without program incentives. Based on our review of incentive structures across the United States (Table 16) we found several leading programs use one to three years as the minimum threshold to provide incentives as shown in the table below. Based on this information, we recommend both Enbridge and Union use a payback criteria to screen out free riders for their C&I custom offerings. Given the payback thresholds from the example programs are also mainly for custom C&I projects, a threshold of one to three years may be appropriate.

Table 16. Payback Criteria Used in Other Jurisdictions

Utility	Program type	Program	Payback criteria
Avista	Custom	Custom Grant	from 1 to less than 13 years payback
Focus on Energy	Custom	Business Incentive	1.5 payback or more
Focus on Energy	Retrofit	Retail Energy Management Challenge	1.5 payback or more
Northwestern Energy	Custom	E+ Business Partners	1.5 payback or more
Vermont Gas Systems	Retrofit	Commercial Retrofit	3 years or higher or to a budgeted $/Mcf saved

Source: (Kwatra & Essig, 2014; Nowak et al., 2013; Wisconsin Focus on Energy, 2015)

Evaluation Plans

Impact Evaluation

Both utilities propose an impact evaluation plan where engineering firms will be contracted to conduct custom project savings verification (CPSV) activities. Given (a) the available most up-to-date CPSV document for custom projects contains detailed information on the evaluation process and methodology[12] and (b) Enbridge the Technical Evaluation Committee (TEC) that appears to be in charge of updating CPSV documentation recently made a few modifications to the current CPSV document, we expect that a new CPSV document should have sufficient information for the 2016-2020 plans (Union Gas Limited, 2015d, Exh. B.Staff.1). However, as discussed in Chapter 4 above, we recommend both utilities provide within their evaluation plans more detailed information regarding how project installation data are verified (e.g., site inspection, phone surveys, application review) and how gross savings are measured (e.g., IPMVP, billing analysis).

Process Evaluation

Enbridge proposes to conduct a process evaluation to evaluate its proposed incentive levels and structures as well as to investigate possible coordination opportunities with LDCs. Enbridge plans to survey participants and contractors to determine effectiveness of incentives and offering delivery. In accordance with the best practice discussed in Chapter 4, Enbridge should also survey non-participants and program administrator staff.

On the other hand, Union does not propose any process evaluation study despite proposing two sets of incentives that depend on the customer type. We recommend Union also conduct a process evaluation study to investigate the effectiveness of the proposed new incentive designs. We also recommend Union investigate possible coordination opportunities with LDCs as part of the process evaluation study.

[12] The CPSV document is a terms of reference for the procurement of verifiers specifying their required qualifications and scope of work.

Further, as recommended above, a payback criteria is a key to screen out free riders for custom C&I projects. Both Enbridge and Union should review simple payback years for each participation and investigate whether an initial payback threshold that the companies may establish is reasonable for the purpose of reducing free riders.

Recommendations

Enbridge and Union

1. Both utilities should provide in their evaluation plans more detailed information regarding how project installation data are verified (e.g., site inspection, phone surveys, application review) and how gross savings are measured (e.g., IPMVP, billing analysis).

Enbridge

1. For the Custom Commercial offering, we recommend Enbridge consider setting the incentive tiers at a more granular scale, for example by increasing the level of incentive for each 5 percent increase in savings or on a sliding scale. We also recommend that Enbridge make it clear what the actual savings thresholds are between the tiers. As is written, it is not clear what the level of incentive is for 10 percent energy savings.

2. Enbridge should use a payback criteria to screen out free riders for their C&I custom offerings. Given that the payback thresholds from the example programs are also mainly for custom C&I projects, a threshold of one to three years may be appropriate.

3. In line with the best practices discussed in Chapter 4, Enbridge should also survey non-participants and program administrator staff for the proposed process evaluation study.

4. For the proposed process evaluation, Enbridge should review simple payback years for each participation and investigate what level of payback threshold is reasonable for the purpose of reducing free riders.

Union

1. Union should use a payback criteria to screen out free riders for their C&I custom offerings. Given that the payback thresholds from the example programs are mainly for custom C&I projects, a threshold of one to three years used by those programs may be appropriate.

2. Union should conduct a process evaluation study and investigate in particular the following issues:

    a. The effectiveness of the proposed new incentive designs

    b. Potential coordination opportunities with LDCs as part of the process evaluation study

    c. Project payback

d. A reasonable payback threshold level for the purpose of reducing free riders

5.4.4 Small Business Direct Install

Overview

Enbridge: Commercial & Industrial Direct Install (New). This offering is similar to a typical small business direct install program that is offered in many other jurisdictions. The offering provides a turnkey solution for smaller C&I customers to install a prescribed set of low-cost natural gas savings measures at no cost or low cost. It assists customers from the savings assessment stage to the end of the installation of eligible energy savings technologies (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 14-17).

Union: Direct Install (Pilot) (New). This proposed pilot offering provides turnkey solutions to small business customers by providing high customer incentives and full support throughout the entire process for the installation of various measures, including heating and ventilation equipment (Union Gas Limited, 2015a, Exh. A, Tab. 3, App. A, pp. 30-36).

Discussion of Key Issues

Eligible measures and incentives

Enbridge's offering covers 50 percent of the total installation costs for air doors, infrared heaters, and demand control kitchen ventilation. It also covers 100 percent of the total installation costs for pre-rinse spray valves. Many small business direct install (DI) programs in other jurisdictions install various other low cost measures such as pipe insulation, low-flow showerheads, aerators, and programmable thermostats. A 2008 Ontario program evaluation study reviewed market penetration rates. (Navigant, 2008). This study estimated a market penetration rate for commercial thermostats, which was about 48 percent, and did not provide market penetration rates for the other DI-specific measures mentioned above. In addition, more effective and efficient measures have become available and likely have much lower market penetration rates (e.g., 0.5 gpm aerator, and a showerhead water control valve that circulates water until it reaches a certain temperature). Further, while the 2008 evaluation study mentioned above found a high market penetration for showerheads and aerators for the residential sector, there is also a possibility that the market share for such products within the small business sector may be lower, or that a hard-to-reach customer segment exists within the small business sector. Thus, it might still make sense to include other low cost measures in the proposed DI offering. We recommend Enbridge conduct a process evaluation to investigate the need for offering other low cost measures such as aerators, showerheads, and tank wraps. It should include emerging measures.

As discussed in Section 5.3.3 Residential Products, standard programmable thermostats are not likely to result in meaningful energy savings, according to some recent studies that cast doubts about the effectiveness of such measures (leading the U.S. Environmental Protection Agency to discontinue its ENERGY STAR label for programmable thermostats). However, it would make sense to promote NEST-like wifi-enabled adaptable thermostats to small business customers. We recommend Enbridge offer

similar incentives for small business customers to install adaptable thermostats as it proposes for its residential customers.

In the pilot, Union proposes to test technologies that achieve deeper savings such as heating and ventilation equipment, while it recognizes that other jurisdictions mainly offer low cost measures such as pre-rinse spray valves, pipe insulation and low-flow showerheads and aerators. This is a reasonable proposal as small business customers will have opportunities to explore all cost-effective energy efficiency measures in the beginning. However, we recommend that Union explore offering different incentive levels based on the incremental costs of the measures it proposes to promote.

Small business direct install measures tend to have an incentive structure as a percent of total installed costs. This approach makes sense for energy efficiency measures against which no standard measures exist, such as pipe insulation, showerheads, aerators and other controls. In these instances, the incremental costs equal the total installed costs. These measures tend to cost less than other measures with deep energy savings. Thus, the incentives are often set up to provide a high percentage (e.g., 50 to 70 percent) of total installed costs. In contrast, deeper measures such as heating systems often have both standard efficiency and high efficiency models that can be compared each other. Thus, the same incentive design used for low cost, retrofit measures discussed above is not suitable for these deep savings measures. Thus, for promoting high cost measures such as HVAC systems, we highly recommend Union provide a lower level of incentives more consistent with its Prescriptive offering so that the incentives are mainly used to cover the incremental costs of energy efficient measures.

In sum, we recommend Union either offer a lower incentive level as a percent of total installed costs for such deep savings measures than for low savings measures, or adopt prescriptive incentive structures for such measures as proposed under the C/I Prescriptive offering.

Evaluation Plans

Impact evaluation

For impact evaluation of this offering, Enbridge proposes two approaches for measure verification activities: (a) ensure accurate tracking of the offering participants and measures installed; and (b) on-site verification of installation for appliance measures. We recommend Enbridge provide more detailed information as to how the impact evaluation should be conducted for this offering, as discussed in Chapter 4. The California Evaluation Framework suggests that engineering analysis informed by field observations conducted under IPMVP Option A may be the most appropriate method for direct install programs (TechMarket Works, 2004, p. 482).

Union did not propose any evaluation plan for this offering. Although it is a pilot offering, we recommend it consider conducting an impact evaluation.

Process Evaluation

Enbridge proposes to survey participants and contractors to determine effectiveness of incentives and offering delivery specifics. We have recommendations on three aspects on Enbridge's process evaluation.

First, we recommend Enbridge consider conducting program materials review. This involves a review of program materials such as marketing materials, training documents, and tracking database. Some specific perspectives that should be examined include: consistency, selling energy efficient solutions, and opportunities to streamline.

Second, we recommend Enbridge engage an evaluation contractor to interview Enbridge's program administrator staff in addition to participants and contractors.

Third, we recommend Enbridge consider including the following topics as part of its survey and interview approach: training, marketing practices, standardization of offers, audit procedures, invoicing and tracking procedures, and QA/QC procedures by following a recent impact evaluation plan for the direct installation program prepared by program administrators in Massachusetts (Massachusetts Program Administrators, 2013, p. 92).

Union did not propose any evaluation plan for this offering. We recommend it conduct process evaluation studies and investigate the effectiveness of incentives and offering delivery methods including program materials and reporting (e.g., marketing materials and tracking database), marketing practices, standardization of offers, audit procedures, invoicing and tracking procedures, and QA/QC procedures.

Recommendations

Enbridge

1. Enbridge should offer similar incentives for small business customers to install adaptable thermostats as it proposes for its residential customers. As part of the turnkey solution, Enbridge should facilitate the processing of rebates for this measure when participants are interested in implementing it.
2. Enbridge should conduct a process evaluation to investigate the need for offering other low cost measures such as aerators, showerheads, and tank wraps.
3. Enbridge should provide more detailed information as to how the impact evaluation should be conducted for this offering.
4. For its proposed process evaluation, Enbridge should add the following specific activities:
    a. Interview Enbridge's program administrator staff in addition to participants and contractors.
    b. Investigate offering delivery specifics including program materials (e.g., marketing materials and tracking database), marketing practices,

standardization of offers, audit procedures, invoicing and tracking procedures, and QA/QC procedures.

Union

1. We recommend Union either offer a lower incentive level as a percent of total installed costs for deep savings measures such as HVAC systems than for low savings measures, or adopt prescriptive incentive structures for such deep savings measures as proposed under the C/I Prescriptive offering.

2. Union did not propose any evaluation plan for this offering. Although it is a pilot offering, we recommend it consider including an impact evaluation study in its evaluation plan.

3. We recommend Union conduct process evaluation studies and investigate the effectiveness of incentives and offering delivery methods, including program materials and reporting (e.g., marketing materials and tracking database), marketing practices, standardization of offers, audit procedures, invoicing and tracking procedures, and QA/QC procedures.

5.4.5 Small Commercial New Construction (Enbridge Only)

Overview

Enbridge: Small Commercial New Construction (New). This offering provides builders and owners/developers training on energy modeling alternatives for building small commercial buildings (up to 75,000 sq ft, generally fall within Rate 6) along with financial incentives for the cost of modeling and performance-based incentives for post-construction modeling results. The offering also provides technical assistance on the installation of specific measures (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 30-33).

Union: N/A.

Discussion of Key Issues

Incentive Level

The offering provides incentives to cover the cost of pre and post energy model (approximately $10,000), and also a performance incentive of $1.00/$m^3$. This level of incentive appears to be overly high compared to other jurisdictions. Similar programs in other jurisdictions are providing incentives at much lower rates ranging from $0.12/$m^3$ to $0.35/$m^3$ as shown in the table below. Further, some programs provide an incentive cap such as a dollar cap or a 50 percent of project cost. We recommend Enbridge reduce its proposed performance-based incentive level to $0.50/$m^3$ or lower.

Table 17. Incentive per Savings Achieved in Other Jurisdictions

Program Administrator	Program	Incentive (USD$/therm)	Incentive (CAD$/m^3)	Incentive cap
SCG	Savings by Design	$1.00	$0.45	up to $500k or 50% of project cost (whichever is less)
Energy Trust of Oregon	New Buildings	$1.20	$0.54	n/a
Xcel	Design Assistance	$0.40	$0.18	n/a
Nicor Gas	Economic Redevelopment	$0.75	$0.34	$100,000
Enbridge	Small commercial new construction	$2.23	$1.00	n/a

Source:(Southern California Gas 2015; Oregon 2015; York et al. 2013; Nowak et al. 2013).

Incentive Design

Using a performance-based incentive for greater savings or more rigorous construction plans is an effective approach to encourage participants to go deeper with energy savings. This method is used by several leading program administrators in other jurisdictions such as investor-owned utilities in California, Efficiency Vermont, Xcel in Colorado, Commonwealth Edison and Nicor Gas in Illinois (York et al., 2013, pp. 180–182). More advanced approaches have been adopted in the Savings by Design program by California's investor-owned utilities.

One such approach is to provide incentives to both a building design team and a building owner. The gas investor-owned utilities in California provide $1 USD/therm ($0.36 USD per m^3) for owners and $0.33 USD/therm ($0.12 USD per m^3) for design teams. A recent program evaluation study found out that "[d]esign team incentives are important in encouraging high-performance design practices," and also that "[t]he financial assistance a building owner receives from either the Whole Building or Systems Approach was seen as the primary strength of the program and linked directly to participation rates (Navigant, 2014, p. 49). "

Another approach is to provide performance incentives based on a sliding scale. In California, while the gas investor-owned utilities are providing a fixed dollar amount per unit of gas savings, the electric investor-owned utilities are increasing the performance incentive from $0.10 USD/kWh annual savings to $0.40 USD/kWh for energy savings from 10 to 40 percent beyond the California building code (Savings by Design, 2015; York et al., 2013, p. 181).

Marketing

Marketing is one of the most important initiatives to increase program participation. However, Enbridge's plan lacks information on its marketing strategy on this offering, especially as to how Enbridge plans to solicit customers into the proposed offering. According to a recent research report on energy efficiency best practices by ACEEE, one promising approach—especially for small commercial buildings—is to use on-line tools (York et al., 2013, p. 179). The tool and the associated on-line materials

work effectively as marketing tools. They generate phone calls from users as a follow-up to determine qualification for participation in the program with the full range of design assistance and associated financial incentives. Enbridge's Small Commercial New Construction offering should consider adopting this strategy.

Public Recognition

Another important best practice in new construction program offerings is to provide public recognition for participating projects. For example, this approach includes publicizing successful projects as case studies, providing plaques and certificates, or supporting participants to obtain a nationally recognized building certification (e.g., LEED) as practiced by several entities including California investor-owned utilities, the Energy Trust of Oregon, NYSERDA, and Efficiency Vermont (Navigant, 2014, p. 50; York, Neubauer, Nowak, & Molina, 2015, pp. 60–64). We recommend that Enbridge provide public recognition to successful projects in line with these best practices. We also recommend Enbridge consider linking the Energy Leaders Initiative offering to the Small Commercial New Construction offering.

Evaluation Plans

Enbridge did not provide any evaluation plan for this offering. Given this is a new offering, Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year. As discussed in Chapter 4, energy simulation modeling is appropriate for this offering as it targets new construction. An impact evaluation study should be conducted starting in the first year of the offering operation.

Recommendations

Enbridge

1. Enbridge should reduce its proposed performance-based incentive level to $\$0.50/m^3$ or lower.
2. For the Small Commercial New Construction offering, Enbridge should consider adopting on-line marketing tools to generate phone calls from users as a follow-up to determine qualification for participation in the program.
3. Enbridge should follow best practices by providing public recognition for successful projects. Enbridge should also consider linking its Energy Leaders Initiative offering to the Small Commercial New Construction offering.
4. Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year.
5. Enbridge's evaluation plan should include impact evaluation activities starting in the first year of the offering operation.

5.4.6 Energy Leaders Initiative (Enbridge Only)

Overview

Enbridge: Energy Leaders Initiative (New). This offering seeks to identify energy leaders that are already energy efficient, and to offer energy efficiency services for such customers through energy audits and assessment and through enhanced incentives for deeper energy measures. This initiative also intends to incent those participants in the Run it Right ("RiR") and Comprehensive Energy Management ("CEM") offers (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 19-22).

Union: N/A.

Discussion of Key Issues

Incentives

Enbridge proposes to provide customers up to 50 percent higher than existing offers as an increase incentive. No further details of the proposed incentive design are available. Specific types of measures promoted under this offering are also not available, except for RiR and CEM measures. Thus, we cannot comment on the incentive level or designs.

Public Recognition

As discussed in Section 5.4.5 Small Commercial New Construction (Enbridge Only), leading commercial new construction programs use public recognition as a key leverage to increase program participation and as a marketing strategy. The Energy Leader Initiative offering could play an effective role in providing public recognition values to leaders in the new construction industry. We recommend Enbridge consider linking the Energy Leaders Initiative offering to Enbridge's new construction offerings, including the Small Commercial New Construction offering and the Savings by Design offering.

Evaluation Plans

Enbridge did not provide any evaluation plan for this offering. Given this is a new offering, Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year. Enbridge's evaluation plan should include an impact evaluation study.

Recommendations

Enbridge

1. Enbridge should consider linking the Energy Leaders Initiative offering to Enbridge's new construction offerings, including the Small Commercial New Construction offering and the Savings by Design.
2. Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year.

3. Given this is a new offering, Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year.

4. Enbridge's evaluation plan should include impact evaluation planactivities.

5.5. Low Income Programs

5.5.1 Overview

The table below provides an overview of the offerings included in this program for each utility, and indicates whether those offerings are new or existing. Each of these offering types is discussed in more detail in the sections that follow.

Table 18. Low Income Programs Offerings

Offering Type	Enbridge		Union	
Core Offerings				
New Construction	Low Income New Construction (Pilot)	New	n/a	n/a
Single Family	Home Winterproofing	Existing	Home Weatherization Offering	Existing
Multi Family	Low Income Multi-Residential – Affordable Housing	Existing	Low Income Multi-Family Offering (Demonstration)	New
Additional Offerings				
Additional Offering 1	n/a	n/a	Aboriginal Offering	New
Additional Offering 2	n/a (these measures will be introduced into the Home Winterproofing program in 2016)	n/a	Furnace End-of-Life Upgrade Offering	New

5.5.2 Low Income New Construction

Overview

Enbridge: Low Income New Construction (New, Pilot). Incents and provides technical support to affordable housing developers and builders to construct new homes that are at least 15 percent more efficient than homes built to code (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 36, 45-48).

Union: N/A.

Discussion of Key Issues

Absence/Pilot of a Core Offering

Enbridge's plan describes the Low Income New Construction program as a pilot program. Although this program is a new program and will be ramping up during the plan period, no core program should be offered as a pilot as there is no good reason to delay or suspend services to this important market.

Union's plan does not include a Low Income New Construction offering.

Marketing

Marketing efforts include street posters in selected low income neighborhoods (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, p. 36). This approach does not seem to make sense for this market as the participants are developers and builders that may not live in low income neighborhoods. Also, inhabitants of new low income dwellings may not have contact with the developers and builders prior to construction and thus are not well positioned to influence these program participants to design more efficient homes and buildings.

Evaluation Plans

Impact Evaluation

In its impact evaluation plan, Enbridge is not clear how it will estimate and verify savings. The plan states only that it will "[v]erify IDP [(Integrated Design Process)] documents to establish estimated savings are at least 15% above OBC." (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 2, p. 33). Enbridge should clearly state how IDP documents are used to establish estimated savings, and how it intends to verify the claimed savings.

Process Evaluation

Enbridge has no process evaluation plan for this pilot offering. As this is a new pilot, it should conduct a process evaluation study and identify the effectiveness of the proposed incentives and delivery mechanisms and areas for improvements.

Recommendations

Enbridge

1. Enbridge should roll out as a full offering, rather than as a pilot, the Low Income New Construction offering.
2. Without further substantiation of the usefulness of the street poster marketing approach, Enbridge should consider redirecting funds for these posters to other marketing opportunities.
3. Enbridge should clearly state how IDP documents are used to establish estimated savings, and how it intends to verify the claimed savings.

4. As this is a new pilot, it should conduct a process evaluation study and identify the effectiveness of the proposed incentives and delivery mechanisms and areas for improvements.

Union

1. A comprehensive suite of low income offerings should include Low Income New Construction, Low Income Single-Family and Low Income Multi-Family offerings, which are referred to as core offerings in this section. Union should provide a Low Income New Construction offering. This offering should be consistent with Enbridge's program, including the recommendations above.

5.5.3 Low Income Single Family

Overview

Enbridge: Home Winterproofing (Existing). This offering provides incentives for assessment and weatherization services. A furnace replacement measure will be added to the offering in 2016 (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 35, 41-45).

Union: Home Weatherization Offering (Existing). This offering provides incentives for assessment and weatherization services. Customers are also referred to the Furnace End-of-Life Upgrade offering from this offering as appropriate (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 73-77).

Discussion of Key Issues

Eligible Measures

Neither Enbridge nor Union offers all of the measures expected in a comprehensive program. Neither appears to provide any early replacement measures. Also, the plans do not include heating equipment repairs, boilers, water heaters (including tankless and solar hot water), windows, duct sealing and insulation or boiler reset control measures. In addition to the measures listed above, Enbridge also does not provide pipe wrap.

Program Delivery

Key details of program delivery are missing from Enbridge's and Union's plans. For example, the initial audit and post installation inspection processes are not described, including: whether or not a blower door test is performed; whether or not infrared thermography is used; and whether or not combustion analysis, draft testing, and combustion appliance zone tests are conducted.

- The WarmChoice program "was one of the first weatherization programs in the country to require combustion efficiency testing, blower door testing, an infrared thermography inspections of completed insulation and air sealing work". This improved savings greatly (Nowak et al., 2013).

- National Grid's Low Income Retrofit Program in Massachusetts conducts a post-installation quality assurance inspection in all of the installations. More than half of the units are also inspected during installation (Nowak et al., 2013).

Partners

Neither plan describes any collaboration between the gas utilities, electric utilities, and key low income partners except for marketing purposes. Key aspects of collaboration in other jurisdictions include leveraging additional funding sources and improving the cost effectiveness of program delivery.

- National Grid coordinates delivery of its Low Income Retrofit Program in Massachusetts with Action, Inc., the other program administrators in the state, and the Low Income Energy Affordability Network (LEAN)(Nowak et al., 2013). National Grid coordinates all aspects of its programs including "planning, delivery, implementation, education, marketing, training, cost-effectiveness, evaluation and quality assurance" (Nowak et al., 2013).

Incentives

Enbridge does not offer incentives to address health and safety repairs. Health and safety repairs are a key barrier to participation in this sector and should be addressed.

- The WarmChoice program provides repairs of water leaks and natural gas cook stoves that are producing high levels of carbon monoxide, and ventilates homes that are tightened at or below the building tightness limit through proper air sealing and insulation. The program also addresses safety and efficiency of combustion equipment in both its initial and post installation inspection processes (Nowak et al., 2013).

- National Grid's Low Income Retrofit Program in Massachusetts performs a wire inspection prior to weatherization due to high penetration of unsafe knob and tube wiring in its service territory. The program also addresses window glass replacement and adjustment of window meeting rails that are barriers to weatherization (Nowak et al., 2013).

- The table below shows the most common pre-weatherization issues in the Boston area, and the most common solutions, including rebates and grants offered to address these issues. In addition to the rebates and grants listed below, customers can also apply to use a portion of a Mass Save HEAT Loan for fixing pre-weatherization problems.

Table 19. Pre-Weatherization Issues in the Boston Area

Pre-Weatherization Condition	Explanation	Remediation
High carbon monoxide	If your heating system doesn't burn cleanly, it can produce carbon monoxide or "CO," an odorless gas that is very toxic. In a drafty, uninsulated home, this might not be a health problem, but if all the drafts were sealed up, the CO would build up inside the house and produce dangerous air quality.	$300 rebate available to you for to hire a licensed HVAC contractor to tune up or clean your heating system
		If high CO persists, the system may need to be replaced
		Mass Save incentives are available for purchasing new high-efficiency heating systems
Draft or spillage of combustion devices	If the draft up your flue pipes or chimney is not adequate to insure that all the gases from your natural gas or oil-fired equipment are pulled completely out of your home, adding insulation and air sealing could create back-drafts of CO and dangerous air quality inside your home.	Chimney cleaning, lining or rebuilding
		Fixing flue issues or adding power to your heating systems' ventilation
Knob-and-Tube wiring	If insulation is installed over old fashioned knob-and-tube wiring, this could create a fire hazard.	$250 rebate available to you for hiring a licensed electrician to determine if the knob-and-tube wiring is "live" or inactive.
		If inactive, your electrician can sign off on a form and you can proceed with insulation.
		If live, ask the electrician to give you a quote for rewiring. If possible, ask for separate figures for basement, attic, and walls.
		$2,000 grant available for rewiring (up to 25% total cost of rewiring plus new insulation)
Improper ventilation of attic, bathroom fans, dryers	If bathroom, dryer, and attic vents are inadequate, moisture can build up, potentially leading to mold and other damage.	$250 rebate available for fixing dryer vents
		Increase attic ventilation
		Extend bathroom and dryer vents to the outside
Mold or moisture presence in attic or basement	Mold and moisture can cause indoor air quality issues.	Remove mold and ventilate
		Stop the source of moisture through roof repair or basement water sealing
Dirt floors in basement	If a damp basement is made less drafty through air sealing or insulation, moisture coming up through dirt floors can cause indoor air quality and mold issues.	Put down a plastic vapor barrier
		Pour cement
Asbestos	Before asbestos was understood to be a dangerous carcinogen, asbestos "vermiculite" was used to insulate attics and asbestos wrap was used to insulate heating systems and pipes.	$3,000 grant available for removing asbestos from a furnace or boiler (up to 25% of the total cost of asbestos removal and new heating system).
		Asbestos removal must be performed by a contractor certified for asbestos removal.

Sources: MassSave, 2015; Renew Boston, 2015.

Evaluation Plans

Impact Evaluation

Enbridge proposes to review the program record tracking of offering participants and installed measures, and verify installation of select measures (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 2, p. 30). If Enbridge plans to rely on the forthcoming TRM, it should clearly state so. However, as energy savings are expected to be significant (e.g., exceeding 10 percent), we recommend an energy billing analysis be conducted for this offering.

Union proposes a plan for the OEB to conduct energy modeling analyses to measure and verify savings, and does not propose to analyze actual energy bills (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C., p. 36). This is the same approach as proposed for its residential single-family offering. As we discussed for the single-family offering, Union should propose a plan for the OEB to conduct a billing analysis because historical consumption data exist and expected energy savings are likely to be substantial.

Process Evaluation

Union proposes to conduct its process evaluation in 2018 to align with the start of the Aboriginal offering despite the fact that its offering on low income weatherization starts in 2016. This plan would miss a valuable opportunity to benefit from lessons from the operation of this offering in 2016. Instead of waiting for the Aboriginal offering to start, Union should start its process evaluation as early as possible in the first year of the low income weatherization offering. As discussed in Chapter 4, a 2007 paper that compiled lessons learned from 30 years of the process evaluation history in North America states:

> Process evaluations should begin when a program concept is being developed, as part of the research support for the program, along with market research. Early activities can include testing the program response as it is rolling out in pilot phases or early implementation (Peters, 2007).

Early evaluation activities will likely find valuable lessons learned that can be used not only for its offering, but also for the Aboriginal offering scheduled to start in 2018.

Union's survey plan is comprehensive in that it plans to survey participants and non-participants as well as interview delivery agents, partners, offering managers and administrative staff. In contrast, Enbridge's survey plan does not include non-participants or administrative staff as surveyees.

Neither Enbridge nor Union provides a specific plan to review program materials and tracking records, although Union may intend to do it: the Union plan states one of the tasks includes "[r]eviewing the accuracy of the offering's design and validating the offering theory" and "[e]stablishing the effectiveness of the offering's procedures and delivery process" (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 35).

Recommendations

Enbridge and Union

1. If they do not do so already, Enbridge and Union should consider performing a blower door test, using infrared thermography, and conducting combustion analysis, draft testing, and combustion appliance zone tests in audits.

2. Enbridge and Union should consider adding early replacement measures, heating equipment repairs, boilers, water heaters (including tankless and solar hot water), windows, duct sealing, duct insulation, and boiler reset control measures to their offerings.

Enbridge

1. Enbridge should also consider adding pipe wrap to its offering.

2. Enbridge should consider offering incentives to address as many of the health and safety barriers to weatherization as possible.

3. If Enbridge plans to rely on the forthcoming TRM, it should clearly state so. However, as energy savings are expected to be significant (e.g., exceeding 10 percent), we recommend using an energy billing analysis on a sample of offering participants.

4. Enbridge should include in its survey plan non-participants or administrative staff as surveyees.

5. Enbridge should make sure that it conducts a review of program materials and tracking records in its proposed process evaluation study.

Union

1. Instead of waiting for the Aboriginal offering to start before beginning its process evaluation, Union should start its evaluation as early as possible in the first year of the low income weatherization offering.

2. Instead of the proposed energy modeling analysis, Union should propose a plan for the OEB to conduct a billing analysis as historical consumption data exist and expected energy savings are likely to be substantial.

3. Union should conduct a review of program materials and tracking records in its proposed process evaluation study.

5.5.4 Low Income Multi-Family

Overview

Enbridge: Low Income Multi-Residential – Affordable Housing (Existing). This offering aims to reduce the energy consumption of existing Multi-Residential buildings in the affordable housing market (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 34, 36-41).

Union: Low Income Multi-Family Offering (New, Demonstration). This offering aims to reduce the energy consumption of existing Multi-Residential buildings in the affordable housing market (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 83-87).

Discussion of Key Issues

Pilot of a Core Offering

Union describes its Low Income Multi-Family offering as a demonstration. Although this program is a new program and will be ramping up, this program should be rolled out as a full program rather than piloted: There is no good reason to delay or suspend services to this important market.

Eligible Measures

Neither Enbridge nor Union offers all of the measures expected in a comprehensive program. Neither appears to provide any early replacement measures. Also, the plans do not include heating equipment repairs, furnaces, water heaters (including tankless and solar hot water), programmable thermostats, duct sealing and insulation, boiler reset control measures or pipe wrap. They also appear to neglect measures in common area spaces which, though often electric, can be key to achieving coordinated and cost-efficient delivery across gas and electric.

There are three relevant aspects of the Multi-Family initiative in Massachusetts: (1) An Energy Action Plan (EAP) that is developed for each facility, identifying all energy efficiency opportunities regardless of fuel source (2) additional C&I services and incentives, as many buildings contain Residential and Commercial metering and (3) a Multi-Family Market Integrator (MMI), jointly contracted by all program administrators and responsible for facilitating and coordinating the delivery of the initiatives services. This integration program ensures that cross-sector services are delivered seamlessly to customers, including services provided by commercial sector service providers (LEAN Energy Retrofits, 2014, pp. 46–52). Please see the program guide for more detailed information (LEAN Energy Retrofits, 2014).

Enbridge includes high efficiency boilers as both a prescriptive and custom measure without explaining this overlap.

Addressing Key Barriers

Multi-family programs in particular need to be designed to streamline the process and remove the more complex barriers to delivery in the multi-family housing sector. The Enbridge and Union programs do not appear to fully address multi-family sector-specific barriers. Well-designed programs often include:

1. A single point-of-contact or one-stop shopping to prevent customers from having to apply to different utility companies and different programs (some buildings are best characterized as Residential and some as Commercial);
    - CNT Energy's Energy Savers program in Chicago, Illinois leverages this approach (Nowak et al., 2013);

2. A mix of incentives and financing to offset first cost bias and lack of access to capital. A barrier that is especially problematic for this sector is "lack of funds to spend on efficiency upgrades due to competing priorities" (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 86). Financing should be a component of the solution and is described in Section 8 below.

3. Construction support and oversight for building owners. A barrier that is especially problematic for this sector is "limited human resources to identify and implement upgrade projects" (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 86). Delivery should include assistance for building owners throughout the process, including during audit, design, construction (i.e. sending out bid proposals, reviewing bids, scheduling and monitoring) and inspection. Delivery should also include education and continued engagement of building owners to ensure buildings are maintained and operated efficiently;

    - PSE&G's Residential Multi-Family Housing program provides full program oversight from intake through the end of the project (Nowak et al., 2013).

    - The Energy Savers Program "guides building owners through every step of the process, from finding the most cost-effective energy-savings investments to obtaining low-cost financing and utility rebates, overseeing construction, and ensuring reliable results (Nowak et al., 2013)."

4. A flexible audit structure. Investment grade audits are time consuming, costly, and may not be applicable for smaller or newer properties. "Providing simpler, less costly audits where appropriate also saves the program money and allows program funding to be utilized by a greater number of participants (Nowak et al., 2013)."

    - One of the key lessons learned on the Energy Savers Program was that "complex technical reports are not essential (Nowak et al., 2013)."

Incentives

Enbridge's incentive for custom measures is $0.40/m3 (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 34) while Union's is $0.10/m3 (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 84). While different service territories may warrant slightly different incentives—this can be acceptable as long as the difference is explained—the difference in incentives between Enbridge and Union is significant and the drivers of this difference are not explained.

Union does not offer an incentive for operational improvements.

Partners

Neither plan describes any collaboration between the utilities and key low income partners except for marketing purposes. Key aspects of collaboration in other jurisdictions include leveraging additional funding sources and improving the cost effectiveness of program delivery.

- National Grid coordinates delivery of its Low Income Retrofit Program in Massachusetts with Action, Inc., the other program administrators in the state, and the Low Income

Energy Affordability Network (LEAN) (Nowak et al., 2013). National Grid coordinates all aspects of its programs including "planning, delivery, implementation, education, marketing, training, cost-effectiveness, evaluation and quality assurance (Nowak et al., 2013)."

Financing

Zero or low interest financing should be offered to address first cost bias, a significant barrier for this segment. As discussed in the Customer Financing section, there are many jurisdictions in the United States and Canada that offer low interest loans or on-bill financing to low income multi-family buildings.

- PSE&G's Residential Multi-Family program offers full buy down of the interest charges, offering 0 percent on-bill financing. "The PSE&G on-bill payment option is a critical component to the success of the Multi-Family program (Nowak et al., 2013)."
- The Energy Savers Program provides financing at a 3 percent interest rate (Nowak et al., 2013).

Evaluation Plans

Process Evaluation

Union proposes to conduct a process evaluation, while Enbridge does not. However, Enbridge provides three research questions for this offering: (a) how effective is the delivery approach? (b) are the incentives at the appropriate level for effective management of the market? and (c)are there LDC programs that can be leveraged? Thus, we recommend Enbridge conduct a process evaluation and investigate these issues.

Union's survey design for its proposed process evaluation could be improved. Its process evaluation will focus on whether low income tenants in market rate buildings are benefitting from the offering. Thus it proposes to survey a sample of tenants and interview participating building owners or managers (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 52). However, Union should also interview participating contractors and offering delivery agents to gain a holistic view on the effectiveness of this offering, including how tenants are benefiting from the offering.

Further, Union does not provide a specific plan to review program materials and tracking records.

Recommendations

<u>Enbridge and Union</u>

1. Enbridge and Union should consider adding early replacement measures, heating equipment repairs, furnaces, water heaters (including tankless and solar hot water), windows, programmable thermostats, duct sealing, duct insulation, boiler reset control measures and pipe wrap to their offerings.
2. Leverage the existing Low Income Multi-family Working Group to discuss providing a single point of contact for building owners, financing options to augment and/or reduce

incentives over time, and a more flexible audit structure to improve program cost effectiveness. Improved cost effectiveness may free up some funds, enabling the working group to consider providing additional program oversight and support to building owners. This would in turn mitigate costs by improving project completion rates.

3. Enbridge and Union should provide reasonably consistent custom incentive offerings, unless differences are merited and explained in plans.

Enbridge

1. Enbridge should clarify whether it plans to offer high efficiency boilers as both a prescriptive and custom measure.
2. In order to find answers to its research issues in its evaluation plan, Enbridge should conduct a process evaluation and investigate the issues.

Union

1. Union should roll out as a full program, rather than as a pilot, its Low Income Multi-Family offering.
2. Union should offer an incentive for operational improvements, similar to Enbridge.
3. In its process evaluation, Union should also interview participating contractors and offering delivery agents to gain a holistic view on the effectiveness of this offering, including how tenants are benefiting from the offering.
4. Union should conduct a review of program materials and tracking records in its proposed process evaluation study.

5.5.5 Aboriginal Offering (Union Only)

Overview

Enbridge: N/A.

Union: Aboriginal Offering (New). This offering provides measures offered in the Home Weatherization and Furnace End-of-Life Upgrade offerings for aboriginal customers. Its delivery model targets the Band Councils of each of the 13 Aboriginal reserves (Enbridge Gas Distribution 2015b, Exh. A, Tab 3, App. A, pp. 77-80).

Discussion of Key Issues

Target Market

Enbridge does not appear to offer targeted services to Aboriginal groups.

Evaluation Plans

The same issues and recommendations for Union's Home Weatherization are applicable for the Aboriginal offering.

Recommendations

Enbridge

1. If Enbridge has Aboriginal groups in its service territory, Enbridge should consider offering this program, in coordination with Union, to Aboriginal groups.

5.5.6 Furnace End-of-Life Upgrade Offering (Union Only)

Overview

Enbridge: N/A.

Union: Furnace End-of-Life Upgrade Offering (New). This offering provides low income single-family customers with an incentive to upgrade to a 95 percent or greater efficiency rating furnace when their existing unit reaches end-of-life and is being replaced (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 80-82).

Discussion of Key Issues

Cross-Utility Consistency

Union is offering this measure as a stand-alone program, rather than within its core low income programs. Providing this offering within the low income programs, as Enbridge is proposing, is a more cost-effective delivery model and avoids customer confusion due to inconsistency across program administrators.

Evaluation Plans

Process Evaluation

The same issues and recommendations discussed for the Home Weatherization offering apply to the Furnace End-of-Life Upgrade offering.

Recommendations

Union

1. Consider moving this program within the core low income offerings, similar to Enbridge.

5.6. Residential Market Transformation Programs

5.6.1 Overview

The table below provides an overview of the offerings included in this program for each utility, and indicates whether those offerings are new or existing. Each of these offering types are discussed in more detail in the sections that follow.

Table 20. Residential Market Transformation Program Offerings

Offering Type	Enbridge		Union	
New Construction	Residential Savings by Design	Existing	Optimum Home	Existing
Behaviour Programs	My Home Health Record	New	Behavioural (Resource Acquisition)	New
Home Labeling	Home Rating	Existing	n/a	n/a

Note that Union includes its behaviour offering as part of its Resource Acquisition program, while Enbridge categorizes this as part of its Market Transformation program. Both utilities' offerings are addressed in this section on Market Transformation programs for ease of reference, and to be consistent with the Guidelines where it states that Market Transformation "programs should also focus on influencing consumer behaviour and attitudes that support reduction in natural gas consumption (Ontario Energy Board, 2014a, p. 13)."

5.6.2 Residential New Construction

Overview

Enbridge: Residential Savings by Design (Existing). This offering incents home builders to construct new homes that are 25 percent more efficient than homes built to code though application of the Integrated Design Process (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 53-58).

Union: Optimum Home (Existing). This offering incents home builders to construct new homes that are 20 percent more efficient than homes built to code through education and support for home builders and homebuyers (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 99-107).

Discussion of Key Issues

The key issues for this offering for Enbridge and Union relate to the customer market targeted to receive the incentives, the incentive structures proposed by Enbridge, the proposed longevity of Union's offering, and the services included as part of Enbridge's offering. Each of these issues is discussed in detail below.

Target Market

The incentives provided by both Enbridge and Union are only for home builders. The utilities could consider expanding their marketing, and potentially incentives, to other stakeholders and decision makers in the new construction market. These stakeholders might include architects, developers, and contractors. For Enbridge, this could also include educating homebuyers on the value of buying more efficient homes, similar to how Union educates homebuyers (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 101). Enbridge could provide synergies between the Home Rating system and the Savings by Design offerings, thereby increasing participation in both offerings and reducing implementation costs.

The first three years of Union's offering focused on recruiting builders. Union proposes to switch to the next phase of the offering, and does not expect to continue recruiting new builders. Union should not turn away builders that are not already enrolled in the program, as doing so would create lost opportunities.

Incentives

Enbridge's incentives are on a sliding scale and decrease overtime so that builders can continue to learn through the program, but to avoid builders becoming free riders and taking advantage of the incentive. However, the number of homes for which a builder can achieve the different incentive levels seems high (up to 50 homes the first time through the offering, up to 100 homes the second time through the offering, and up to 200 homes the third time through the offering). We expect that builders will be able to increase their understanding of improved home design through far fewer than 50-200 homes, so Enbridge should consider whether this is an appropriate use of program spending.

Program Longevity

Union proposes to discontinue this offering at the end of 2016 as a new building code is expected for 2017. Union explains that this creates uncertainty in how to design a new construction offering when the new code is not yet final. Union should commit to continuing support of a new construction offering, whatever the design of the new building code may be. It is important to address the new construction market to ensure an overall comprehensive DSM plan. Without an offering in place to continue supporting builders and home owners lost opportunities may result.

Services

Enbridge's provides general training for home builders. However, Enbridge could provide additional services related to technical training during the design/build process, similar to Union's offering.

Evaluation Plans

Impact Evaluation

Enbridge proposes to verify modeled energy savings for new construction projects in its Residential Savings by Design offering. In contrast, Union has no impact evaluation plan for its Optimum Home

offering. We recommend Union propose a similar impact M&V approach to the Enbridge's plan for 2016 results as well as for projects in 2017 and beyond, in case the offering is extended beyond 2016.

Process Evaluation

Enbridge's survey plan only targets program participants, while Union's survey plan targets various key market players including consumers, participating and non-participating builders as well as program staff and consultants. Enbridge should follow Union's survey plan for its process evaluation.

Union notes that its process evaluation study focuses on "whether or not the interventions, tools, and processes offered to builders and consumers were effective at overcoming previous program barriers, as well as whether not participants were satisfied with the program." (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 26). It is likely that Union plans to conduct a desk review of program materials and reporting. Enbridge does not mention anything associated with this activity. We suggest both Enbridge and Union make sure that their process evaluation plans include a review of program materials and reporting.

Recommendations

Enbridge

1. Enbridge could consider expanding its marketing to other stakeholders and decision makers in the new construction market, including architects, developers, contractors, and homebuyers.
2. Enbridge should consider whether it is an appropriate use of program spending to incent builders for up to 50, 100, or 200 energy efficient homes, or whether fewer homes would be as effective.
3. Enbridge could provide additional services related to technical training during the design/build process.
4. Enbridge should follow Union's survey plan for its process evaluation and include homeowners, non-participating builders, program staff, and consultants as surveys.
5. Enbridge should make sure that its process evaluation plan includes a review of program materials and reporting.

Union

1. Union should not turn away builders that are not already enrolled in the program, as doing so would create lost opportunities.
2. Union should commit to continuing support of a new construction offering, whatever the new design may be with the new building code.
3. Union should make sure that its process evaluation plan includes a review of program materials and reporting.

5.6.3 Residential Behaviour

Overview

Enbridge: My Home Health Record (Resource Acquisition, New). This offering provides residential customers with a home energy report that includes the customer's historical usage comparisons, benchmarks the customer's usage and house relative to similar customers, and energy savings tips. The report is designed to educate customers on their energy consumption and drive participation in other DSM offerings (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 67-71).

Union: Behavioural (New). This offering provides residential customers with a home energy report that includes the customer's historical usage comparisons, benchmarks the customer's usage and house relative to similar customers, and energy savings tips. The report is designed to educate customers on their energy consumption and drive participation in other DSM offerings (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 8-11).

Note that Union includes its behaviour offering as part of its Resource Acquisition program, while Enbridge categorizes it as part of its Market Transformation program. Both utilities' offerings are addressed in this section on Market Transformation programs for ease of reference, and to be consistent with the Guidelines where it states that Market Transformation "programs should also focus on influencing consumer behaviour and attitudes that support reduction in natural gas consumption (Ontario Energy Board, 2014a, p. 13)."

Discussion of Key Issues

Enbridge claims that the home energy reports will have targeted savings tips based on a customer's energy usage patterns, housing characteristics, and demographics. Experience with the OPower program in other jurisdictions indicates that the reports may not be as personalized as Enbridge claims, with customers being compared to neighbors with different heating fuels or suggesting they install DSM measures that they have already installed. Enbridge should work with OPower to ensure they have the customer data needed to individualize the reports to the extent practicable.

Enbridge explains that certain customers will only receive reports via email, rather than being mailed hard copies of their reports. Enbridge will need to ensure that the emailed reports are actually received by the recipients, and are not captured in email junk mail filters.

Union has not yet selected a vendor to implement this offering. Therefore, the specific offering details included in the plan are subject to change, making it difficult to provide concrete feedback on this offering at this time. Union should provide the Board with an update on the specific offering details once a vendor has been selected, which should include identification of any changes to the offering description included in the current plan.

Both Enbridge and Union expect to spend a sizable portion of their portfolio budgets on this offering. Enbridge expects to spend on average 8 percent of its annual budget on this offering (about $6.4 million), while Union expect to spend about 6 percent of its annual budget on average each year (about

$2.9 million). Comparatively, all of the gas program administrators in Massachusetts expect to spend about $3.9 million CAD ($3.1 million USD) each year of their 2016-2018 efficiency plans, which is about 1.5 percent of the annual budget. Enbridge and Union should assess the offering budget to determine whether it can be reduced, or should at least justify the seemingly high amount budgeted for this new offering.

Evaluation Plans

Impact Evaluation

Union's proposed impact evaluation for this offering follows the best practice in impact evaluation for behavior programs discussed in Chapter 4. Union states that "[i]mpact evaluation for this offering will include a randomized control trial (RCT) and ex-post measurement – rather than ex-ante deemed savings – to measure savings." (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 20). In contrast, Enbridge just proposes to "[a]ssess verification and methodology for removing participants using related Enbridge offers." (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 2, p. 44). Enbridge's evaluation plan should follow the impact evaluation approach proposed by Union.

Process Evaluation

Enbridge describes a process evaluation plan for its behavior offering, while Union has no process evaluation plan for its behavior offering. Both behavior offerings are new for Enbridge and Union. Thus, it is critical to conduct a process evaluation and examine any areas for improvements for the following years. Union should conduct a process evaluation study.

Enbridge's survey approach only targets participants. It should also include other types of key program players such as offering delivery agents (e.g., Opower) as well as non-program participants. Enbridge should also conduct a review of offering materials and reporting.

Recommendations

<u>Enbridge</u>

1. Enbridge should work with OPower to ensure they have the customer data needed to individualize the reports to the extent practicable.
2. Enbridge will need to ensure that the emailed reports are actually received by the recipients, and are not captured in email junk mail filters.
3. Enbridge should assess the offering budget to determine whether it can be reduced, or should at least justify the seemingly high amount budgeted for this offering.
4. Enbridge's evaluation plan should follow the impact evaluation approach proposed by Union.
5. Enbridge's survey plan should also include offering delivery agents (e.g., Opower) as well as non-program participants.

6. Enbridge should also conduct a review of offering materials and reporting.

Union

1. Union should provide the Board with an update on the specific offering details once a vendor has been selected, which should include identification of any changes to the program description included in the current plan.
2. Union should assess the offering budget to determine whether it can be reduced, or should at least justify the seemingly high amount budgeted for this offering.
3. Union should conduct a process evaluation study particularly because its behavior offering is new.

5.6.4 Home Rating (Enbridge Only)

Overview

Enbridge: Home Rating (Existing). This offering encourages voluntary home energy labeling, particularly during the purchase and sale of a home, by engaging homeowners and the real estate community on the benefits of a home rating system (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 71-75).

Union: N/A. While Union does not provide a separate offering that encourages home energy labeling similar to Enbridge, Union uses the EnerGuide rating (Natural Resource Canada, 2014) as part of the Home Reno Rebate Offering, which is the dominant method of evaluating and labeling the energy efficiency of homes in Canada (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 4, 7).

Discussion of Key Issues

The specific actions that Enbridge plans to take within this offering are not well defined. Enbridge explains that it will engage in communication campaigns, including mass outreach, direct marketing, workshops, leveraging relationships with real estate agents, and promoting education through other residential offerings. Enbridge should detail the role it will play in each of these activities so as to determine whether such activities are an appropriate use of program spending.

This offering is focused on marketing the importance of home energy labeling, and on increasing customers' understanding of a home rating system and the benefits of an energy efficient home. Enbridge could investigate whether providing an incentive to homeowners and/or real estate agents that actually complete a home energy label prior to the sale of the home would increase adoption of home labeling.

Evaluation Plans

Impact Evaluation

While promoting a home rating system is a market transformation activity, Enbridge also proposes to require participants to install at least two measures (as it proposes for its Home Energy Conservation

offering). Thus, as recommended for the Home Energy Conservation offering, we recommend Enbridge conduct a billing analysis on a sample of offering participants to the extent the savings are expected to be substantial.

Process Evaluation

Enbridge only plans to survey participants in order to determine effectiveness of incentives and offering delivery. To follow the best practice on the survey design mentioned in Chapter 4, Enbridge should include other key players as surveyees, in particular real estate agents and program administrator staff.

Its process evaluation should be an appropriate place to investigate whether providing an incentive to homeowners and/or real estate agents that actually complete a home energy label prior to the sale of the home would increase adoption of home labeling.

Recommendations

Enbridge

1. Enbridge should detail the actions it expects to take within this offering so as to determine whether such activities are an appropriate use of program spending.
2. Enbridge should conduct a billing analysis on a sample of offering participants to verify energy savings to the extent the savings are expected to be substantial.
3. Enbridge could investigate whether providing an incentive to homeowners and/or real estate agents that complete a home energy label prior to the sale of the home would increase adoption of home labeling. Its process evaluation study is an appropriate place for this investigation.
4. Enbridge should include other key players as surveyees, in particular real estate agents and program administrator staff.

5.7. C&I Market Transformation Programs

5.7.1 Overview

The table below provides an overview of the offerings included in this program for each utility, and indicates whether those offerings are new or existing. Each of these offering types are discussed in more detail in the sections that follow.

Table 21. C&I Market Transformation Program Offerings

Offering Type	Enbridge		Union
Commercial New Construction	Commercial Savings by Design	Existing	n/a
	New Construction Commissioning	New	n/a
Commercial Behaviour	Energy Compass	Existing	n/a
	Small Commercial & Industrial Behavioural	New	n/a
School	School Energy Competition	New	n/a

Enbridge's Run it Right and Comprehensive Energy Management offerings, which are included in the Market Transformation program, are discussed in the Performance-Based and Market Transformation Programs section below, along with Union's RunSmart and Strategic Energy Management offerings.

5.7.2 Commercial New Construction (Enbridge Only)

Overview

Enbridge: Commercial Savings by Design (Existing). The goal of this offering is to increase the number of buildings built to 25 percent above the current Ontario building code in the construction of large commercial and industrial buildings. This offering includes buildings at or above 50,000 square feet per project (including aggregate multi-location projects), and is designed to simultaneously prepare builders for the upcoming Code update in 2017. To meet its goal, this offering will provide (a) training on an integrated design process (e.g., visioning session and a full-day charrette) to building design teams and (b) financial incentives to the builders who demonstrate 25 percent above building code performance based on a certified energy model (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 58-62).

Enbridge: New Construction Commissioning (New). This offering provides technical assistance and financial incentives to builders to use the Commissioning phase to ensure that: a facility is set up to operate at the most efficient level possible as was intended; that it meets the needs of the building owner and occupants; and that it provides training to facility operators (Union Gas Limited, 2015a, Exh. B, Tab 2, Sch. 1, pp. 8-11).

Discussion of Key Issues

Incentive Design (Commercial Savings by Design)

Enbridge provides fixed financial incentives over two phases regardless of the size of building projects. It proposes to provide $15,000 in the beginning for an approved pre-construction energy model result, and $15,000 for an approved post-construction energy model result. These fixed incentive amounts could potentially discourage larger or more complex projects from participating as their incentive relative to the total project cost would be smaller compared to the incentives for smaller or simple projects. In line with Energy Trust Oregon's New Buildings program, which was recently selected as an exemplary commercial new construction program by ACEEE, we recommend the incentive toward energy modeling be set at a certain percentage of the total modeling cost (Nowak et al., 2013). Energy Trust of Oregon provides an incentive amount of 75 percent of the total modeling cost up to $50,000 USD.

Although the Commercial Savings by Design is an offering under the Market Transformation program, commercial new construction programs in other jurisdictions typically offer additional incentives toward the cost of installed energy efficiency measures based on demonstrated energy savings levels. As discussed in Section 5.4.5 above, many leading new commercial construction programs, including new

construction programs in California and Oregon as well as Enbridge's own Small Commercial New Construction offering, provide performance-based financial incentives. In addition, also discussed in Section 5.4.5, California's Savings by Design new construction programs found that offering incentives to both a design team and a building owner was effective in increasing participation rates. Further some of such entities offer tiered or sliding-scale incentives for projects with deeper savings. We recommend Enbridge also offer performance incentives for both building design teams and building owners under its Commercial Savings by Design offering. We also recommend Enbridge consider adopting tiered or sliding-scale incentives.

Eligible Projects (Commercial Savings by Design)

Some leading-edge new construction programs provide incentives to ultra-low energy buildings such as net-zero energy buildings and passivehaus. For example, Energy Trust Oregon's New Buildings program covers 50 percent of the cost of net-zero certification from the International Living Future Institute, including the application fee (Energy Trust of Oregon, 2015). We recommend Enbridge offer similar financial assistance for projects achieving net-zero energy buildings or deeper energy savings.

Eligible Projects and Target Market (New Construction Commissioning)

It is not clear whether projects that participate in the Commercial Savings by Design are eligible to participate in the New Construction Commissioning offering, although the plan clearly indicates that Part 3 commercial buildings are target buildings for both offerings. This is because the plan also indicates that some of the first steps of this offering are (a) recruit new construction projects; (b) enroll them in the commissioning offer; (c) ensure they did not participate in SBC for this project (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, p. 66). Enbridge should make it clear upfront in the target market section whether projects participating in the Commercial Savings by Design are eligible or not.

Offering Coordination and Integration (Commercial Savings by Design and New Construction Commissioning)

Enbridge has learned from operating its Savings by Design offering for the past three years that its commissioning strategy is underutilized and the commissioning aspect of the offering needs to be enhanced (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, p. 60). In response, Enbridge proposes to launch the New Construction Commissioning offering as a new, separate offering. However, because the commissioning aspect is an integral aspect of new construction, Enbridge's proposed new offering should be part of the Commercial SBC offering so that every new construction project participating in SBC will have an opportunity to enhance its commissioning initiatives.

Public Recognition (Commercial Savings by Design)

As discussed in Section 5.4.5 Small Commercial New Construction (Enbridge Only), leading commercial new construction programs use public recognition as a key leverage to increase program participation and as a marketing strategy. For example, this approach includes publicizing successful projects as case studies, providing plaques and certificates, or supporting participants in obtaining a nationally

recognized building certification (e.g., LEED) as practiced by several entities, including California Investor-owned utilities, the Energy Trust of Oregon, NYSERDA, and Efficiency Vermont (Navigant, 2014, p. 50; York et al., 2015, pp. 60–64). We recommend that Enbridge follow these best practices by providing public recognition to successful projects in the Commercial Savings by Design offering. We also recommend Enbridge consider linking the Energy Leaders Initiative offering to this offering.

Evaluation Plans

Impact Evaluation

For both the SBD and the Commissioning offerings, Enbridge proposes to review documentation submitted by participants (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 38, 41). Enbridge should provide more detailed information on their impact evaluation plans for these offerings. For new construction, building energy simulations are often used to estimate energy savings for each project. Thus, for a sample of participating projects or all projects (if the population of projects is not large) Enbridge should propose for the OEB to review all key project data and review and verify modeled energy savings.

Enbridge should also propose for the OEB to examine to what extent the new commissioning offering leads to additional savings. This assessment could be done through a literature review. The OEB could also explore whether it is possible or appropriate to conduct a regression analysis of the pre- and post-billing data for each participant and non-participant in the control group.

Process Evaluation

For both the SBD and the Commissioning offerings, Enbridge proposes to survey participants to determine the effectiveness of the offers (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 36, 39). We recommend Enbridge consider including in its survey and interview plan other market and program actors including non-participants, offering delivery agents, and program administrator staff. Enbridge should also review program materials and reporting data.

Recommendations

Enbridge

1. Enbridge should set the incentive toward energy modeling at a certain percentage of the total modeling cost (Nowak, Kushler, Witte, & York, 2013).
2. Enbridge should offer performance incentives for both building design teams and building owners under its Commercial Savings by Design offering. We also recommend Enbridge consider adopting tiered or sliding-scale incentives.
3. Enbridge should offer a similar financial assistance for projects achieving net-zero energy buildings or deeper energy savings.
4. Enbridge should provide public recognition to successful projects in this Commercial Savings by Design offering in accordance with best practices in new construction

programs. We also recommend Enbridge consider linking the Energy Leaders Initiative offering to this offering.

5. Because the commissioning step is an integral aspect of new construction, Enbridge's proposed new offering should be part of the Commercial SBC offering so that every new construction project participating in the SBC will have an opportunity to enhance their commissioning initiatives.

6. Enbridge should provide more detailed information on their impact evaluation plans for both commercial new construction offerings. Enbridge should propose for the OEB to review all key project data and verify modeled energy savings.

7. Enbridge should also include a plan for the OEB to examine to what extent the new commissioning offering leads to additional savings.

8. We recommend Enbridge consider including in its survey and interview plan other market and program actors including non-participants, offering delivery agents, and program administrator staff. Enbridge should also review program materials and reporting data.

5.7.3 Commercial Behaviour (Enbridge Only)

Overview

Enbridge: Energy Compass (Existing). Enbridge offers a free diagnostic service and performance report to C&I customers to identify opportunities for capital and operational energy efficiency improvements (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 75-79).

Enbridge: Small Commercial & Industrial Behavioural (New). This proposed pilot behavioural initiative would increase energy awareness and literacy by providing small volume C&I customers with tailored reports containing energy consumption data, energy savings tips, and references to relevant efficiency offerings (Union Gas Limited, 2015a, Exh. B, Tab 2, Sch. 1, pp. 88-91).

Union: N/A.

Discussion of Key Issues

Overlap and Redundancy (Energy Compass and Small Commercial & Industrial Behavioural)

The analysis provided through the Energy Compass offering appears to be similar to the analysis expected from the Small Commercial & Industrial Behavioural offering. Given the similarity, it is not clear whether both offerings are necessary, or whether having both offerings entails redundancy, increases complexity, and adds cost for little benefit over having just one offering. A process evaluation could provide insight into this issue.

Enbridge indicated that the proposed suite of behavioural and energy management offerings for commercial customers (Compass, Run It Right, Small Commercial and Industrial Behavioural, and School Energy Competition) is intended to address the diverse needs of different customer segments. Enbridge

further asserted that "a suite of programs is necessary to enhance awareness and literacy, to promote increased participation, and to ultimately drive enhance[d] energy performance for customers. It is believed that once customers become engaged in energy performance and understand its merits and the savings to be had, the opportunity to move them along the value chain will be enhanced (Response to BOMA IR-42)." Enbridge should provide evidence that Energy Compass has successfully increased participation in other efficiency offerings. At a minimum, Enbridge should more clearly indicate how the benchmarking analyses, the process of obtaining participants, and follow through are different between the Energy Compass and Small Commercial and Industrial Behavioural offering.

Energy Reports (Small Commercial & Industrial Behavioural)

Energy report offerings for the commercial sector are very new, and their benefits have not been rigorously analyzed. We are not aware of any evaluations of similar offerings in other jurisdictions. The novelty and unproven benefits of such an offering suggests that no more than a pilot scale would be appropriate. Enbridge proposes a moderately sized treatment group of 7,500 customers (Enbridge Gas Distribution 2015, Exh. B, Tab 2, Sch. 1, p. 90). A small budget would also be appropriate for a pilot, however, Enbridge has not provided budget information for this offering.

Enbridge claims that the energy reports will detail consumption relative to "similar facilities," and energy savings tips will be "based on the customer's load profile." (Enbridge Gas Distribution 2015, Exh. B, Tab 2, Sch. 1, p. 90). However, comparisons with facilities that have similar load profiles but different functions may not result in behavior changes. Likewise, energy savings tips that are only based on load profile will have much less value than tips that also take into account facility function and processes. C&I energy uses are diverse, and their efficiency needs (particularly for industrials) are complicated. At a minimum, Enbridge should ensure that its offering contractor has the customer data needed to individualize the reports, including information on type of industry and major energy uses.

Evaluation Plans

Impact Evaluation

Enbridge does not provide a plan for evaluation of either the Energy Compass or the Small Commercial & Industrial Behavioural pilot. It is not clear whether there is a need to conduct an impact evaluation for these offerings, as the focus of these programs is to educate customers on energy efficiency opportunities and increase their participation rates in other offerings. On the other hand, it might make more sense to conduct an impact evaluation for the Small C&I Behavioural pilot, as it is very similar in nature to Enbridge's My Home Health Record and could use similar evaluation methods.

As discussed in Chapter 4, if Enbridge wishes to claim savings from the Small Commercial & Industrial Behavioural offering, it should propose a plan for the OEB to engage an external independent evaluator for the pilot very early in the process and allow that evaluator to conduct a randomized control trial to randomly assign customers to treatment and control groups.

Process Evaluation

Process evaluation is vital for evaluating the effectiveness of the Energy Compass and the Small Commercial & Industrial Behavioural offerings. In particular, Enbridge should investigate in a process evaluation study to what extent the offerings increase participation rates in other DSM offerings and programs, as this is one of the core goals for the offerings.

Recommendations

Enbridge

Energy Compass and Small Commercial & Industrial Behavioural

1. Enbridge should conduct process evaluation studies to evaluate the effectiveness of these two offerings. Enbridge should particularly investigate to what extent the offerings increase participation rates in other DSM offerings and programs, as this is one of the core goals for the offerings.

Energy Compass

2. Enbridge should provide evidence that Energy Compass has successfully increased participation in other efficiency offerings.

Small Commercial & Industrial Behavioural

3. Enbridge should provide budget information for this offering.
4. Enbridge should ensure that OPower has the customer data needed to individualize the reports, including information on type of industry and major energy uses.
5. If Enbridge wants to claim savings from this offering, Enbridge should propose a plan for the OEB to engage an external independent evaluator for the pilot very early in the process and allow that evaluator to conduct a randomized control trial to randomly assign customers to treatment and control groups.

5.7.4 Schools (Enbridge Only)

Overview

Enbridge: School Energy Competition (New). Targeting primary and secondary school students, this offering seeks to increase energy awareness and stimulate behavior change through education, outreach, and competitions between schools (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 79-84).

Union: N/A.

Discussion of Key Issues

The description of the offering suggests that "goal-setting" is a part of the process but does not indicate who sets the goals and whether there would be any parameters for or assistance with setting them. In

general, competition goals should be measurable, ambitious, specific, considerate of participant capabilities, and aligned with participant values. Clear goals are important because they inform the planning process, drive framing and messaging, and give participants "an endpoint on which to focus their efforts and attention." (U.S. Environmental Protection Agency, 2014, p. 2). Without clear goals, the competition runs the risk of faltering.

Beyond goal setting, the agents for each of the elements are also not clearly identified. The focus of the offering as a whole appears to be on students, however some elements will require assistance from faculty and building operators, if not external technical assistance. In particular, this is likely to be the case for energy management systems. In general, these systems require training in order to translate results into appropriate efficiency measures. (Enbridge did not provide details on the specific Energy Management Information System to be provided to participating schools.) Encouraging participation by members of the student body, faculty, administration, and building operation staff may help with interpretation of the data coming out of the system and also facilitate consideration of a wider range of energy saving measures. Such measures could include behavioural change as well as possible improvements to equipment.

The costs and benefits associated with the energy management system and meters that Enbridge proposes to provide to participating schools are also of concern. Technical expertise and access to capital may be needed to develop and follow through with the recommendations that would result from proper use of an energy management system and meters equipment. This suggests that this offering should be coupled with other enabling strategies, otherwise it may not be the best use of these potentially expensive resources.

Evaluation Plans

Impact Evaluation

Enbridge does not provide a plan for evaluating the impact of the School Energy Competition. While a primary focus of this offering is on increasing energy awareness, Enbridge is also proposing to provide an Energy Management Information System, which should be used as a tool for identifying areas for energy performance improvement and driving energy savings. As such, it may be appropriate to conduct an impact analysis. As with evaluation of any behavioural offering, this analysis should take care to avoid double counting savings.

Process Evaluation

Process evaluation will be important for determining the effectiveness of the School Energy Competition. Enbridge indicates that it would conduct an evaluation, but the description of the proposed evaluation is short and vague. Enbridge proposes that the key metric for evaluation of the offering is participants, and the approach is to "ensure accurate tracking and reporting of the offering participants." (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 2, p. 48). A process evaluation plan should be more specific about issues to be investigated. The process evaluation for this proposed offering should investigate to what extent the offerings increase participation rates in other DSM

offerings. Also, it should examine who uses the energy management system, how often, and for what purpose. Interviews with key agents, including members of the student body, faculty, school administrators, and building operation staff, as well as implementation contractors and program administrator staff, will be important for answering these questions. In addition, the process evaluation should include a review of records, educational materials, marketing materials, and the energy management system.

To the extent that the School Energy Competition will reduce electricity consumption, Enbridge should consider coordinating with electric distribution companies on this offering.

Recommendations

Enbridge

1. Enbridge should indicate how goals would be set and who would set them.
2. The offering should explicitly encourage participation by diverse groups of students, members of the faculty and administration, and building operators.
3. The offering should be coupled with other enabling strategies or offerings so that identified opportunities result in a wider range of measures, to make full use of metering and energy management system capabilities.
4. Enbridge's evaluation plan should include an impact analysis.
5. The process evaluation for the School Energy Competition should include investigation of its effect on participation in other DSM offerings, participants' use of the energy management system, and effectiveness of materials. It can do this through interviews with key persons in participating schools, implementation contractors, and program administrator staff, and through review of records, educational materials, marketing materials, and the energy management system.
6. To the extent that the School Energy Competition will reduce electricity consumption, Enbridge should consider coordinating with electric distribution companies on this offering.

5.8. Large Volume Customers Program

5.8.1 Overview

Table 22 Large Volume Customers Program Offerings

Offering Type	Enbridge		Union	
Large Volume	n/a	n/a	Large Volume	Existing

5.8.2 Large Volume (Union Only)

Overview

Enbridge: N/A.

Union: Large Volume (Existing). For its T2 and Rate 100 customers, Union proposes to discontinue incentive payments for studies or equipment investments, and instead offer training, specialized technical support, and audits by qualified Union Professional Engineers to "sustain the efforts to date." (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 66).

Discussion of Key Issues

Programs that are comparable to the proposed Large Volume offering, i.e., those focused on providing technical assistance to large volume customers, vary considerably in their design. However, they generally employ a mechanism to ensure that the technical assistance results in energy savings. They may impose a fee if the customer does not implement the recommendations of the technical assistance, require that savings are verified before incentives are paid in full, and/or set up a contract that specifies the participant's commitments.[13] In North Carolina, for example, Duke Energy offers on-site energy assessments to its large business customers. Participants are charged an on-site assessment fee, which can be recovered by participating in the Smart $aver Incentives program (Duke Energy, 2015).

As another example, Bonneville Power Authority (BPA) offers the Energy Smart Industrial (ESI) Energy Program Manager (EPM) component, which provides participating organizations with salary co-funding for a dedicated energy manager. EPM participants are required to establish a 12 to 18 month savings goal of at least one million kWh per year. Total funding is provided in four separate progress payments, and total EPM funding is tied to verified savings (Amundson, Eskil, & Martin, 2011, p. 2-13). Also under the ESI umbrella, BPA offers the High-performance Energy Management and Track & Tune components, which likewise tie incentives to savings (BPA Energy Efficiency, 2012a, 2012b).

Through its Memorandums of Agreement (MOU) program, NSTAR offers its large customers a highly customized approach to energy efficiency services. A multi-year plan is developed based on discussions between senior decision makers for both NSTAR and the customer. The mix of services provided under the program vary from case to case, but may include technical assistance, turnkey installation approaches, financial incentives, and training, among other things. Both parties commit to a final MOU

[13] In the U.S., many states place a surcharge on each unit of electricity or gas consumed in order to fund public benefits programs, such as energy efficiency. Over the last decade, some states passed legislation allowing the largest energy customers to "self-direct" these public benefits charges towards improving the efficiency of their facilities. A defining characteristic of these self-direct programs is the option for a customer to retain or recoup all or a portion of its total public benefits charges over a period of time. As such, we do not consider the proposed Large Volume program to be comparable with self-direct programs. Nevertheless, leading self-direct programs include a mechanism to ensure that the technical assistance results in verified energy savings, and to recoup funds if savings are not realized. (Chittum, 2011).

that sets forth very specific commitments and strategies to acquire target levels of energy efficiency resources (Nowak et al. 2013a, 94).

Alternately, Large Volume participants could be required to implement recommended measures as a condition of receiving technical assistance, as is frequently required with retro-commissioning programs (which also focus on technical assistance). Retro-commissioning programs often require that all measures that meet a payback threshold (e.g., less than 1.5 years) are implemented. A similar requirement could be incorporated into the design of the Large Volume offering to help ensure that participants follow through with recommendations.[14]

Evaluation Plans

Union does not provide an evaluation plan for this offering. However, it would be appropriate to at least conduct a process evaluation to examine the effectiveness of this offering and identify any modifications for offer training, specialized technical support, and audits by qualified Union Professional Engineers.

Recommendations

Union

1. To ensure that recommended measures are implemented, Union should (a) collect the costs for the technical assistance from the customer if a customer does not implement the recommendations from the technical assistance, then Union should; (b) require execution of an agreement including customer energy savings commitments, and/or (c) require implementation of all recommended measures that meet certain conditions (e.g., a payback period of 1.5 years or less).
2. It would be appropriate to at least conduct a process evaluation to examine the effectiveness of this offering and identify any modifications for offer training, specialized technical support, and audits by qualified Union Professional Engineers.

5.9. Performance-Based and Market Transformation Programs

5.9.1 Overview

The table below provides an overview of the offerings included in this program for each utility, and indicates whether those offerings are new or existing. Each of these offering types are discussed in more detail in the sections that follow.

[14] While the payback period required by large volume customers could be higher than for smaller retrocommissioning customers, research shows that industrial sector decision-makers require short payback periods, from one to three years (DOE 2015 page 39).

Table 23. Performance-Based and Market Transformation Program Offerings

Offering Type	Enbridge			Union		
Retro-commissioning	Run it Right	MT	Existing	RunSmart	PB	Existing
Strategic Energy Management	Comprehensive Energy Management	MT	New	Strategic Energy Management	PB	New

Note: PB is short for the Performance Based program, and MT is short for the Market Transformation program.

5.9.2 Retro-commissioning

Overview

Enbridge: Run it Right (Existing). Run it Right offers incentives that vary with the annual gas consumption and complexity of the building. It provides medium to large commercial and small industrial customers with an analysis of current energy use trends, a recommissioning tune up of building systems, and continuous monitoring of energy performance through an energy management system. (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 84-88).

Union: RunSmart (Existing). RunSmart helps mid- to large-sized commercial customers identify energy saving opportunities associated with retro-commissioning heating and hot water equipment and control systems, based on a free facility walk-through and a review of building envelope integrity. Additional incentives are available after a 12-month period, based on the savings realization level (i.e., 5%, 5-10%, 10-15%, or greater than 15%) (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 54-55).

Discussion of Key Issues

Incentives

For the Run It Right offering, Enbridge proposes to offer incentives based on consumption and complexity of facility operations.

Table 24. Run it Right Incentives

Annual Normalized Gas Consumption (m^3)	Complex	Moderately Complex	Simple
> 1,000,000	$10,000	$7,500	$5,500
500,000 - 999,999	$7,000	$5,500	$4,500
300,000 - 499,999	$6,000	$4,500	$3,500
0 - 299,999	$5,000	$3,500	$2,500

Source: (Enbridge Gas Distribution 2015b, Exh. A, Tab 3, App. A, p 88).

Enbridge provides a vague description of the categories for operations complexity, as follows:

> Complex facilities typically include: industrial facilities, universities, and hospitals with multiple systems. Moderately complex facilities include: offices, municipalities, large offices, large retail (malls), hotels, and multi-residential with multiple systems. Simple

> facilities typically include: multi-residential, retail, long term care, elementary schools, restaurants, and warehouses. (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 87-88).

These categories leave much to interpretation. In addition, while building size and energy consumption thresholds are sometimes used to determine *eligibility*, we are not aware of any retro-commissioning programs that use building complexity to determine *incentive levels* for retro-commissioning.

Another issue with Enbridge's offering design is that it does not provide a mechanism to reduce free riders. Often, retro-commissioning programs deter free-ridership by requiring that customers implement certain measures identified through the free energy audit as a condition of participation (without any financial incentives). For example, CenterPoint's Retro-Commissioning program requires participants to implement recommended measures with a simple payback of 1.5 years or less, and imposes a financial penalty for failure to meet this commitment (York et al., 2015, p. 57).

Enbridge proposes that incentives be based on (historical) average normalized gas consumption from 2011 to 2013, regardless of actual performance achieved after participating in the Run It Right offering. ACEEE notes that gaining commitment to follow retro-commissioning projects through to completion is a "key to successful programs." (York et al., 2015, p. 57). To that end, retro-commissioning programs often include a mechanism to ensure that participants take action to improve energy performance, such as by releasing incentives in stages at progress milestones or tying incentives to actual post-participation energy performance. For example, Wisconsin Focus on Energy ties incentives to energy performance: its retro-commissioning program offers an incentive of $0.40 (USD) per estimated therm (equivalent to CAD $0.18/m3) toward the cost of the audit, and another $0.40 (USD) per verified Therm once all agreed upon measures are installed (Focus on Energy, 2015).[15]

Retro-commissioning programs may use different energy performance improvement mechanisms for customers of different sizes. In partnership with Nicor Gas, People's Gas, and North Shore Gas, Commonwealth Edison (ComEd) offers a retro-commissioning program that provides participating customers with a free expert analysis of the performance of their building's energy using systems (Nowak et al. 2013a, p. 71).[16] While ComEd's RCx Building Tune Up option (only available to small customers) does not call for a specific financial commitment from participants, the retro-commissioning options targeting medium and large customers do, e.g. by requiring financial commitments to spend threshold amounts on implementation of measures. The monitoring-based commissioning option for

[15] The retrocommissioning program also offers an incentive of $0.04 (USD) per estimated kWh toward the cost of the audit, and $0.04 (USD) per verified kWh once all agreed upon measures are installed. The incentives for the complete audit are limited to 75% of the cost of the audit. Incentives may not exceed 100% of retrocommissioning costs. Additional caps include $200,000 per site per calendar year, and $400,000 per customer per calendar year combined for all incentives (Focus on Energy, 2015).

[16] Currently, ComEd offers four options for retrocommissioning, all of which provide funding for the study. Two of these options only provide incentives for the study. One option (available to customers with small buildings) fully funds implementation of selected operational improvements, in addition to funding the study. The monitoring-based commissioning option provides funding based on verified energy savings (ComEd, 2015).

large customers combines both performance-based incentives with financial commitments: under this option, ComEd provides participants with a cash incentive to help with the cost of building automation software, combined with an incentive of $1.00 USD per verified therm in Nicor's service area (equivalent to $0.45 CAD /m3) and $0.07 USD per KWh for verified project savings over an 18-month monitoring period (Nowak et al. 2013a, p. 72). In return, customers must execute a contract with an approved service provider for retro-commissioning software integration and at least 18 months of monitoring, and dedicate 60 to 100 hours of support by the customer's building team (ComEd, 2015).

In contrast to Enbridge's proposed offering, Union's proposal ties incentives to performance, and reflects an appropriate range of energy savings for retro-commissioning programs.[17] In addition to a site assessment and re-commissioning services, Union proposes to offer incentives after a 12-month period based on savings realization: an incentive of $0.20 per annual m^3 saved will be awarded for savings greater than 5 percent of baseline consumption. In addition, an incremental deep savings bonus of $0.05/annual m^3 saved would be awarded for savings greater than 10 percent but less than 15 percent and $0.10/annual m^3 saved for savings greater than 15 percent (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 55).

Energy Management System

Enbridge proposes to provide free access to the Enbridge Energy Management Information System (EMIS) for the 12-month monitoring term (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, p. 87). Enbridge's EMIS is not described in the filing, but such a description would facilitate review of the offering. Enbridge also does not indicate what the charge would be for access to this software after the 12-month period. Ongoing access to energy management software may be important for sustaining the savings associated with retro-commissioning. Furthermore, it may not be appropriate for Enbridge to use a ratepayer-funded energy efficiency program as a platform for increasing subscription to its presumably proprietary software (and increasing associated revenues).

Eligible Measures

It is not clear if Union's RunSmart incentives are applied to savings from operations and maintenance measures alone, excluding savings as a result of capital investments. The filing indicates that savings will be based on actual billing meter data normalized for weather, and that customers participating in RunSmart are not eligible for General Service customer project incentives (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 55-56). However, a customer could receive incentives for installing measures through the Prescriptive program, and also receive an incentive through the RunSmart program for the savings in part achieved with the prescriptive measure(s). The filing should clearly indicate whether savings from capital improvements are excluded from the calculation of eligible savings.

Participation

[17] ACEEE reports that retrocommissioning can yield "cost-effective energy savings of an average of 5-15% with payback times from 0.2 to 2.1 years; in some cases, annual savings as much as 30% are possible (York et al., 2015, p. 53)."

Union's participation goal (10 percent) over a 5-year period is not overly aggressive for an established retro-commissioning program (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 61). From June 2008 to October 2014, a roughly six-year period that included program initiation and ramp up to full operation, ComEd achieved a cumulative participation rate of 10 percent (York et al., 2015, p. 55). Union could consider increasing its target participation to reflect that it is not a new program.

Evaluation Plans

Impact Evaluation

Enbridge did not propose to implement any impact evaluation study for its Run it Right offering. In contrast, Union's impact evaluation plan includes a desk review of project files and a billing analysis to measure energy savings using a whole-facility measurement and verification approach (the IPMVP Option C) (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 69-70). We recommend that on-site audits and inspections of operating conditions and installed equipment be conducted on a sample of projects.

This billing analysis approach develops a baseline energy consumption model, and compares post-retrofit actual energy consumption with post-retrofit modeled energy consumption using the baseline model. As the California Evaluation Framework and SEEAction recommend, a billing analysis with the IPMVP Option C is suitable for a whole-facility retrofit involving multiple, interacting measures with significant potential energy savings (e.g., typically 10 percent or more) (SEEAction, 2012, pp. 481, 483; TechMarket Works, 2004, pp. 4-6). To follow this best practice, the impact evaluation for the Run it Right offering should be based on the IPMVP Option C. We also recommend appropriate measure installation verification activities, including desk review of project files and on-site inspection on a sample of projects, as discussed in Section 4.2 Measure Verification Activities above.

While Union proposes an appropriate evaluation method, there is some room for improvement. Union notes that "[e]nergy savings for RunSmart projects will be based on actual billing meter data, normalized for weather." (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 56). Weather is one of the most important factors affecting commercial energy usage, and occupancy is another important factor (SEEAction, 2012, p. xv). Thus, we recommend that the evaluation take into account occupancy and any other important factors to adjust billing meter data.

Process Evaluation

Enbridge proposes to conduct a process evaluation for Run it Right. However, its evaluation plan only indicates that it will "[c]onduct internal review of offering processes and effectiveness" (Enbridge Gas Distribution, 2015b). A process evaluation plan should be more specific about issues that need to be investigated. It should also include surveys of program participants and non-participants as well as other key players, such as implementation contractors and program administrator staff. As discussed in Chapter 4, Enbridge should at least conduct the following tasks: (a) reviews of records, materials, tools, etc., (b) interviews and discussions with program management and staff, implementing contractors, subcontractors, and field staff, and (c) interviews, discussions, surveys and/or focus groups with participants and non-participants (TechMarket Works, 2004).

Unlike Enbridge, Union did not propose any process evaluation plan for RunSmart. While RunSmart is an existing offering, Union's evaluation plan shows no indication of any previous process evaluation plan. Thus, we recommend Union conducts a process evaluation study as a way to identify opportunities for program design and delivery improvements.

Recommendations

Enbridge

1. Enbridge should consider requiring that participants implement identified measures with a very short payback (e.g., 1 year or less) without any utility financial incentive, to screen out free riders.
2. Enbridge should consider redesigning the incentive structure consistent with common models by implementing a mechanism to ensure energy performance improvement.
3. Enbridge should provide information about the EMIS, and charges after the first 12 months. It should also consider redesigning the offering to ensure longer-term savings.
4. Enbridge should provide estimates of participation, savings, and payback at the offering level.
5. Enbridge's evaluation plan should include an impact evaluation based on the IPMVP Option C.
6. Enbridge should propose a plan for an evaluation contractor to conduct appropriate measure installation verification activities including desk review of project files and on-site inspection on a sample of projects, as discussed in the Cross Offering Evaluation Issues section above.
7. Enbridge should conduct the following process evaluation tasks: (a) reviews of records, materials, tools, etc., (b) interviews and discussions with program management and staff, implementing contractors, subcontractors, and field staff, and (c) interviews, discussions, surveys and/or focus groups with participants and non-participants.

Union

1. Union should clarify whether or not savings as a result of capital investments would count towards eligible savings.
2. Union should consider a more aggressive participation goal.
3. Union should consider taking into account occupancy and any other important factors to adjust billing meter data.
4. We recommend Union propose a plan for an evaluation contractor to conduct on-site audits and inspect operating conditions and installed equipment on a sample of projects.

5. Union should conduct a process evaluation study as a way to identify opportunities for program design and delivery improvement in line with the best practices that are recommended for Enbridge above.

5.9.3 Strategic Energy Management

Overview

Enbridge: Comprehensive Energy Management (New). The Comprehensive Energy Management (CEM) pilot offering would help large C&I customers reduce energy costs associated with operations and foster a corporate culture change around energy efficiency. Under the pilot, Enbridge would provide technical assistance, tools, and financial resources to customers who commit to: incorporating energy usage into their performance goals, providing resources for energy management, creating energy or sustainability teams, and participating in training. (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 91-100).

Union: Strategic Energy Management (Existing). As a successor to Union's Integrated Energy Management System program, the Strategic Energy Management (SEM) program offers large industrial manufacturing customers technical support for developing energy use metrics, provides recommendations for sub-metering, and assists with the development of an energy management plan. Staged financial incentives are available for start-up activities associated with sub-metering and data management equipment, and for demonstrating energy performance improvement against baseline performance (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, pp. 56-57).

Discussion of Key Issues

Incentives

Enbridge proposes to provide four incentives through the CEM offering: (1) an incentive to offset the cost of a monitoring system, tied to annual gas consumption; (2) a verified savings incentive ($0.30/$m^3$, up to $100,000 per project, not to exceed 50 percent of the cost); (3) incentives for capital equipment (through the Custom Industrial offering); and (4) "funds to promote energy awareness and encourage energy efficiency training" (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, p. 96). No context is provided for the size of these incentives.

Similar to Enbridge's proposed incentive to offset the cost of the monitoring system (1), the ComEd monitoring retro-commissioning program offers an incentive to defray the cost of monitoring components. This incentive might be appropriate but should be considered in light of the other three incentives Enbridge proposes.

While there is a wide range in energy management program design, incentives for verified savings (2) are not uncommon. For example, Energy Trust of Oregon provides $0.20 USD per annual therm saved ($0.09 CAD /m3) or $0.02 USD per annual kWh saved ($0.025 CAD per annual kWh) (Nowak et al. 2013a, p. 81). Paying incentives based on energy savings may encourage participants to save more than a fixed incentive amount would. On the other hand, tying financial incentives directly to operations or process energy performance improvements on a per-unit-of-energy basis may not sufficiently encourage the

facility to change its culture or practices, and thus it may not continue to realize energy savings once financial incentives are removed. If financial incentives are linked to energy savings, then the program design should include elements to encourage participants to sustain energy performance improvement efforts after performance incentives are no longer provided. This could include: a requirement that the participant provide evidence that it has implemented a plan for monitoring and measuring energy use and/or adopted a company policy affirming its commitment to energy management, ongoing follow up by the program administrator, or even a smaller performance-based bonus incentive in later years. Enbridge's proposed incentive to promote energy awareness (4) could fill this role, depending on what the requirements are for participants to achieve that incentive. However, Enbridge does not describe the timing of, or any requirements for achievement of, the last incentive.

Another issue with the CEM performance incentive (2) is that it is not clear how it would be calculated. Enbridge does not indicate whether savings eligible for the performance incentive would be normalized for weather and production. Furthermore, the filing is silent regarding whether or not capital investment savings are excluded from performance incentives. Enbridge has linked the CEM offering to the Custom Industrial offering. (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, p. 96). This link is likely to be beneficial, as a major benefit of SEM programs is that participants tend to implement more and deeper energy efficiency measures. This is because participation in SEM tends to increase communications about and awareness of energy efficiency throughout the organization. However, Enbridge should clarify whether the CEM performance incentive is intended to be applied to operations and maintenance savings only, to allow proper consideration of the appropriateness of the overall incentive level.

Union proposes a tiered performance incentive structure for its SEM offering, with fixed incentive levels for specific performance improvements each year. A participant that achieved savings in Year 3 greater than 5 percent relative to its baseline would receive $10,000. For savings in Year 4 greater than 10 percent relative to a baseline, a participant would receive $15,000, and for Year 5 it would receive $20,000 for savings in excess of 15 percent (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 58). This structure may encourage customers to focus on attaining the specific performance thresholds, rather than achieving the highest level of energy performance feasibly and economically attainable for that organization. Union has not provided justification for the specific fixed incentives it proposes in relation to the energy performance improvement. Union should consider using a sliding scale for determining performance incentives or basing incentives on energy saved. This approach would dissuade participants from targeting threshold levels of performance improvement, and it would be more readily comparable to programs in other jurisdictions. For example, Energy Trust of Oregon provides participants in its Strategic Energy Management initiatives with $0.20 (USD) per annual therm saved (equivalent to CAD $0.09/m3) or $0.02 (USD) per annual kWh saved (Nowak et al., 2013).

Customer Commitments

Participants in Union's SEM offering sign an MOU outlining their commitment to the program and performance incentive opportunities (Union Gas Limited, 2015a, Exh. A, Tab 3, App. A, p. 58). Union did

not provide a model MOU and only briefly describes customer commitments, so we are unable to comment on its contents.

In contrast, Enbridge indicates customer requirements for its proposed CEM pilot:

- Make energy usage a specific performance goal
- Provide resources to follow through with energy management
- Create energy or sustainability teams (at least one dedicated energy manager or champion who allocates some time towards energy efficiency activities)
- Demonstrate commitment to improve operations and maintenance practices
- Be willing to invest in enabling EMIS elements (Sub-meters, Hardware/Software) to better control and manage their energy
- Be willing to participate in training (Enbridge Gas Distribution 2015b, Exh. B, Tab 2, Sch. 1, pp. 94-95).

Union should describe customer eligibility and requirements in a similar way. We recommend that the MOU include requirements such as those listed by Enbridge, including at a minimum a requirement for setting an energy performance improvement goal, a requirement that the participant implement a plan for monitoring and measuring energy use and/or adopt a company policy affirming its commitment to SEM, and customer commitment to devote resources (staff and funding) to the energy management system and training (See, Consortium for Energy Efficiency, 2014).

Evaluation Plans

Impact Evaluation

Enbridge did not propose any impact evaluation study, while Union proposes an impact evaluation similar to the approach it proposes for RunSmart. Union indicates that each participant develops an energy performance baseline regression model based on key independent variables and the baseline measurement boundary (e.g., whole facility, or a specific process or system within the facility) (Union Gas Limited, 2015a, Exh. A, Tab 3, App. C, p. 75). Union's impact evaluation includes a desk review of project files, but did not propose any specific M&V method such as the IPMVP Option C. Given that a baseline measurement boundary could differ by project, the IPMVP Option C will not always be appropriate. In any event, Union should indicate in its plan that an appropriate M&V method will be determined on a project-by-project basis reflecting the project boundary. Enbridge should follow Union's impact evaluation plan with one modification: it should indicate how an M&V method by project would be selected.

Process Evaluation

Enbridge proposes to conduct a process evaluation for CEM. However, its evaluation plan only indicates that it will "[c]onduct internal review of offer" (Enbridge Gas Distribution, 2015b, Exh. B, Tab 2, Sch. 2, p.

55). A process evaluation plan should be more specific about issues that need to be investigated. Also, it should include surveys of program participants, non-participants, and other key players such as implementation contractors and program administrator staff. As discussed in Chapter 4, Enbridge should at least conduct the following tasks: (a) reviews of records, materials, tools, etc., (b) interviews and discussions with program management and staff, implementing contractors, subcontractors, and field staff, and (c) interviews, discussions, surveys and/or focus groups with participants and non-participants (TechMarket Works, 2004). In addition, to the extent that SEM activities will save electricity consumption, both Enbridge and Union should consider exploring opportunities to coordinate with electric distribution programs.

Unlike Enbridge, Union did not propose a process evaluation plan for SEM. While SEM is an existing (though evolved) offering, Union's evaluation plan shows no indication of any previous process evaluation plan. Thus, we recommend that Union conduct a process evaluation study as a way to identify opportunities for program design and delivery improvements.

Recommendations

Enbridge and Union

1. To the extent that SEM activities will save electricity consumption, both Enbridge and Union should consider exploring opportunities to coordinate with electric distribution programs.

Enbridge

1. Enbridge should clearly indicate whether or not savings from capital improvements are excluded from the calculation of eligible savings.
2. Enbridge should provide context for the size of the incentives.
3. If financial incentives are linked to energy savings, then the program design should include elements to encourage participants to sustain energy performance improvement efforts after performance incentives are no longer provided.
4. Enbridge should indicate in its evaluation plan whether or not savings eligible for the performance incentives would be normalized for weather and production.
5. Enbridge should indicate in its evaluation plan that an appropriate M&V method by project will be determined based on the project boundary.
6. Enbridge should conduct the following process evaluation tasks: (a) reviews of records, materials, tools, etc., (b) interviews and discussions with program management and staff, implementing contractors, subcontractors, and field staff, and (c) interviews, discussions, surveys and/or focus groups with participants and non-participants

Union

1. Union should consider using a sliding scale for determining performance incentives.

2. Union should describe customer eligibility and requirements.

3. Union should indicate in its plan that an appropriate M&V method by project will be determined based on the project boundary.

4. Union should conduct a process evaluation study as a way to identify opportunities for program design and delivery improvements, according to the best practices that are recommended for Enbridge above.

6. SHAREHOLDER INCENTIVES

6.1. Shareholder Incentive Structure in Ontario

The Board has stipulated that the total annual shareholder incentive available for each utility for the 2016-2020 plan is $10.45 million, consistent with the amount made available for shareholder incentives in 2012. This amount is fixed for each year of the plan, and cannot fluctuate with costs incurred or benefits achieved, or even with inflation. This maximum amount of incentive can only be achieved if the utility achieves 150 percent of its targets (Ontario Energy Board, 2014b, pp. 22–23).

The Board instructed the utilities to use a scorecard methodology for designing their shareholder incentive. The utilities are required to submit a weighted performance scorecard that allocates the available incentive to each program and scorecard metric. As part of this allocation process, the utilities must consider: (1) the programs that save significant natural gas, (2) the allocation of budget to each program, and (3) the Board's key priorities outlined in Section 6.1 of the Framework (Ontario Energy Board, 2014b, pp. 22–23).

The Board identified three levels of achievement for each metric within a scorecard: 75%, 100%, and 150%. If the utility achieves 100% of its targets, then it may receive 40% of the maximum incentive (or $4.2 million). The remaining 60% of the maximum incentive is available for achievement between 100% and 150%. The percentages apply to the weighted score of a scorecard. For example, no incentive will be provided if the weighted score of a scorecard is less than 75% of the target. Between the identified levels of achievement, incentive amounts are linearly interpolated (i.e., the mechanism is not a step function). Finally, a portion of the maximum incentive available after 100% of the targets are achieved can be allocated to addressing the key priorities (Ontario Energy Board, 2014a, p. 3, 2014b, pp. 22–23).[18]

The Board also established a cost-efficiency incentive, which allows the utilities to roll forward any unspent budget for use in the following year, but only if the utility was able to achieve 100 percent of its target for that year. Such an approach provides the utilities with flexibility for achieving greater savings each year (Ontario Energy Board, 2014a, p. 3, 2014b, pp. 22–23).

[18] Using the Board's example, "if a gas utility proposes to dedicate 10% of the overachievement incentive amount (i.e., 10% of $6.3M or $0.6M) to the key priority metrics, approximately $5.7M would remain available to the gas utility if it achieves between 100% and 150% of its targets. This structure maintains the full shareholder incentive amount available at 100% of target (or $4.2M) ensuring the gas utilities are properly motivated to undertake DSM activities, while providing an additional incentive to pursue the key priorities outlined in the DSM framework. (Ontario Energy Board, 2014a, p. 3)."

6.2. Proposed Shareholder Incentive Scorecard and Metrics

6.2.1 Enbridge's Proposed Scorecards

Enbridge proposes metrics, weights, and targets for each year and for each program, which are summarized by program in the tables below. Enbridge allocated the total incentive to each program based on the program's percent of the total budget. Enbridge considers the DSM targets for 2019 and 2020 to be preliminary, and expects that they will be reviewed during the mid-term review. Therefore, the targets for 2019 and 2020 are not included in the tables below.

For the Resource Acquisition program, the majority of Enbridge's incentive is based on achievement of gas savings in terms of cumulative cubic meters (CCM). For 2016, Enbridge has separate metrics for savings from large and small volume customers. Historically, all savings achievements were grouped together, which caused Enbridge to focus on its largest C&I customers as they provided the majority of savings. Enbridge explains that separating the two types of customers allows the company to shift focus to smaller C&I and residential customers that have greater barriers to entry.

The Residential Deep Savings metric focuses on achieving 15 percent of gas savings for each home within the Home Energy Conservation offering. Enbridge states that this added metric will "cement attention on a market segment which comprises the vast majority of Enbridge's customers and will account for a significant portion of the DSM budget from 2016 to 2020." Further, this metric does not increase the maximum shareholder incentive available to Enbridge, and instead works in tandem with the small volume customer metric. (Enbridge Gas Distribution 2015b, Exh. B, Tab 1, Sch. 4, p. 17).

Table 25. Enbridge's Resource Acquisition Scorecard

Resource Acquisition Scorecard					
Metric	**Units**	**Weight**	**100% of Target**		
			2016	**2017**	**2018**
Metrics and Targets					
Large Volume Customers	CCM (millions)	40%	604	601	614
Small Volume Customers	CCM (millions)	40%	290	365	414
Residential Deep Savings	Participants	20%	7,508	10,000	12,346
Shareholder Incentive Achievement					
Max Shareholder Incentive			6,028,149	6,018,665	6,237,051
40% of Max Incentive (100% achieved)			2,411,260	2,407,466	2,494,820
Large Volume Customers	$	40%	964,504	962,986	997,928
Small Volume Customers	$	40%	964,504	962,986	997,928
Residential Deep Savings	$	20%	482,252	481,493	498,964

Source: (Enbridge Gas Distribution 2015b, Exh. B, Tab 1, Sch. 4, pp. 10-14).

Gas savings also dominate the Low Income program's incentive metrics. Enbridge notes that it considers the Multi-Residential metric to be quite aggressive, and requests flexibility to adjust the eligibility criteria used for each region when implementing this offering. Finally, the Low Income New Construction metric is designed to increase the efficiency of new construction developments to a level

that is above current building code so as to decrease the energy costs that are ultimately borne by low income residents or social housing providers (Enbridge Gas Distribution 2015b, Exh. B, Tab 1, Sch. 4, pp. 22-23).

Table 26. Enbridge's Low Income Scorecard

Low Income Scorecard					
Metric	**Units**	**Weight**	**100% of Target**		
			2016	**2017**	**2018**
Metrics and Targets					
Single Family Ontario Building Code (Part 9)	CCM (millions)	45%	29	30	30
Multi-residential Ontario Building Code (Part 3)	CCM (millions)	45%	59	62	70
Low Income New Construction	Project Applications	10%	5	7	9
Shareholder Incentive Achievement					
Max Shareholder Incentive			2,070,551	1,871,569	1,834,735
40% of Max Incentive			828,220	748,628	733,894
Single Family Ontario Building Code (Part 9)	$	45%	372,699	336,882	330,252
Multi-residential Ontario Building Code (Part 3)	$	45%	372,699	336,882	330,252
Low Income New Construction	$	10%	82,822	74,863	73,389

Source: (Enbridge Gas Distribution 2015b, Exh. B, Tab 1, Sch. 4, pp. 19-21).

Because the Market Transformation program is intentionally designed to achieve indirect savings, Enbridge focuses the shareholder incentive metrics for this program predominately on the numbers of participants within each offering. In its plan, Enbridge specifies for each offering who it will consider an official participant for the purposes of each metric.

Table 27. Enbridge's Market Transformation Scorecard

Market Transformation Scorecard					
Metric	**Units**	**Weight**	**100% of Target**		
			2016	**2017**	**2018**
Metrics and Targets					
Home Health Report	CCM (millions)	5%	20	25	20
School's Energy Competition	Schools	5%	50	60	70
Run it Right	Participants	20%	75	86	99
Comprehensive Energy Management	Participants	20%	6	9	10
Residential Savings by Design	Builders	10%	30	20	22
	Homes Built	15%	2,501	2,250	2,295
Commercial Savings by Design	New Developments	15%	30	15	20
New Construction Commissioning	Enrollments	5%	20	26	28
Home Rating	Ratings	5%	596	808	982
Shareholder Incentive Achievement					
Max Shareholder Incentive			2,351,299	2,559,766	2,378,214
40% of Max Incentive			940,520	1,023,906	951,286
Home Health Report	$	5%	47,026	51,195	47,564
School's Energy Competition	$	5%	47,026	51,195	47,564
Run it Right	$	20%	188,104	204,781	190,257
Comprehensive Energy Management	$	20%	188,104	204,781	190,257
Residential Savings by Design	$	10%	94,052	102,391	95,129
	$	15%	141,078	153,586	142,693
Commercial Savings by Design	$	15%	141,078	153,586	142,693
New Construction Commissioning	$	5%	47,026	51,195	47,564
Home Rating	$	5%	47,026	51,195	47,564

Source: (Enbridge Gas Distribution 2015b, Exh. B, Tab 1, Sch. 4, pp. 29-33).

6.2.2 Union's Proposed Scorecards

Union proposes metrics, weights, and targets for each year and for each program, which are summarized by program in the tables below. Due to the formulaic target-setting mechanism proposed by Union for 2017 through 2018 (see Section 6.3 below), only the 2016 targets are provided in the tables below.

There are a number of things to note about Union's proposed scorecards before reviewing them in detail:

- Union allocated the total incentive to each program based on the program's percent of the total budget.
- Union proposes an upper limit of 125 percent consistent with its 2012-2014 DSM Plan (EB-2011-0327), rather than 150 percent consistent with the Framework.

- Union proposes to update the 2016 savings targets included in its scorecards once the TRM and net-to-gross impact reviews have been completed.
- Union does not propose a scorecard for its Large Volume program.

For the Resource Acquisition Scorecard, Union proposes metrics for savings and for participants, with more weight given to the savings metric. Union explains that such metrics will ensure achievement of the Board's priorities, especially long-term benefits to customers. To be considered a participant for purposes of the Home Reno Rebate Participants metric, a customer must install two measures and achieve savings greater than 15 percent.

Table 28. Union's Resource Acquisition Scorecard

Resource Acquisition Scorecard			
Metric	**Units**	**Weight**	**2016 Target**
Metrics and Targets			
Cumulative Savings	CCM (millions)	75%	1,110
Home Reno Rebate Participants	Homes	25%	3,000
Shareholder Incentive Achievement			
Max Shareholder Incentive	$		7,360,000
40% of Max Incentive (100% achieved)	$		2,944,000
Cumulative Savings	$	75%	2,208,000
Home Reno Rebate Participants	$	25%	736,000

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, pp. 20-21).

For the Low Income Scorecard, Union proposes three metrics related to achievement of savings goals, focused on the different market segments within the low income customer sector (single family, assisted multi-family, and market rate multi-family).

Table 29. Union's Low Income Scorecard

Low Income Scorecard			
Metric	**Units**	**Weight**	**2016 Target**
Metrics and Targets			
Single Family Cumulative Savings	CCM (millions)	60%	34
Social & Assisted Multi-Family Cumulative Savings	CCM (millions)	35%	15
Market Rate Multi-Family Cumulative Savings	CCM (millions)	5%	2
Shareholder Incentive Achievement			
Max Shareholder Incentive	$		2,710,000
40% of Max Incentive	$		1,084,000
Single Family Cumulative Savings	$	60%	650,400
Social & Assisted Multi-Family Cumulative Savings	$	35%	379,400
Market Rate Multi-Family Cumulative Savings	$	5%	54,200

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, pp. 26-27).

Union proposes a metric for its only Market Transformation program offering (Optimum Home). This metric measures the percentage of homes built to Optimum Home standards in relation to the total number of homes built in a program year by participating builders who remain enrolled in the program. Union will determine the 2016 target depending on the offering's results in 2015. The Optimum Home offering is being phased out in 2016, therefore Union is not proposing targets beyond 2016.

Table 30. Union's Market Transformation Scorecard

Market Transformation Scorecard			
Metric	**Units**	**Weight**	**2016 Target**
Metrics and Targets			
Homes Built	Builders	100%	2015 Actual +20%
Shareholder Incentive Achievement			
Max Shareholder Incentive	$		250,000
40% of Max Incentive	$		100,000
Homes Built	$	100%	100,000

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, p. 30).

Union's Performance Based Scorecard focuses on both savings and participants, with the weights given to each metric varying across the five-year term of the plan. The 2016 weighting focuses on participant metrics because savings for these offerings will not be realized until a full year (post implementation) of metered data is available for analysis. In future years Union has placed greater weight on the savings metrics, and less weight on the participant metrics.

Table 31. Union's Performance Based Scorecard

Performance Based Scorecard								
Metric	**Units**	**Weighting**					**2016 Target**	**2017-2018 Targets**
		2016	**2017**	**2018**	**2019**	**2020**		
Metrics and Targets								
RunSmart Participants	Participants	50%	20%	10%	10%	10%	25	125% of Prior Year Actual
SEM Participants	Participants	50%	20%	10%			3	2+ Prior Year Actual
RunSmart Savings (%)	m3		60%	40%	40%	40%		10% Aggregate Participant Savings
SEM Savings (%)	m3			40%	50%	50%		2018: 5%; 2019-2020: 102% of Prior Year Actual
Shareholder Incentive Achievement								
Max Shareholder Incentive	$						130,000	
40% of Max Incentive (100% achieved)	$						52,000	
RunSmart Participants	$	50%					26,000	
SEM Participants	$	50%					26,000	

Source: (Union Gas Limited 2015a, Exh. A, Tab 3, pp. 32-33).

6.2.3 Shareholder Incentive Metrics in Other Jurisdictions

Every jurisdiction employs a different shareholder or performance incentive mechanism for energy efficiency achievement by program administrators. The amount available for the incentive, the metrics

on which earned incentives are based, and the upper bounds and lower thresholds for achievement all vary across regions.

ACEEE conducted a survey of U.S. state performance incentives in 2015 that included identification of the metrics on which achievement of performance incentives are based (Nowak et al., 2015). The results are summarized in the table below. Many jurisdictions have adopted a shared benefits structure through which, if the utility achieves its savings goals, it can receive a certain percentage of the net benefits or total benefits achieved. Therefore, the utility has an incentive to meet its savings goals while maximizing net benefits or total benefits.

Table 32. Metrics Incented through State Performance Incentive Mechanisms

State	Metrics Incented
Arizona	Savings achieved
Arkansas	Shared net benefits if savings targets achieved
California	Primarily savings based, with some additional targets
Indiana	Shared net benefits if savings targets achieved
Massachusetts	Benefits and net benefits achieved
Michigan	Multiple metrics, including savings, participants, and others
Minnesota	Shared net benefits if savings targets achieved
Missouri	Shared net benefits if savings targets achieved
Oklahoma	Shared net benefits if savings targets achieved
Rhode Island	Savings achieved
Texas	Savings achieved
Vermont	Savings achieved and specific performance metrics

Source: (Nowak et al., 2015).

6.2.4 Appropriateness of Proposed Metrics

Enbridge's and Union's scorecards focus either on savings or participants or both, depending on the program. Most other jurisdictions also primarily incent achieving or exceeding savings targets, as savings are one of the primary reasons for implementing DSM programs.

Ontario is one of the few jurisdictions to propose incenting the number of participants achieved. While this may not be common practice, we find it is an important metric that should be included in a shareholder incentive mechanism. The more customers that participate, the less of an impact the rate increases required to fund energy efficiency will have on customers' bills, as more customers achieve usage reductions thereby offsetting the rate increase. Incenting the utilities to focus on increasing customer participation will assist in removing financial, informational, and other barriers to participants, and will help to increase customers' understanding of energy efficiency and their energy usage.

In addition to savings and participants, the Board could consider requiring the utilities to develop metrics or other mechanisms that focus on program cost-effectiveness. Such a metric would ensure that

the utilities keep costs low while achieving significant savings. Further, such a metric would motivate the utilities to save not only gas, but electricity, water, and the non-energy benefits included in the TRC Plus 15 percent adder. The addition of a cost-effectiveness metric would create a balance with the savings metrics, as a cost-effectiveness only metric could result in cream skimming activities (i.e., implementing only the most cost-effective measures and not more holistic measures that may be more expensive or save less energy).

When comparing Enbridge's and Union's incentive mechanisms to each other, there are several differences that arise. First, Enbridge's Resource Acquisition scorecard includes separate targets for lower and higher volume customers, while Union's scorecard does not. Separating savings goals such as Enbridge has done removes the temptation to focus entirely on large volume customers who typically provide the greatest savings at the lowest cost, thereby making it easier to achieve the target incentive. This approach requires the utility to focus on residential and smaller C&I customers, who are usually more difficult to reach and provide lower savings per dollar spent. Therefore, similar to Enbridge, Union should develop separate metrics for lower and higher volume customers within the Resource Acquisition scorecard.

Second, Union's proposed shareholder incentive does not propose a metric related to low income participant achievement, while Enbridge does in its scorecard. As discussed above, it is important to increase customer participation, especially for low income customers who are generally considered hard to reach. Further, the utilities' incentives should be similar to each other where appropriate. Therefore, the Board should instruct Union to include a metric related to increasing participation in the Low Income program.

Finally, Union does not include a scorecard for its Large Volume program, even though the utility is expecting to spend approximately $873,000 on this program each year. Union should consider including a scorecard for the Large Volume program to ensure that the costs for that program are appropriately spent.

6.2.5 Recommendations

1. The Board should continue to allow shareholder incentive metrics that motivate the utilities to save energy and increase customer participation in the DSM programs.
2. The Board should consider requiring the utilities to develop metrics or other mechanisms that focus on program cost-effectiveness. Such a metric would ensure that the utilities keep costs low while achieving significant savings.
3. The utilities' scorecard metrics should be similar to each other where practical and appropriate.
4. Similar to Enbridge, Union should develop separate metrics for lower and higher volume customers within the Resource Acquisition scorecard.
5. Union should include a metric within the Low Income scorecard related to increasing participation in the Low Income program.

6. Union should consider including a scorecard for the Large Volume program to ensure that the costs for that program are appropriately spent.

6.3. Performance Incentive Target Adjustments

6.3.1 Enbridge's Proposed Target Adjustment Factor

Enbridge proposes to adopt a target adjustment factor (TAF) that would adjust its savings targets as input assumptions change over time in response to evaluations and audit processes. Enbridge explains that the purpose of the TAF is to ensure that targets, and subsequent shareholder incentives, are fair and predictable for both ratepayers and shareholders. Enbridge proposes to apply the TAF to each cumulative cubic meter (CCM) metric to determine its actual savings targets, based on the variance in CCM that can be attributed to changes in input assumptions (Enbridge Gas Distribution 2015b, Exh. B, Tab 1, Sch. 4, pp. 40-41).

Specifically the TAF is calculated as follows:

$$TAF = \left(\frac{\text{CCM Based on Input Assumptions and Adjustment Factors at Time of Audit} - \text{CCM Based on Input Assumptions and Adjustment Factors at Time of Filing}}{\text{CCM Based on Input Assumptions and Adjustment Factors at Time of Filing}} \right)$$

6.3.2 Union's Proposed Formulaic Target Setting Mechanism

Union proposes that the 2017 through 2020 metric targets be based on a formulaic target setting mechanism that adjusts a year's targets based on the previous year's performance. Union explains that this approach provides flexibility for the targets to reflect the best available information and most recent experience at the time the targets are set. More specifically, Union will determine the cumulative natural gas savings targets for each year by multiplying that year's budget by the prior year's post-audit cost of saved energy or cost per participant (depending on the scorecard metric). For some scorecards, Union proposes a percentage increase in targets each year to further incent the utility to deliver programs cost-effectively (Union Gas Limited, 2015a, Exh. A, Tab 3, pp. 22-23).

Union offers the following illustrative example to demonstrate how this mechanism will work:

> For illustrative purposes, if Union's 2016 post-audit achievement [by the Resource Acquisition program] is 1,109,631,656 m^3 while spending $30.8 million dollars (promotion and incentive spend) to achieve those results, the yield would be 36.0 m^3 per dollar spent. To calculate the 2017 target, the 2016 post audit yield (36.0 m^3/$) will be multiplied by the 2017 Resource Acquisition promotion and incentive budget ($34.2 million) and 1.02 to equal a target of 1,255,189,380 m^3. The Lower Band will be 941,392,035 m^3 (75% of 1,255,189,380 m^3) and the Upper Band will be 1,568,986,725 m^3 (125% of 1,255,189,380 m^3). (Union Gas Limited, 2015a, Exh. A, Tab 3, p. 23).

This method will apply to all scorecards, except the Market Transformation scorecard which will be phased out in 2016, and will be adjusted according to whether the metric's units are in terms of savings or in terms of participants.

Note that Union applied this same methodology to establish their Resource Acquisition targets in their 2012-2014 program (EB-2011-0327).

6.3.3 Appropriateness of Shareholder Incentive Adjustment Mechanisms

The utilities propose different mechanisms to adjust their annual shareholder incentives to avoid the risk associated with updates to input assumptions. As discussed in more detail in Section 9.2 below, it is a best practice to limit the impact that evaluation studies can have on the shareholder incentive a utility achieves. However, it is also important to maintain precedent where policy decisions have already been determined.

In Massachusetts, the program administrators revise their performance incentive rates (i.e., the incentive dollar earned for each dollar benefit or net benefit achieved) only for updates to avoided costs. Avoided costs are seen as beyond the utilities' control, and therefore they should not be penalized for applying such updated information. However, the program administrators do not update the incentive rates to account for program implementation or other evaluation impacts that effect savings during the course of a three-year plan. The mechanism used in Massachusetts does not change the overall pool of performance incentives available to the program administrators.

Beyond this treatment in Massachusetts, we are unaware of other jurisdictions where shareholder incentives are adjusted by this type of mechanism. As discussed in more detail in Chapter 8.1, some jurisdictions will adjust the amount of shareholder incentives awarded at the completion of a year to account for adjustments to input assumptions. However, it is much less common to adjust the shareholder incentive targets against which a utility's actual performance will be compared.

The Board should reject both Enbridge's and Union's proposed adjustment mechanisms because the overall five-year savings goal targets that the utilities are required to achieve should not be adjusted during the course of the plan. Such an approach encourages the utilities to reach their initial goals more creatively should evaluation impacts decrease claimed savings for current measures. If evaluation study results reduce the amount of savings the utilities can claim from certain measures, then the utilities will need to investigate new measures, increase marketing for other measures, or implement other strategies that results in greater savings. Therefore, it is important the initial goals (and therefore shareholder incentive targets) established during this planning process are appropriately aggressive to ensure the utilities remain motivated to achieve savings throughout the plan term.

Note that Union's proposed approach is particularly problematic because it accounts not only for input assumption updates, but also changes in implementation. It also proposes annual target updates. Accounting for implementation changes and updating the performance incentive annually removes the benefits of applying a multi-year plan. Through a multi-year plan, a utility has the flexibility to achieve

the overall multi-year goal at a pace that is suitable for its service territory, customers, and energy markets, which may not be the same pace every year.

6.3.4 Recommendations

1. The Board should reject both Enbridge's and Union's proposed shareholder incentive target adjustment mechanisms because the overall five-year savings goal targets that the utilities are required to achieve should not be adjusted during the course of the plan.

2. The Board should thoroughly investigate whether the initial goals (and therefore shareholder incentive targets) established during this planning process are challenging to achieve to ensure the utilities remain motivated to reach greater savings throughout the plan term.

6.4. Pay-for-Performance

The Framework encourages a pay-for-performance type of a structure for pilot programs (Ontario Energy Board, 2014a, p. 24). Such a mechanism combines a utility's cost recovery and shareholder incentive amounts into one standard rate for all cubic meters of natural gas saved ($/m^3). Both Enbridge and Union indicate that they are investigating a pay-for-performance mechanism as part of their plans (Enbridge Gas Distribution 2015b, Exh. B, Tab 1, Sch. 2, p. 9; Union Gas Limited, 2015a, Exh. A, Tab 3, p. 65).

Union expects that it will examine the associated strengths, risks, impacts, and limitations of a pay-for-performance mechanism. It will do an in-depth quantitative analysis of Union's programs to determine which programs are conducive to such a mechanism. If Union deems a pay-for-performance mechanism appropriate, it will propose it to the Board for approval during the mid-term review. (Union Gas Limited, 2015a, Exh. A, Tab 3, p. 65).

Our research indicates that there have been very few pay-for-performance mechanisms implemented in other jurisdictions. Such an approach could result in programs that "cream skim," meaning they focus on implementing measures that have the lowest costs with the highest savings potential. This could happen if the rate is set such that the utility receives a flat amount for cost recovery and performance incentives. The utility will likely aim to keep costs as low as possible, so that they can keep the remaining revenue from the established rate as a performance incentive.

We suggest that the Board review Union's analysis on this issue during the mid-term review to assess whether a pay-for-performance mechanism is appropriate for use in Ontario. We caution that the proposed shareholder incentive mechanisms may be a better use of ratepayer funding to incent the utilities to deliver successful programs.

7. COORDINATION BETWEEN GAS AND ELECTRIC PROGRAMS

7.1. Background on the Structure of Gas and Electric EE Programs in Ontario

Enbridge and Union offer gas DSM programs across the province. In Union's franchise area, there are 65 electric LDCs (Response to VECC IR 5), while there are 26 electric utilities in Enbridge's franchise area (Response to BOMA IR 54). Province-wide, more than 70 LDCs are required to provide electric energy efficiency services through their Conservation and Demand Management (CDM) programs. Some electric utilities coordinate with each other on these programs (Independent Electricity System Operator, 2015).

A key principle included in the DSM Framework is that gas utilities should "pursue coordination and integration in designing, promoting and delivering DSM programs with the OPA as well as with electricity distributors, where appropriate and possible, to increase overall efficiency, reduce delivery costs, and maximize program impacts" (Ontario Energy Board, 2014b, p. 8). The gas utilities are currently engaged in collaborative efforts with the electric utilities, although these efforts are limited at present. Enbridge has indicated that it "participates on a number of working groups with the electricity distributors and has undertaken utility to utility discussions with key LDCs" (Response to BOMA IR 54). Union has now joined the CDM Working Groups with the goal of identifying potential areas of collaboration, and has discussed coordination and integration of CDM and DSM with 12 electricity distributors (Response to OEB 31).

7.2. Program Coordination Proposals in the 2015 – 2020 DSM Plans

7.2.1 Enbridge

Enbridge has been discussing coordination with various LDCs over the past 18 months (Enbridge Gas Distribution 2015b, Exh. B, Tab 4, Sch. 1, p. 6). Conversations are reportedly "leading towards the implementation of pilots…as opposed to immediate and complete collaboration for an entire program" (Enbridge Gas Distribution 2015c, Exh. B, Tab 1, Sch. 3, p. 17). Enbridge notes that such pilots "may end up being characterized by comparatively high costs for comparatively low verified results," and thus will not commit to such collaborative endeavors (Enbridge Gas Distribution 2015c, Exh. B, Tab 1, Sch. 3, p. 17). Enbridge identifies low income programming, residential home retrofits, residential new construction, small commercial, C&I custom projects, and other initiatives as priority areas of focus for collaboration efforts (Enbridge Gas Distribution, 2015b, pp. 3–6). Enbridge also presents a list of unnamed LDCs and areas on which they will collaborate (Enbridge Gas Distribution, 2015b, Exh. B, Tab 4, Sch. 1, p. 8).

Enbridge has proposed a Collaboration and Innovation Fund (CIF) to facilitate a "relatively small, but meaningful commitment to the ongoing development of appropriate innovative and collaborative pilots

and research" (Enbridge Gas Distribution 2015b, Exh. B, Tab 4, Sch. 2, p. 2). In its response to SEC IR 3, Enbridge indicated that as the electric utilities develop or pursue their CDM plans, the potential projects that may be appropriate for CIF funding will be clearer. While Enbridge expects the CIF to evolve consistent with evolving electricity conservation market and Board priorities, Enbridge set forth a set of filters for assessing whether to proceed with initiatives:

- Has it been endorsed/approved by the IESO?
- Will it be straightforward to integrate/collaborate this initiative?
- Will it address a new or unsaturated market opportunity?
- Is it innovative – either in approach or technology?
- Does it improve the customer's ability to access conservation programming?
- Does it broaden the reach of conservation programming?
- Does it aid in using program dollars more effectively? (Response to VECC IR 9).

Enbridge has indicated that it believes the efforts to collaborate will be time consuming in the short term (including through the program design phase), but should require decreasing resources over the longer term as offers are implemented (Response to BOMA IR 54).

7.2.2 Union

Regarding Union's proposed collaboration activities, Union has reportedly discussed coordination and integration of CDM and DSM with 12 electricity distributors (Response to OEB IR 31). The collaboration activities include:

- participating in Conservation First Implementation Committee (CFIC) and CDM working groups to seek alignment on DSM and CDM programs;
- further engaging with LDCs to understand their CDM plans and their interest in the collaboration opportunities Union has identified;
- engaging with LDCs and IESO to discuss pilot opportunities for coordinated and/or integrated collaborative programs; and
- working with Enbridge and IESO to develop aligned measures and assumptions (Union Gas Limited, 2015a, Exh. A, Tab 1, App. C, pp. 2-3).

Union has indicated that once the electric LDCs have completed their CDM Plans for 2015-2020, it intends to have additional discussions on potential areas of collaboration (Union Gas Limited, 2015a, Exh. A, Tab 1, App. C, p. 3). Union has presented a list of collaboration activities (co-marketing, gas/electric pilots, identification of electric measures through existing gas offerings, etc.) for each of its proposed programs (Union Gas Limited, 2015a, Exh. A, Tab 1, App. C, pp. 3-7).

Like Enbridge, Union has proposed funding for CDM collaboration pilots, as a part of the annual Pilots budget for 2016 to 2020 (Response to CCC IR 6).

7.3. Examples of Coordination Between Gas and Electric Programs

Some jurisdictions are moving towards greater coordination between gas and electric efficiency programs in order to attain greater economies of scale, reap larger savings and avoid lost opportunities, minimize customer and contractor confusion, and increase customer receptiveness to recommendations. Nowak et al. (2014) identified different models for effective institutional relationships for providing combined natural gas and electric energy efficiency programs, described below.

- **Statewide integrated programs**. In this model, separate program administrators (PAs) are maintained but program operations, branding, and implementation are combined and/or standardized across a state or province. Massachusetts, Connecticut, and the Energy Watch partnership in California are examples of this model. This structure is able to attain program consistency and uniformity across multiple areas, reducing customer, contractor, and supplier confusion. Also, this model allows attainment of a scale beyond what is possible with only a subset of utilities collaborating (Nowak et al., 2014, p. 19). Small PAs often have fewer resources to deliver on goals, but these entities may benefit from the resources and scope for innovation that come with collaborating with larger PAs (Nowak et al. 2014, p. 62). Challenges include the flexibility and ongoing and frequent communications required to make it work (Nowak et al., 2014, p. 19). In Massachusetts, this model has meant that strategies that make sense for one PA may not be deployed, possibly resulting in foregoing benefits to that PA's customers (Halfpenny et al., 2012).

- **Third-party statewide administrator programs**. This model involves a non-utility, third-party PA drawing on pooled ratepayer funds to administer a portfolio of programs for the entire jurisdiction. Examples include Delaware, Maine, New Jersey, New York, Oregon, Vermont, Wisconsin, and Washington D.C. (Nowak et al., 2014).[19] The Ontario Power Authority had a similar role for electric efficiency programs until 2014, when responsibility for efficiency program design and planning was shifted to the LDCs. In addition to program scale and consistency, benefits of this structure are lessening or avoiding single-fuel administrator coordination issues such as savings and cost allocation, competition between utilities, and budgeting and plan timeline conflicts (Nowak et al., 2014). Generally these structures require legislation to establish the parameters under which the third-party PA operates.

[19] Nova Scotia's EfficiencyOne is a third-party administrator, however its focus is on electricity savings only.

- **Coordinated programs.** In this model, two or more single-fuel utilities collaborate to provide both gas and electric efficiency measures to customers.[20] As an example of this type of model, Commonwealth Edison (ComEd), Nicor Gas, Peoples Gas, and North Shore Gas coordinate on retro-commissioning and home energy savings programs (Nowak et al., 2014, p. 20-21). As compared with no coordination, this model allows for more savings and cost efficiencies. However, this model has additional coordination challenges relative to the statewide coordination and third-party PA structures (Nowak et al., 2014, p. 20-21). Open and frequent communication between the utilities and the implementation contractor are needed, e.g., to ensure that all parties are on the same page with program goals, strategies, and messaging. Balancing gas and electric goals, budgets, and objectives poses a challenge unique to coordinated programs. For example, one utility may want to expand a program, while a partner utility may not have resources or funding to accommodate such a change (Nowak et al., 2014, p. 100). Alignment of program years is important for program and project management, and timing of plan submittals complicates planning processes (Nowak et al., 2014, p. 98). Beyond these challenges, we are not aware of any programs coordinated between more than a small number of utilities.

7.4. Discussion, Conclusions and Recommendations

As both gas companies have noted, the sheer number of LDCs in Ontario will pose significant challenges for implementing and maintaining coordinated gas and electric offerings. While establishing either the province-wide integrated program or third-party administrator model would require significant communications and negotiations at the outset, either structure could improve the effectiveness and breadth of collaboration efforts over the current ad hoc efforts. However, the recent transition to LDC responsibility for energy efficiency programs suggests that a province-wide program or third-party administrator model is not likely feasible in Ontario in the near term.

Short of adopting one of the other coordination models, the gas companies should take a more pro-active role to lead the way for more electricity and gas DSM coordination. This would include three different elements (a) coordinating among themselves; (b) identifying those programs and offerings that are most suited to electricity and gas coordination; and (c) offering standard program design templates that electric utilities could select from. These three elements combined would lead to a much more consistent, transparent, and efficient approach than what has been proposed by the gas companies.

With regard to coordinating among themselves, the companies should work together to identify those programs and offerings where electricity and gas coordination would be most effective, identify program design issues that both companies could use to coordinate with electric companies, work out some of the details of how the programs will be marketed and delivered to customers, and propose methods for allocating costs and energy savings between electricity and gas utilities. By working out

[20] Nowak et al. also describe combination utility programs, in which a single utility that provides both electric and gas service provides efficiency services targeting both gas and electric measures. As this model is not relevant to Ontario, it is not discussed here.

these important issues together, the gas companies can be more efficient in developing ideas, can allow for stakeholder input, and will create a more uniform and transparent approach across Ontario.

It also makes sense for the two gas companies to identify up front which DSM programs and offerings are best suited for coordination between gas and electric utilities. The areas currently proposed for coordination vary by gas company. Enbridge indicates that one LDC is interested in Enbridge running a residential new construction program on its behalf (Enbridge Gas Distribution 2015b, Exh. B, Tab 4, Sch. 1, p. 8). In contrast, Union does not propose coordination in the residential new construction area (Union Gas Limited, 2015a, Exh. A, Tab 1, App. C, p. 4). While Enbridge does not identify opportunities for coordination with home retrofits, Union has indicated that it intends to investigate LDC interest in collaborating on a pilot for identifying deep electricity savings through its Home Reno Rebate assessment (Union Gas Limited, 2015a, Sch. A, Tab 1, App. C, p. 4). This ad hoc approach to identifying suitable programs and offerings for coordination is likely to lead to inefficient and inconsistent coordination efforts.

DSM offerings and programs that address the whole building, e.g., new construction offerings, retrofit/audit offerings, and retro-commissioning offerings, are very good candidates for cross-utility coordination. The gas companies should start by offering coordination for each of these whole building programs. Many of the most common retro-commissioning improvements, such as scheduling measures, usually create both gas and electric savings. ComEd and partner gas companies reported that investigating gas savings opportunities in addition to electric adds a small amount (only 10 to 15 percent) to the total service provider fee for their joint retro-commissioning program, and adds nothing to program administration costs (Nowak, Kushler, & Witte, 2014, p. 97).

Finally, the gas companies should develop standard program design “templates” for coordinating the electric and gas programs. Each electric utility would be offered a standard coordination template for each program that is identified as suitable for coordination. The template could include all of the important details of program coordination, such as marketing the program, delivering the program, providing customers with audits and technical assessments, the efficiency measures to be offered, the customer incentives to be offered, financing options, and the allocation of responsibilities, costs and savings to the electric and the gas utilities. Each electric utility would be given the opportunity to negotiate modifications to the coordination arrangement with the gas company if desired. Starting with a standard template, however, will substantially reduce time and resources relative to working out a different coordination arrangement with each electric utility. The standard template approach will also result in much more consistent and transparent arrangements between electric and gas utilities throughout Ontario. In addition, this approach might make it much easier, and therefore more likely, for electric companies to coordinate their DSM programs with the gas companies.

7.5. Summary Recommendations

Below we provide a summary of the recommendations discussed in this chapter.

1. Both companies should take a more pro-active role to lead the way for more electricity and gas DSM coordination, in particular in (a) coordinating among themselves; (b) identifying those programs that are most suited to electricity and gas coordination; and (c) offering standard program design templates that electric utilities could select from.

2. With regard to coordinating among themselves, both companies should identify program design issues that both companies could use to coordinate with electric companies, work out some of the details of how the programs will be marketed and delivered to customers, and propose methods for allocating costs and energy savings between electricity and gas utilities

3. Both companies should start by offering coordination for their whole building offerings (e.g., new construction programs, retrofit/audit programs, and retro-commissioning offerings) because such offerings are very good candidates for cross-utility coordination.

4. Both companies should develop standard program design "templates" for coordinating the electric and gas programs so that both gas and electric companies could reduce time and resources required for program coordination activities and develop programs that are more consistent and transparent arrangements between electric and gas utilities

8. CUSTOMER FINANCING

8.1. Background

Neither Enbridge nor Union is proposing to offer any low-cost financing options in the current plan.

Enbridge has indicated that on-bill financing is technically feasible. The utility describes a number of discussions with key stakeholders over the 2012-2014 timeframe and estimates costs of $10,000 to $40,000 to continue with research and design planning during 2015 and 2016. Enbridge is forecasting needing implementation funds for 2016 and beyond, to be driven by the research and design planning over the next year. Enbridge believes that "a workable proposal will require…partnership with organizations currently financing energy-efficiency upgrades through LIC, revolving lines of credit, etc. and/or a highly specialized and focused program design". Enbridge states that "any OBF activities must not affect the risk profile of the utility, and ensure the utility is kept whole in terms of cost recovery" (Enbridge Gas Distribution 2015b, Exh. B, Tab 4, Sch. 3, pp. 3-4).

Union states it is not proposing offering on-bill financing due to the fact that customers "do not cite access to financing as an obstacle to undertaking energy efficiency improvements" (Union Gas Limited, 2015a, Exh. A, Tab 1, App. B, p. 1). This assessment is based on results presented from Union's survey of its own customers, which provides data on Residential customers as a whole. This survey does not show results broken out for target markets that have a greater need for financing offerings. Union commits to "investigate how to facilitate financing options for customers through partnership and education efforts" (Union Gas Limited, 2015a, Exh. A, Tab 1, p. 13). Union proposes to provide information via bill inserts to customers on financing options for energy efficiency, initiate dialogue with key financial institutions about how financing options may be leveraged for energy efficiency programs, and develop a webpage to provide customers with financing information (Union Gas Limited, 2015a, Exh. A, Tab 1, App. B, p. 3).

8.2. Overview of the Uses & Benefits of Financing

Energy efficiency financing, including utility and third-party funded financing, provides up-front capital to fund energy efficiency improvements and is one tool that can be used to increase energy savings from energy efficiency programs. Financing offers several important benefits including:

- Financing enables customers who are unable to pay the upfront costs of energy efficiency investments to participate. This includes enabling customers who are planning to be participants in the future to install energy efficiency measures sooner than they would otherwise be able.
- Financing enables program participants to invest more in efficiency and achieve deeper savings than they would have achieved otherwise.

- Financing can expand energy efficiency efforts while mitigating ratepayer impacts by shifting away from incentives or rebates to greater participant contributions over time.

- Financing can transform energy efficiency investments from uncertain short-term (i.e., annual expenditures) to a long-term strategic investment by creating a revolving pool of funds that are dedicated to energy efficiency improvements for years to come (Nowak, Kushler, Witte, & York, 2013).

Enbridge and Union do not discuss many of these benefits in their review of financing.

Financing solutions need to be targeted to specific customer types and needs. As a result, multiple financing models may be needed to reach a number of different target markets with different financing needs. Development of a financing approach is dependent upon identification of the target market(s) or program(s) where participation needs to be addressed. It also requires development of a specific goal to increase the number of customers participating and the depth of their participation. Target markets can include groups of hard-to-reach/hard-to-serve customers such as low income, multi-family, or equipment replacement markets, as well as small business markets, whole house/building retrofit and new construction markets.

Neither Enbridge nor Union discuss specific target markets where financing could be useful. Union conducted a survey of its Residential and C&I customers which found:

1. 18 percent of customers who are not planning on pursuing energy efficiency in the next five years say this is because they "do not have the money" (Union Gas Limited, 2015a, pp. 27-28). This suggests that financing may be useful for certain customers.

2. "Deep energy efficiency measures such as basement wall insulation are less likely to have been installed compared to less costly 'shallow' measures such as adding weather stripping. This tendency is consistent across all customer groups" (Union Gas Limited, 2015a, p. 25).This shows that there is a significant opportunity to improve the depth of engagement. Financing can help to solve this problem.

3. 24 percent of Residential and 37 percent of C&I customers indicated that access to financing options was valuable (Union Gas Limited, 2015a, p. 33). While this survey does not provide further investigation of the customer segments that are more inclined to need and use financing (i.e., low income, multi-family, and small business markets), this survey does indicate that there are target markets for financing within the Residential and C&I customer bases.

4. 32 percent of Residential and 47 percent of C&I customers indicated that financing at a rate of 5.5 percent would make them more likely to make energy efficiency upgrades (Union Gas Limited, 2015a, pp. 31, 34). This indicates that a financing offering with just a moderately competitive interest rate can accelerate implementation of energy efficiency measures and help overcome the first-cost barrier to investment in energy efficiency.

The survey fails to adequately capture and characterize the potential opportunities for customers to use financing moving forward, for two reasons:

- For those who have completed a project in the past five years, 66% paid for improvements primarily with savings/cash. 9% used a line of credit, 6% used a credit card, 3% used a mortgage/home equity loan and 2% used a personal loan from a financial institution (Union Gas Limited, 2015a, p. 26).These breakouts are similar to those of customers who plan to make improvements in the next five years (Union Gas Limited, 2015a, p. 29). This indicates that customers have little experience or familiarity with the financing approach, most likely because financing is not currently offered. It also indicates that customers may have difficulty envisioning using financing moving forward when it has not been available or utilized in the past.

- The economic environment has challenged the use of financing historically. However, this environment is changing and will not be stagnant over time. This is not a good reason to forego investigation and application of financing. In fact, challenging economic environments have been shown to be good times to offer financing as these periods are when the most financial assistance is needed.

Any financing program that is developed should employ the following best practice design principles:

- Financing should be easy-to-access, the process should be streamlined, and the turnaround time between the loan application and approval should be short.

- Financing repayment should be structured to reduce participants' monthly energy bills or at least achieve bill neutrality.

- Financing can be used as a means to mitigate some of the non-participant ratepayer burden from aggressive efficiency programs. Careful consideration should be given to the incentive/financing mix and interest rates as these program design elements can be significant sources of cost for a large program.

- Contractor education needs to be a critical component of any financing program, as contractors are typically responsible for educating consumers about financing options when they pitch their products and services. Contractor standards are also essential to opening the door to private investment.

8.3. On-Bill Financing

On-bill financing (OBF) is a product provided by (or in partnership) with a utility that allows customers to repay the loan on their monthly bills.

On-bill financing has experienced a surge in interest because it provides a more convenient repayment option for customers than other repayment arrangements because it is coupled with the customer's utility bill. Also, on-bill financing can be more effective than traditional products at reaching hard-to-reach markets such as low income, multi-family, and small business markets. Utility capital often provides a starting point from which jurisdictions can scale financing efforts.

Further, OBF has the potential to promote comprehensive energy efficiency upgrades by allowing customers to implement multiple energy efficiency measures at once, when financial constraints would otherwise limit the customer to fewer measures. While studies of on-bill financing are still lacking, a

case from the Pacific Gas & Electric (PG&E) EnergySmart Grocer (ESG) program suggests that on-bill financing does promote more comprehensive upgrades. The ESG program offers prescriptive financial incentives to mid-to-large size grocery stores and supermarkets, and started offering on-bill financing in 2012 in order to increase the comprehensiveness of efficiency projects and produce more energy savings from each project. As a result, the average number of measures per project was double the number of measures installed for projects without on-bill financing (OBF) (Geers & Rosendo, 2014).

The key barriers to implementing on-bill financing are structuring utility bills to accommodate the charge, dealing with partial payments/defaults, and dealing with transferability when customers move. While utilities cite defaults as their most significant concern with on-bill financing, a recent survey that reviewed 27 on-bill financing programs in the United States, Canada, and United Kingdom revealed that default rates for on-bill financing are low. The range was 0 to 3 percent with a median value of 0.08 percent for the residential sector and 0.9 percent for the non-residential sectors (SEEAction, 2014). There are also ways to reduce the risk of loan defaults to the utility such as setting up loan loss reserves or loan guarantees (e.g., Connecticut Small Business Energy Advantage, New York On-Bill Recovery Loan Program).

8.4. Recommendations

Regulatory / Policy

1. Identify a third party to establish and lead a finance working group. The purpose of this group is to:
    a. research how well existing financing offerings meet the needs of customers in each program;
    b. identify opportunities to design new offerings, targeted to specific programs and customers within these programs;
    c. identify additional sources of financing, including third-party and ratepayer funds; and
    d. discuss the value of financing for specific types of customers, such as low income and Aboriginal groups.

9. USE OF INPUT ASSUMPTIONS IN EVALUATION

9.1. Introduction

Enbridge and Union rely on a set of approved input assumptions that represent the best available information regarding energy efficient technology (Enbridge Gas Distribution 2015b. Exh. B, Tab 2, Sch. 6; Union Gas Limited, 2015a, Exh. A, Tab 3, App. D). The input assumptions are used to calculate the final energy savings achieved through DSM programs (Ontario Energy Board, 2014a, p. 31). They are updated annually, after the annual evaluation of savings results, based on recommendations from the evaluators.

A Technical Reference Manual (TRM) is currently in development under the direction of the Technical Evaluation Committee (TEC), and is expected to be completed in the second quarter of 2015. It will be a complete listing of measures and assumptions for use by Union and Enbridge, thereby replacing the existing input assumptions. Since the DSM Plans were submitted before the TRM release, the utilities have used the existing input assumptions in their DSM Plans. The input assumptions used for the 2016-2018 plans were jointly filed with the OEB on March 27, 2015 in EB-2014-0354.

Included as part of the input assumptions are details and values associated with each measure planned for installation such as natural gas savings, electricity savings, water savings, effective useful life (EUL), as well as impact factors such as free ridership, spillover, and persistence (where applicable). Issues associated with some of these impact factors are addressed below, including a discussion of when new or updated impact factors based on evaluation results should be applied during planning and reporting cycles.

Within the energy efficiency industry, there are many terms used to classify different types of energy savings. These terms are important to understand before reviewing and discussing the issues related to the input assumptions. A few key terms are summarized below (Northeast Energy Efficiency Partnerships, 2011).

- Gross Savings: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated and unadjusted by any factors.
- Adjusted Gross Savings: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. It adjusts for such factors as data errors, installation and persistence rates, and hours of use, but does not adjust for free-ridership or spillover.
- Net Savings: The total change in energy that is attributable to an energy efficiency program. This change in energy may include, implicitly or explicitly, the effects of free riders, spillover, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand.

- Free Rider: A program participant who would have implemented the program measure or practice in the absence of the program.

- Spillover: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program.

- Net-to-Gross Ratio: A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts. The factor itself may be made up of a variety of factors that create differences between gross and net savings, commonly including free riders and spillover. The commonly used formula for calculating NTG ratios is: 1 – Free-ridership Rate + Spillover Rate = NTG Ratio.

Once gross savings are determined, impact factors that account for measure effects such as persistence and realization can be applied to determine the adjusted gross savings. Finally, net savings are determined by applying free-ridership and spillover factors to the adjusted gross savings, often through an NTG ratio that combines both of these factors.

9.2. Applying New or Updated Input Assumptions

9.2.1 The Difficulty of Choosing a Savings Type

As highlighted above, there are many different ways to categorize savings from energy efficiency, whether they be categorized as net, gross, adjusted gross, planned, or actual savings. Each type of savings can be appropriate within specific contexts and regulatory filings; however, determining which type of savings to use for a specific filing is not always apparent for a number of reasons.

The primary reason is that energy efficiency planning, evaluation, and reporting follows a cyclical, interdependent process, with evaluation informing planning and reporting—often with time lags from when the programs were implemented, when the studies were completed, and when the studies are applied. The issue that frequently arises in this process is the question of when to apply new evaluation results. Should new evaluation results be applied to reported values, or should they only affect future planning efforts? Input assumptions connected to free ridership and spillover are of particular concern with regard to this issue, as evaluation results recommending new NTG ratios can significantly impact net savings within a single year.

The other reason it is difficult to determine the appropriate savings type for use in various regulatory filings is that jurisdictions throughout North America use the savings types differently, depending on what the savings are being used to estimate. For example, adjusted gross savings are often used for system planning purposes in order to accurately build a reliable system. Net savings are primarily used for regulatory purposes, to indicate the amount of savings that are directly attributable to the program efforts. Some jurisdictions use gross savings and some use net savings for regulatory purposes, while in some cases both gross and net savings are applied for different purposes.

9.2.2 Primary Contexts for Presenting Savings

There are at least three different filing contexts through which the type of savings plays a role:

- Reliability needs. This refers to the DSM savings estimates included in filings developed by the utilities for use in forecasting system-wide services, such as sales forecasts or infrastructure developments and improvements.

- Regulatory planning and program design. This refers to the DSM plans filed by Enbridge and Union that are currently under review for approval by the OEB. These plans present the utilities' proposed program designs, implementation and marketing strategies, performance incentives, and expected costs and savings.

- Regulatory reporting, including achieved shareholder incentives and LRAMs. This refers to the annual reports filed by the utilities for review and approval by the OEB. These reports look backwards in that they compare the utilities' actual performance to their planned performance as presented in their regulatory plans. As part of this process, a utility determines the shareholder incentive and LRAM that it is eligible to receive based on its actual program implementation and savings results.

Regarding reliability needs, system planning process are used to ensure that the utility system is built in a reliable, efficient manner. Therefore, it is critical that reliability needs are based on the most up-to-date, best available information and data sources at the time of filing. Reliability needs should also rely on adjusted gross savings rather than net savings, to the extent that load forecasts do not account for free-ridership impacts.

Similarly, the input assumptions used to support regulatory plans should always be based on the most up-to-date, best available information and data sources at the time of filing. The program designs presented in the regulatory plans should also be based on the most up-to-date information, but can account for evaluation results more implicitly, such as by adjusting the target market or modifying program designs if high free-ridership values are discovered in an evaluation. There is no valid reason why utilities should rely on stale data when projecting their program performance. To do otherwise could result in sub-optimal programs designs and implementation strategies that miss opportunities and under-serve customers.

Regulatory reporting is where the issue of whether to apply new savings assumptions becomes a more challenging policy decision, particularly because it impacts the shareholder incentive achieved by a utility. Using updated input assumptions ensures that the best information is being incorporated into the reported results, while using the same input assumptions as used in the plan removes the utilities' perception of risk for shareholder incentive purposes, thereby encouraging more advanced program designs. The advantages and disadvantages of the different savings options available for regulatory reporting are discussed below.

9.2.3 Best Practices for Regulatory Reporting

Relevant literature consistently recommends that best practice with regard to regulatory reporting is to maintain the planned input assumptions, at least for the savings on which performance incentives are based, especially with regard to free-ridership and spillover impacts.[21] An ACEEE study eloquently phrased the rationale for the best practice, stating:

> For purposes of judging program administrator performance, when a priori net savings assumptions (e.g., NTG ratios) have been agreed to, evaluation results should generally only be applied prospectively, to adjust future energy savings calculations.
>
> That approach should hopefully reduce the likelihood of protracted argument and litigation… reduce the program administrator's perception of risk, and thus encourage more innovative programs. It is also consistent with basic fairness. If all parties have agreed to accepted NTG values based on a given program design and that design is faithfully executed, it is reasonable not to retroactively change the playing field used for crediting energy savings accomplishments (Kushler et al., 2014, p. 32).

The inherent idea of maintaining the planned input assumptions for shareholder incentive purposes is that utilities should not receive reduced incentives for factors outside of their control. There are a number of factors for which a utility has greater influence, such as the number of measures installed, the types of measures installed, the customers targeted for participation, and other program implementation elements. Such factors should be based on actual data and results when filed in regulatory reports. It is a policy decision for regulators to decide the extent to which evaluation impacts over which utilities have little influence should effect utility shareholder incentives and program results.

Conversely, applying updated evaluation results during regulatory reporting can be appropriate in certain contexts or depending on regulatory precedent. As discussed above, it is important that system planning processes use the best available estimates of how much incremental resource was actually acquired. Applying updated input assumptions can also be used for informational purposes to understand how evaluation studies are impacting programs to better design future programs.

For programs that are new or that have very uncertain free-ridership potential, it may be more appropriate to wait until evaluation results are available to estimate net savings. In such instances, all parties agree ahead of time that the updated evaluation results will be applied during reporting, so the "rules of the game" remain consistent between planning and reporting.

One of the most important contexts to use updated input assumptions is for Lost Revenue Adjustment Mechanisms (LRAM). Allowing recovery of lost revenue is intended to remove a utility's disincentive from implementing successful energy efficiency programs that essentially erode revenue by decreasing sales. In effect, an LRAM makes a utility financially "whole" by returning revenues that have been "lost"

[21] The referenced literature includes Kushler et al., 2012, pp. 30, 39, 2014, pp. 25, 32; NMR Group, 2012, pp. 23–24; SEEAction, 2012b, pp. 8–11 through 8–12.

from energy efficiency savings. These lost revenues relate to the actual savings experienced at a customer's meter which result in a sales decrease. For example, if a customer did not install a more efficient heating system, then the utility would continue to receive revenue from the sales of the inefficient heating system. If a customer does install a more efficient heating system, and an evaluation study determines that the savings from the more efficient heating system are actually 100 m^3 rather than the 130 m^3 as expected in the plan, then the actual sales that the utility "lost" are 100 m^3, not 130 m^3, and the amount collected through the LRAM should reflect this adjustment. Therefore, the savings associated with the LRAM should apply updated evaluation and audit results, and should not be maintained from the plan.

Recovery of lost revenues and shareholder incentives are fundamentally different, so it is entirely appropriate to apply different policies for the savings used to determine the amount a utility receives from each mechanism. An LRAM removes a disincentive, making a utility neutral to implementing efficiency. Using updated evaluation impacts for purposes of the LRAM is reasonable, because it better reflects the actual decrease in sales experienced by a utility. Conversely, the shareholder incentive provides a reward for implementing successful, well-designed programs that increase efficiency savings. Maintaining planned input assumptions for shareholder incentive purposes is reasonable based on the reasons discussed above, and because to do otherwise could result in decreased shareholder incentives to utilities if evaluation results decrease savings, defeating the purpose of an incentive.

Note that only applying evaluation updates on a going-forward basis does not imply less frequent evaluation studies, especially within a multi-year plan. Programs should be regularly evaluated to validate savings, focus program efforts on specific market areas, and to ensure appropriate implementation and spending of ratepayer funding.

9.2.4 Jurisdictional Review for Regulatory Reporting

Jurisdictions take different approaches on when to apply evaluation results. ACEEE surveyed U.S. states on evaluation practices and found that 31 states apply evaluation results on a going-forward basis, that 17 states use evaluation results to determine eligibility and/or the amount of shareholder incentives, and that 10 states use evaluation results to determine eligibility and/or the amount of lost revenue recovery (Kushler, Nowak, & Witte, 2012, pp 10, 28). Another study conducted by NMR indicates that all of the New England States and New York only apply updated free-ridership and spillover values to future planning and reporting documents (Forum, 2012, p. 24).

Massachusetts has taken a hybrid approach to applying evaluation results. The state requires program administrators to update savings and impact factors that affect adjusted gross savings during regulatory reporting, asserting that "it is imperative that the adjusted gross savings associated with each program year be determined using the most up-to-date information available," so as "to ensure that the value of the resources procured through the energy efficiency programs is represented in an accurate and reliable manner." However, the impact factors used for free ridership and spillover in the regulatory plans are held constant in the regulatory reporting. In making this determination, the Massachusetts Department of Public Utilities explained that:

> Net savings have a more limited role than adjusted gross savings in determining the value of the resources acquired through the energy efficiency programs. Net savings values, which indicate the level of adjusted gross savings that can be attributed only to the energy efficiency programs, are used primarily to inform and guide future program design decisions. This forward-looking function is not enhanced by a retrospective application of updated evaluation study results.
>
> The retrospective application of updated net savings impact factors has produced sufficiently reliable and accurate results, to date, for determining the performance of traditional energy efficiency programs. Continuing this practice, however, could provide a disincentive for Program Administrators to adopt the innovative approaches to energy efficiency that likely will be needed going forward to meet the requirements of the Green Communities Act and the GWSA. To avoid the risk that performance in administering the plans could be negatively affected by post-implementation adjustments to program savings that are difficult to project beforehand, Program Administrators may seek to adopt an overly cautious approach to program design and implementation. Revising our current practice so that Program Administrators no longer adjust net savings calculation post-implementation should remove a disincentive for Program Administrators to adopt innovative approaches to program design and implementation. (Massachusetts Department of Public Utilities, 2012, pp. 14–15).

In addition, Massachusetts files two sets of data with their annual energy efficiency reports. The first set is the "preliminary" data, which uses the input assumptions used in the plan, updates for actual implementation (number of units, actual costs), updates custom savings calculations, and adds new measures not originally in the plan. The second set is the "evaluated" data, which updates the preliminary data for any new values that are the result of evaluation studies completed within the previous year. The NTG values are not updated from the planned values in either the preliminary or evaluated data sets. The preliminary data set is intended to isolate the program administrator's performance in implementing the programs, and is the data set that the program administrators use to explain to the Department of Public Utilities any significant variances compared to the plan. The evaluated data is considered the final, actual data for the year, and is used in determining the utility's performance incentives.

It is not uncommon for states to approach net and gross savings differently in this regard. As examples, Georgia reports gross energy savings for its IRP and quarterly DSM reports, but uses net savings to determine performance incentive (Georgia Public Service Commission staff, 2015). Similarly, Maryland uses gross savings figures when reporting their projected energy savings, and net savings for cost-effectiveness and program design purposes (Maryland Public Service Commission, 2011, p. 16).

9.2.5 Ontario's Approach to Evaluation Impacts

As noted above, it is a policy decision for regulators to decide the extent to which evaluation impacts should effect utility shareholder incentives and program results. In Ontario, the Board has previously visited this issue and established a policy for how to address updated input assumptions.

Prior to 2012, the gas utilities used updated input assumptions for LRAM calculations, but maintained planned input assumptions for the shareholder incentive calculations. For the 2012-2014 plans, the Board adjusted this framework by agreeing with Staff's Discussion Paper that shareholder incentives should also use updated input assumptions, not just the LRAM calculations. The Board maintained this policy decision for the 2015-2020 plans, which is also consistent with the electric conservation program policy framework. Specifically, the DSM Filing Guidelines stipulate:

> The evaluation of the achieved results for the purpose of determining the lost revenue adjustment mechanism (LRAM) amounts and the shareholder incentive amounts should be based on the best available information which, in this case, refers to the updated input assumptions resulting from the evaluation and audit process of the same program year. For example, the LRAM and shareholder incentive amounts for the 2015 program year should be based on the updated input assumptions resulting from the evaluation and audit of the 2015 results. The updates to the input assumptions resulting from the evaluation and audit of the 2015 results would likely be completed in the second half of 2016.

As such, the precedent in Ontario is to apply updated evaluation results to shareholder incentives and the LRAM. It is important to maintain regulatory precedent on such matters, to provide consistency to the utilities developing and implementing the plan and to participating stakeholders. Only extenuating circumstances should cause the Board to revisit this policy, and such conditions are not apparent in the current proceeding.

9.2.6 Recommendations

1. The best, most up-to-date information available, including recent evaluation updates, should be used for (a) reliability needs, (b) regulatory plans and program design; and (c) regulatory reporting, including achieved performance incentives and LRAM.

9.3. Net Savings Assumptions

9.3.1 Background on Free-Ridership

A free rider is a program participant who would have implemented an energy efficiency measure or practice in the absence of a ratepayer-funded energy efficiency program. Free riders can be: (1) total, in which the participant's activity would have completely replicated the program measure; (2) partial, in which the participant's activity would have partially replicated the program measure; or (3) deferred, in which the participant's activity would have completely replicated the program measure, but at a future time outside the program's timeframe (Northeast Energy Efficiency Partnerships, 2011).

As discussed in the section above, jurisdictions define, calculate, and treat savings differently. When jurisdictions provide definitions for the types of savings reported (which is not always the case), those definitions are typically inconsistent across jurisdictions. More specifically, jurisdiction-reported data in many instances does not indicate whether net savings include adjustments for realization, persistence,

in-service rates and others, in addition to free-ridership and/or spillover impacts. This makes drawing conclusions and findings across multiple jurisdictions difficult.

For Enbridge and Union, free-ridership values differ for the measures included within each gas utility's offering. For prescriptive measures, free-ridership values have been agreed upon by stakeholders (except for a few residential measures, which were determined in a study). By contrast, for custom projects, free-ridership values are based on the 2008 Custom Projects Attribution Study by Summit Blue Consulting. The free-ridership values from this study range from 12 to 50 percent for Enbridge depending on the sector, and are 54 percent for all sectors in Union's territory, except low income.

Free-ridership values for custom projects have not been reviewed or updated since the 2008 study was completed. The TEC is currently performing a study to update the net-to-gross values for custom projects, based on surveys of previous program participants, as well as a revisions of the TRM for prescriptive residential and C&I measures.

9.3.2 Evaluating Free-Ridership

Net savings and associated free-ridership estimates are inherently difficult to estimate given the degree of factors that can influence customer decision making. A SEEAction paper describes some of these difficulties:

> The actual calculation of net energy and demand savings can be more of an art than a science. Essentially, one is attempting to separate out the influence of a particular energy efficiency program (or portfolio) from all the other influences—such as self-motivation, energy prices, and other efficiency programs—that determine participant and non-participant behavior and decisions. With the increasing "push" for energy efficiency by utilities and governments at the local, state, and national level and by private groups and large companies, it can be quite difficult to separate out how one particular program among all this activity influences consumer decisions about whether, when, and to what degree to adopt efficiency actions (SEEAction, 2012b, p. 5–3).

Jurisdictions that account for free-ridership determine net savings either through evaluation studies that provide free-ridership values or by applying deemed or stipulated NTG values.[22]

Jurisdictions that apply free-ridership values using evaluation studies typically rely on survey-based self-reporting to determine the values. Such reports ask questions of program participants and non-participants to determine whether they would have undertaken the action promoted by the utility program on their own but without the incentive provided by the utility. When determining spillover, customers are asked whether they have done other energy efficiency activities or improvements as a result of the utility programs, but without partaking in the incentive offered through the program.

[22] The example jurisdictions referenced below relate primarily to electric energy efficiency programs, although the logic and policies are transferable to gas energy efficiency programs.

Because such questions deal with subjective indicators, such as why a customer chose to implement an energy efficiency measure, stakeholders should exercise caution when using the results.

In general, custom and prescriptive projects are evaluated using the same methodology of customer surveys. However, the different project types are studied separately as custom and prescriptive projects will likely produce different free-ridership estimates. This is because custom projects tend to involve more time, spending, and commitment on behalf of the customer and the customers tend to be larger. On the other hand, prescriptive projects are usually targeted towards small customers and involve more direct-install measures. The commitment level required for a custom versus a prescriptive project is likely a determining factor in whether a customer will move forward with the project, either with or without the help of the utility programs.

Massachusetts periodically conducts an evaluation to review the methodologies it uses to assess free-ridership and spillover for C&I programs. The focus of the most recent study in 2011 was on the general methods for estimating what would have happened absent C&I programs in Massachusetts. The objectives of this study were to develop a standardized methodology for situations where C&I end-users are able to report on program impacts via self-report methods, and to provide a decision framework and guidelines for when the standardized self-report methodology is appropriate and when other methods need to be used (Tetra Tech, 2011).

The study notes three separate instances of differences between custom and prescriptive projects when evaluating free-ridership and spillover:

- For all the methods that include customer ex-post counterfactual surveys, the study proposes collecting all relevant information on the specific projects targeted by the surveys for custom projects, and the general operation of the program for prescriptive measures.
- The study recommends interviewing respondents to estimate free-ridership no later than six months after installation. Ideally, quarterly sampling should be used for prescriptive measures, especially large volume prescriptive projects, and semi-annual sampling should be used for custom measures. The study explained that customers involved with custom measures are likely to have better recall, so a lightly longer lag-time before interviewing customers is reasonable.
- The study recommended dividing the C&I participant population into three categories based upon the type of program: prescriptive retrofit programs, custom programs, and new construction programs.

Conversely, some states use deemed or stipulated NTG values due to the inherent uncertainty in evaluating free-ridership. Such values can be determined based on historical studies of similar programs, studies completed for other jurisdictions, negotiations between stakeholders, or structured expert panels. As examples of deemed NTG values, California, Michigan, and New York rely on deemed NTG ratios of 80%, 90%, and 90% respectively (California Public Utilities Commission, 2015; Michigan Public Service Commission, 2012; New York Evaluation Advisory Contractor Team, 2010). However, if an

evaluation study provides a more accurate free-ridership value, then the state will apply the evaluated value for the measures or programs that were the subject of the evaluation study.

Further, it is not uncommon for jurisdictions to assume zero free-ridership or spillover impacts for low income programs, which results in a 100 percent NTG ratio. The rationale for this assumption is that low income customers are unlikely to install energy efficiency measures absent a utility energy efficiency program. This is true for at least some years of reported data in Connecticut,[23] Illinois,[24] Massachusetts,[25] Nevada,[26] Pennsylvania,[27] Rhode Island[28], and Utah.[29]

9.3.3 Accounting for Spillover

Spillover refers to reductions in energy consumption caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can be participant and/or non-participant spillover. Participant spillover is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy saving practices after having participated in the efficiency program as a result of the program's influence. Non-participant spillover refers to energy savings that occur when a program non-participant installs energy efficiency measures or applies energy savings practices as a result of a program's influence (Northeast Energy Efficiency Partnerships, 2011).

If Ontario is interested in applying free-ridership values, then it should also evaluate spillover values so that it fully accounts for the net effects from energy efficiency. This is a best practice when reviewing net savings. Not including spillover provides unbalanced savings results and analysis. Because Union and Enbridge's programs have been in operation for decades and have matured over the years, there is likely a high number of customers no longer participating in the programs, but who have been strongly influenced by the programs efforts and continue to install more efficient technology as a result. As such, Union's and Enbridge's programs should be credited with such savings efforts.

Further, such an approach is consistent with other jurisdictions. An ACEEE study confirms that many U.S. states that previously only accounted for free-ridership are now also accounting for spillover:

> As recently as 2005, a national review found that use of free ridership values in establishing NTG ratios was widespread while very few estimates actually included any

[23] Northeast Energy Efficiency Partnerships, 2015.

[24] Commonwealth Edison Company, 2014.

[25] Massachusetts Program Administrators, 2015.

[26] Nevada Power Company, 2012.

[27] PECO Energy Company, 2013.

[28] Northeast Energy Efficiency Partnerships, 2015.

[29] Rocky Mountain Power, 2014.

> spillover, but that situation has changed (Khawaja et al. 2012). Indeed, in our earlier study (based on a survey conducted in late 2011), we found that nearly a third of states that reported using net savings were quantifying only free riders and not free drivers/spillover or market effects (Kushler et al. 2012). In our new survey for this project, that number had been reduced to just 14% of states that quantify net savings (and half of those now plan to include spillover in the future) (Kushler et al., 2014, p. 30).

9.3.4 Recommendations

1. Evaluations for free-ridership and spillover should be conducted on a more frequent, regular basis. The last study was conducted in 2008, and the programs and markets have evolved in the last seven years.
2. The Board should consider conducting a study to determine which methodologies are most appropriate for determining free-ridership and spillover values in C&I programs.
3. The Board should evaluate impacts from both participant and non-participant spillover, and should include the results in future planning efforts.

9.4. Savings Persistence Assumptions

Savings persistence is defined as the extent to which a DSM measure remains installed and is performing as originally predicted. It takes into account the effective useful life (EUL) of the measure, as well as the measure persistence. The EUL refers to the number of years that a measure is installed and will operate until failure; it is often referred to as the measure life. Measure persistence is the duration of an energy consuming measure, taking into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued.

A savings persistence rate is the percentage of first-year savings expected to persist over the life of the installed energy efficiency equipment. It is developed by conducting surveys of installed equipment several years after installation to determine presence and operational capability of the equipment. However, measure persistence is generally incorporated as part of the measure life, and therefore is not included as a separate impact factor (Massachusetts Program Administrators, 2015c, p. 12).

In Ontario, savings persistence is currently accounted for as part of the EUL of a technology; it is assumed that savings will persist for the technical life of the measure installed. To date, no persistence evaluations studies have been done to assess savings persistence in Ontario. In June 2015, the Board determined that “a formal persistence study should be given priority to provide support for the persistence of savings associated with large custom commercial and industrial DSM programs” (Ontario Energy Board, 2015, p. 7). Custom measures are not included in the input assumptions, except for the recommended EULs for specific equipment.

Ontario’s approach of accounting for savings persistence as part of the EUL is consistent with common practice. An actual savings persistence study can be expensive, partly because long periods of time are

needed for these studies. Such evaluations involve additional challenges, such as long lifetimes of measures (making it impractical to wait for measure failures or consistent patterns of degradation), incomplete data sets, high cost of data collection, and the need for trained staff (SEEAction, 2012).

Instead of conducting such extensive, expensive studies, savings persistence can be assessed using the following methods:

- Use of historical and documented persistence data, such as manufacturer's studies or studies done by industry organizations such as ASHRAE.
- Laboratory and field testing of the performance of energy-efficient and baseline equipment.
- Field inspections, over multiple years, of efficiency activities that constitute a program.
- Non-site methods such as telephone surveys and interviews, analysis of consumption data, or use of other data (e.g., data from a facility's energy management system).

It is also worth noting that energy efficiency savings are typically measured as compared with a baseline, non-energy efficient measure. Thus, persistence looks at degradation patterns that would be realized in standard efficiency equipment, or typical (non-efficiency) consumer behaviors, and compares them with the degradation patterns of the program's efficient equipment or behaviors. Therefore, savings are the difference over time between the energy use of the efficient equipment or behavior and the standard equipment or behavior it replaced—with consideration of both baseline and project equipment/behavior degradation in performance (which may be the same).

Our research found no evidence to suggest that custom projects are evaluated differently from prescriptive projects with regard to savings persistence, although using the above methods to account for persistence could produce different results for the two types of projects.

For more information on this topic, the California Evaluation Protocols contain a complete, detailed description of persistence analyses (TechMarket Works Team, 2006).

9.4.1 Recommendations

1. The Board should continue to account for savings persistence as part of the EUL of a measure, consistent with best practice.
2. The Board could consider accounting for savings persistence using one or a combination of the methods identified above. This could be considered as part of the upcoming persistence study ordered by the Board in June of 2015.

10. GAS INFRASTRUCTURE PLANNING

Section 13 of the Guidelines directs the utilities to consider DSM when developing both regional and local infrastructure plans. The Board directs the gas utilities to "consider the role of DSM in reducing and/or deferring future infrastructure investments far enough in advance of the infrastructure replacement or upgrade so that DSM can reasonably be considered as a possible alternative" (Ontario Energy Board, 2014b, p. 36).

In addition, the Board directs the gas utilities to conduct a study of the role that DSM should play in future system planning efforts. The gas utilities were asked to file a preliminary scope of such a study, along with a preliminary transition plan, as part of these multi-year DSM plan applications (Ontario Energy Board, 2014b, p. 36).

There appear to be few examples of this sort of explicit incorporation of DSM in gas infrastructure planning in other jurisdictions. Despite the prevalence of electricity integrated resource planning practices in many jurisdictions in North America, we are aware of only two examples where DSM is incorporated in gas infrastructure planning (Wilson & Biewald, 2013): (1) Vermont Gas Systems routinely includes the impacts of its DSM programs in its integrated resource planning process (Neme & Grevatt, 2015, p. 13). (2) The Massachusetts Department of Energy Resources recently commissioned a study to investigate the potential for gas DSM initiatives to defer or avoid the need for significant investments in new gas pipelines into New England (Synapse Energy Economics, 2015).

Nonetheless, the rationale, methodologies and concepts for using DSM to avoid or defer gas infrastructure are very similar to those for using DSM to avoid or defer electricity infrastructure (Neme & Grevatt, 2015, p. 13). Consequently, many of the electricity IRP methodologies and concepts can and should be applied to gas infrastructure planning in Ontario.

10.1. Enbridge

Enbridge's proposed scope of work for a gas infrastructure planning study was filed in this docket as Exhibit C, Tab 1, Schedule 3 (Enbridge IRP Scope Study). In general, for the purposes of this docket, Enbridge's IRP is a reasonable start for addressing this important topic. Several potential areas for improvement are provided below.

Enbridge notes that the objectives of gas infrastructure planning are different from those of broad-based DSM, particularly because infrastructure planning is focused on meeting reliability needs during the peak hour of each and every network (Enbridge IRP Scope Study). This suggests that demand response programs, where customers are provided specific incentives and tools to postpone or avoid gas consumption during peak periods, could play a significant role in mitigating gas infrastructure needs. Enbridge should include a comprehensive assessment of demand response potential in its gas infrastructure planning study.

Enbridge proposes to examine three areas where DSM could potentially impact infrastructure planning: Passive Deferral, New System Design and Active Deferral. The New System design area includes an expanded role for the utility in municipal planning, particularly for new subdivision planning (Enbridge IRP Scope Study, p. 2). Enbridge notes that its Savings by Design program (residential new construction) can help lead to large reductions of natural gas use for new buildings (Enbridge IRP Scope Study, p. 4). If this DSM program can play a meaningful role in helping to avoid or defer new gas infrastructure, then it could conceivably be considered a resource acquisition program. As such, perhaps additional attention and funding should be dedicated to this program if it is found to be cost-effective to do so.

Enbridge indicates that it might need to develop a new cost-benefit test for screening DSM programs focused on addressing gas infrastructure (Enbridge IRP Scope Study, p. 7). This is unnecessary and is likely to result in a distraction of resources and time. The existing cost-benefit screening tests can and should be used for evaluating DSM programs targeted at gas infrastructure. It will be necessary to modify some of the inputs, but the same tests can be used. It will be particularly important to modify avoided costs to reflect the value of avoiding peak hour gas consumption. It may also be necessary to obtain better data on customer load profiles and DSM measure operation profiles, to reflect the value that the DSM measures may provide in avoiding peak hour gas consumption.

Enbridge presents a timeline of the different milestones for its IRP study, with a two-year period (January 2016 – December 2017) encompassing the bulk of the study. This appears to be unnecessarily long, given that many electricity integrated resource plans take roughly six months to conduct. Furthermore, the timeline should include some milestones at which the Company will present their inputs, methodologies and initial findings to stakeholders for their input.

There is a wealth of information available regarding the best practices for electric utility integrated resource planning (Wilson & Biewald, 2013). While there are some important differences between electricity and gas resource planning, many of the best practices from electricity planning will apply to gas planning as well. The Enbridge IRP study should investigate these best practices and incorporate them into their study where appropriate.

Finally, the natural gas DSM Framework directs the utilities to develop studies “based on a consistent methodology” (Ontario Energy Board, 2014b, p. 36). This suggests that Enbridge should work with Union to develop consistent IRP Scope Studies, and consistent IRP Studies.

10.2. Union

Union’s proposed scope of work for a gas infrastructure planning study was filed in this docket as Exhibit A, Tab 1, Appendix D (Union IRP Scope Study). This study provides significantly less detail than Enbridge’s study. In addition, Union’s study does not include a transition plan, claiming that it would be premature to do so at this time (Union IRP Scope Study, p. 1).

Union’s DSM Infrastructure Scope Study suffers from the same limitations as Enbridge’s comparable study, described above. In addition, Union’s study lacks detail regarding how it will conduct its DSM IRP

study. Union's study should include more detail on (a) the study scope; (b) the study approach; (c) the study method; (d) the timeline; and (e) a preliminary transition plan. Union's argument that it is premature to develop a transition plan is not compelling, particularly in light of the transition plan that was filed by Enbridge.

10.3. Recommendations

Enbridge

1. Enbridge should investigate the potential for demand response programs to address gas infrastructure needs.
2. Enbridge should investigate the role that new construction programs, both residential and commercial and industrial, can play in addressing infrastructure needs. It should also investigate ways to increase the priority of these programs in its DSM plans.
3. Enbridge should modify the avoided cost inputs to it cost-benefit screening practice, but does not need to develop a new screening test.
4. Enbridge should develop its first integrated resource plan in a timely fashion, and should allow time for stakeholder feedback and input.
5. Enbridge should incorporate best practices from electricity IRP in its gas IRP study, as appropriate.
6. Enbridge should work with Union to develop consistent IRP Scope Studies, and consistent IRP Studies.

Union

1. Union should investigate the potential for demand response programs to address gas infrastructure needs.
2. Union should investigate the role that new construction programs, both residential and commercial and industrial, can play in addressing infrastructure needs. It should also investigate ways to increase the priority of these programs in its DSM plans.
3. Union should modify the avoided cost inputs to it cost-benefit screening practice, but does not need to develop a new screening test.
4. Union should develop its first integrated resource plan in a timely fashion, and should allow time for stakeholder feedback and input.
5. Union should incorporate best practices from electricity IRP in its gas IRP study, as appropriate.
6. Union should work with Enbridge to develop consistent IRP Scope Studies, and consistent IRP Studies.

7. Union should include more detail in its IRP Scope Study, including information on the study scope; the study approach; the study method; the timeline; and a preliminary transition plan.

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APPENDIX A: SUMMARY OF RECOMMENDATIONS

Chapter 3. Overview and Assessment of the Plans: Recommendations

1. The utilities should coordinate with each other to track and report data comprehensively and consistently. It was difficult to obtain data for this analysis at the offering -level, including costs by costs categories (marketing, incentive, evaluation, administration, and performance incentive), savings and benefits by fuel type (gas, electricity, water, non-energy benefits), cost-effectiveness (total costs, benefits, net benefits, and benefit-cost ratios), and performance incentives (maximum incentive and target incentive). Such information should be readily available in plans and reports in a transparent format that is consistent across the utilities.

2. Participation should be planned for and reported in detail, including the number of participants expected to be served, definitions of what a participant represents in each program (number of units, houses, etc.), and the number of customers that are eligible to participate in each program. This data should be provided for each year of the plan and during annual reporting.

Chapter 4. Assessment of Evaluation Plans: Summary Recommendations

4.9.1 Impact Evaluation Plan

Enbridge and Union

1. Both utilities should make sure that they provide in their evaluation plans key pieces of information recommended by SEE Action (2012).

2. Both utilities should provide information on their expectations on overall certainty of savings (i.e., confidence level and interval).

3. Both utilities should provide information on the name of current evaluators already selected by the OEB, if any, or how the OEB should plan to select evaluators.

Enbridge

1. Enbridge's evaluation plan should mention the use of input assumptions or the TRM for specific offerings where applicable.

2. Enbridge's evaluation plan should indicate how it plans to estimate net energy savings impacts.

Union

3. Union's evaluation plan should provide metrics that will be reported in its evaluation studies (e.g., annual or lifetime m^3 of natural gas).

4.9.2 Savings Verification Activities

We recommend both companies provide detailed information on measure verification activities in their evaluation plans including, but not limited to, typical verification activities such as project site inspections, participant phone and mail surveys, and/or implementer and consumer documentation review.

4.9.3 Gross Impact Evaluation Approach

Details of these deficiencies for both Enbridge and Union are discussed in the section on evaluation plans for specific offerings below.

4.9.4 Evaluation Study Schedules

The utilities' evaluation plans should provide at minimum rough estimates of the start and end of the scheduled evaluation activities, and consider developing more detailed, potential evaluation schedules for key evaluation activities.

4.9.5 Process Evaluation Approach

1. Both utilities should consider initiating process evaluation activities in the first year for all new offerings and also for existing offerings that have significant program design changes such as altered incentive designs and levels, because early evaluation activities could identify problems earlier.

2. Both utilities should consider hiring and working with evaluation contractors during the early program development and implementation period.

4.9.6 Timing of Impact and Process Evaluation Study

1. A plan to launch impact evaluation activities in the first year for each offering (or even before the start of program implementation depending on the offerings in order to collect any baseline data and set up the overall evaluation infrastructure) should be proposed), and should involve data collection activities such as measure installation, field data collection, on-site surveys, metering and monitoring, and billing data collection and preparation.

2. Both utilities should consider initiating the process evaluation earlier than they propose as early evaluation activities could identify problems sooner, which then could be used to improve program designs earlier.

3. Both utilities should consider hiring and working with process evaluation contractors during the early program development and implementation period.

4.9.7 Evaluation Budget

1. Both utilities should reevaluate their evaluation budget based upon our recommendations on various issues on their evaluation plans, in particular because our review of their evaluation plans identified a number of offerings for which no evaluation activities are proposed over the course of the next five years.

4.9.8 Cross-Offering Evaluation Studies

1. Both utilities, or the OEB, should develop their plans to conduct various other cross-offering evaluation studies such as a measure baseline study, a market characterization study, a free-ridership and spillover study, a measure life study, a non-energy benefit study, a market potential study, and a benchmarking study.

2. Cross-offering evaluation studies should be joint studies initiated by the gas utilities or province-wide studies initiated by the OEB.

Chapter 5. Assessment of Programs and Offerings

5.2 Cross Program Issues Recommendations

Enbridge and Union

1. Both companies should consider developing an offering specifically targeting the multi-family building market segment similar to their low income multi-family offerings, or consider offering a single point-of-contact or one stop shopping dedicated to the multi-family market segment so that customers interested in implementing energy efficiency measures for their multi-family buildings could explore various types of offerings and incentives through a single point-of-contact.

2. Both utilities should provide customers with zero or low interest financing to address lack of funding, one of the major barriers identified by Enbridge.

3. Both utilities should develop a residential products offering to promote the installation of high efficiency space heating and water heating equipment. This type of program is essential especially when the homeowners' HVAC equipment has failed or broken and they need to replace the equipment immediately

Union

1. Union should develop a commercial new construction offering similar to Enbridge's new construction offering.

5.3 Residential Resource Acquisition Programs

5.3.2 Single-Family Retrofit: Recommendations

Enbridge

1. Enbridge should remove the requirement that customers must install at least two DSM measures to participate in the offering. Customers seeking to install one DSM measure at a time should not be turned away from the program.

2. Enbridge should focus not just on higher income homes, but on moderate income homes as well.

3. Enbridge should increase the offering incentive cap to be greater than $2,000. For example, Enbridge could be consistent with Union's incentive cap of $5,000.

4. Enbridge should reconsider its tiered incentive structure, and consider offering a sliding-scale incentive structure that should start at a lower savings level than the current 15 percent savings. This would to accommodate some customers that could just install one measure at a time.

5. If Enbridge continues to offer a tiered incentive structure or offers a sliding-scale incentive, then it should lower the amount of savings required to achieve the various incentive levels or increase the level of incentives. As currently structured, a customer is required to achieve a significant reduction in usage in order to receive a relatively limited incentive amount.

6. Enbridge should consider providing incentives such that they are structured on a per-square-foot basis, or on a percentage-of-total-project-cost basis for insulation measures. In addition, it should provide prescriptive incentives for other measures similar to Union's incentive structures. Such a structure provides flexibility to the customer, thereby allowing households of different sizes, shapes, and energy consumption to participate.

7. Enbridge should provide the required home energy audits at no cost to the customer.

8. Enbridge should provide additional measures as part of this offering, such as faucet aerators, showerheads, programmable or adaptive thermostats, lighting measures, or smart strips. Such an offering ensures a holistic approach to program savings.

9. Enbridge should include in its impact evaluation plan a proposal to conduct a billing analysis for this offering.

10. Enbridge should adopt Union's survey approach for its process evaluation.

11. Enbridge should conduct any desk review of program records, data tracking systems, and materials such as marketing materials, training documents, and program manuals.

Union

1. Union should consider providing incentives such that they are structured on a per-square-foot basis, or on a percentage-of-total-project-cost basis. Such a structure provides flexibility to the customer, thereby allowing households of different sizes, shapes, and energy consumption to participate.

2. Union should provide the required home energy audits at no cost to the customer.

3. Union should provide additional measures as part of this offering, such as faucet aerators, showerheads, programmable or adaptive thermostats, lighting measures, or smart strips. Such an offering ensures a holistic approach to program savings.

4. Union should include in its impact evaluation plan a proposal to conduct a billing analysis for this offering.

5. Union should conduct any desk review of program records, data tracking systems, and materials such as marketing materials, training documents, and program manuals.

5.3.3 Residential Products: Recommendations

Enbridge and Union

1. Both Enbridge and Union could conduct a pilot study to explore the reliability and cost-effectiveness of emerging measures suitable for the Energy Savings Kit offering that could replace any potentially obsolete efficiency technologies.

2. Both Enbridge and Union should investigate the reliability and cost-effectiveness of emerging showerheads, and consider incorporating such showerheads into their new pilot study or existing offerings.

3. Both Enbridge and Union should consider partnering with electric utilities that offer incentives for similar thermostat measures, and ensure that the incentive amounts provided to customers are consistent between fuel types.

Enbridge

1. Enbridge should consider increasing the Adaptive Thermostat incentive to the equivalent of at least $100 while evaluating both customer adoption rates for this type of measure and customer payback rates.

2. If Enbridge intends to use the TRM for its savings estimate claim, we recommend that Enbridge clearly states its intention in the plan.

3. Enbridge's evaluation plan should include an Ontario-specific impact evaluation study on adaptive thermostats as existing impact evaluation studies are finding a significant level of natural gas savings ranging from 10 percent to 12 percent of annual heating consumption.

4. Enbridge should also conduct a survey of non-participants in its process evaluation in order to find out reasons for not participating in the offering. To the extent this offering requires Enbridge program staff or contractors to interact with customers to promote and/or install adaptive thermostats, Enbridge should also survey program staff and/or contractors.

Union

1. Union should provide an incentive for adaptive thermostats so that new technologies with higher savings potentials are available for customers looking to adopt them.

2. Union should consider providing incentives for measures other than thermostats and instant hot water saving measures to ensure that all customers are served by a range of DSM technologies and to increase participation.

3. Union should conduct a literature review of standard thermostats and consider whether to discontinue this offering, or include a plan for the OEB to conduct a full impact evaluation study on this measure if it still believes there might be some savings impacts.

4. It might be beneficial to conduct a limited scale process evaluation study by piggybacking on Union's savings verification efforts and ask additional process related questions such as a question regarding the penetration rates of Energy Savings Kit measures.

5.4 C&I Resource Acquisition Programs

5.4.2 C&I Prescriptive Recommendations

Enbridge

1. Enbridge should provide a list of all of the eligible measures under its prescriptive offering.
2. Enbridge should present the proposed incentives as well as its payback analyses for this offering.
3. Enbridge should explore an upstream incentive option as proposed by Union. This approach is an emerging incentive structure that could potentially have a substantial impact on the uptake on C&I energy efficiency measures.
4. Enbridge should provide detailed information on its marketing strategy by emulating Union's filing.
5. As proposed by Union, Enbridge should also explore program coordination opportunities with LDCs as part of its process evaluation.
6. Enbridge should also include non-participants as part of their process evaluation.
7. Enbridge should conduct a review of program materials and records.

Union

1. Union should provide the proposed incentive levels and also provide more detailed information on its payback analysis for its offering.
2. Union's evaluation plan should include an impact evaluation plan similar to Enbridge's plan.
3. Union should conduct a review of program materials and records as part of their process evaluation.

5.4.2 C&I Prescriptive: Recommendations

Enbridge

1. Enbridge should provide a list of all of the eligible measures under its prescriptive offering.
2. Enbridge should present the proposed incentives as well as its payback analyses for this offering.

3. Enbridge should explore an upstream incentive option as proposed by Union. This approach is an emerging incentive structure that could potentially have a substantial impact on the uptake on C&I energy efficiency measures.

4. Enbridge should provide detailed information on its marketing strategy by emulating Union's filing.

5. As proposed by Union, Enbridge should also explore program coordination opportunities with LDCs as part of its process evaluation.

6. Enbridge should also include non-participants as part of their process evaluation.

7. Enbridge should conduct a review of program materials and records.

Union

1. Union should provide the proposed incentive levels and also provide more detailed information on its payback analysis for its offering.

2. Union's evaluation plan should include an impact evaluation plan similar to Enbridge's plan.

3. Union should conduct a review of program materials and records as part of their process evaluation.

5.4.3 C&I Custom: Recommendations

Enbridge and Union

1. Both utilities should provide in their evaluation plans more detailed information regarding how project installation data are verified (e.g., site inspection, phone surveys, application review) and how gross savings are measured (e.g., IPMVP, billing analysis).

Enbridge

1. For the Custom Commercial offering, we recommend Enbridge consider setting the incentive tiers at a more granular scale, for example by increasing the level of incentive for each 5 percent increase in savings or on a sliding scale. We also recommend that Enbridge make it clear what the actual savings thresholds are between the tiers. As is written, it is not clear what the level of incentive is for 10 percent energy savings.

2. Enbridge should use a payback criteria to screen out free riders for their C&I custom offerings. Given that the payback thresholds from the example programs are also mainly for custom C&I projects, a threshold of one to three years may be appropriate.

3. In line with the best practices discussed in Chapter 4, Enbridge should also survey non-participants and program administrator staff for the proposed process evaluation study.

4. For the proposed process evaluation, Enbridge should review simple payback years for each participation and investigate what level of payback threshold is reasonable for the purpose of reducing free riders.

Union

1. Union should use a payback criteria to screen out free riders for their C&I custom offerings. Given that the payback thresholds from the example programs are mainly for custom C&I projects, a threshold of one to three years used by those programs may be appropriate.

2. Union should conduct a process evaluation study and investigate in particular the following issues:

    a. The effectiveness of the proposed new incentive designs

    b. Potential coordination opportunities with LDCs as part of the process evaluation study

    c. Project payback

    d. A reasonable payback threshold level for the purpose of reducing free riders

5.4.4 Small Business Direct Install: Recommendations

Enbridge

1. Enbridge should offer similar incentives for small business customers to install adaptable thermostats as it proposes for its residential customers. As part of the turnkey solution, Enbridge should facilitate the processing of rebates for this measure when participants are interested in implementing it.

2. Enbridge should conduct a process evaluation to investigate the need for offering other low cost measures such as aerators, showerheads, and tank wraps.

3. Enbridge should provide more detailed information as to how the impact evaluation should be conducted for this offering.

4. For its proposed process evaluation, Enbridge should add the following specific activities:

    a. Interview Enbridge's program administrator staff in addition to participants and contractors.

    b. Investigate offering delivery specifics including program materials (e.g., marketing materials and tracking database), marketing practices, standardization of offers, audit procedures, invoicing and tracking procedures, and QA/QC procedures.

Union

1. We recommend Union either offer a lower incentive level as a percent of total installed costs for deep savings measures such as HVAC systems than for low savings measures, or adopt prescriptive incentive structures for such deep savings measures as proposed under the C/I Prescriptive offering.

2. Union did not propose any evaluation plan for this offering. Although it is a pilot offering, we recommend it consider including an impact evaluation study in its evaluation plan.

3. We recommend Union conduct process evaluation studies and investigate the effectiveness of incentives and offering delivery methods, including program materials and reporting (e.g., marketing materials and tracking database), marketing practices, standardization of offers, audit procedures, invoicing and tracking procedures, and QA/QC procedures.

5.4.5 Small Commercial New Construction (Enbridge Only): Recommendations

Enbridge

1. Enbridge should reduce its proposed performance-based incentive level to $\$0.50/m^3$ or lower.

2. For the Small Commercial New Construction offering, Enbridge should consider adopting on-line marketing tools to generate phone calls from users as a follow-up to determine qualification for participation in the program.

3. Enbridge should follow best practices by providing public recognition for successful projects. Enbridge should also consider linking its Energy Leaders Initiative offering to the Small Commercial New Construction offering.

4. Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year.

5. Enbridge's evaluation plan should include impact evaluation plan.

5.4.6 Energy Leaders Initiative (Enbridge Only): Recommendations

Enbridge

1. Enbridge should consider linking the Energy Leaders Initiative offering to Enbridge's new construction offerings, including the Small Commercial New Construction offering and the Savings by Design.

2. Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year.

3. Given this is a new offering, Enbridge should conduct a process evaluation early in the program cycle, ideally in the first year.

4. Enbridge's plan should include impact evaluation plan.

5.5 Low Income Programs

5.5.2 Low Income New Construction: Recommendations

Enbridge

1. Enbridge should roll out as a full offering, rather than as a pilot, the Low Income New Construction offering.

2. Without further substantiation of the usefulness of the street poster marketing approach, Enbridge should consider redirecting funds for these posters to other marketing opportunities.

3. Enbridge should clearly state how IDP documents are used to establish estimated savings, and how it intends to verify the claimed savings.

4. As this is a new pilot, it should conduct a process evaluation study and identify the effectiveness of the proposed incentives and delivery mechanisms and areas for improvements.

Union

1. A comprehensive suite of low income offerings should include Low Income New Construction, Low Income Single-Family and Low Income Multi-Family offerings, which are referred to as core offerings in this section. Union should provide a Low Income New Construction offering. This offering should be consistent with Enbridge's program, including the recommendations above.

5.5.3 Low Income Single Family: Recommendations

Enbridge and Union

1. If they do not do so already, Enbridge and Union should consider performing a blower door test, using infrared thermography, and conducting combustion analysis, draft testing, and combustion appliance zone tests in audits.

2. Enbridge and Union should consider adding early replacement measures, heating equipment repairs, boilers, water heaters (including tankless and solar hot water), windows, duct sealing, duct insulation, and boiler reset control measures to their offerings.

Enbridge

1. Enbridge should also consider adding pipe wrap to its offering.

2. Enbridge should consider offering incentives to address as many of the health and safety barriers to weatherization as possible.

3. If Enbridge plans to rely on the forthcoming TRM, it should clearly state so. However, as energy savings are expected to be significant (e.g., exceeding 10 percent), we recommend using an energy billing analysis on a sample of offering participants.

4. Enbridge should include in its survey plan non-participants or administrative staff as surveyees.

5. Enbridge should make sure that it conducts a review of program materials and tracking records in its proposed process evaluation study.

Union

1. Instead of waiting for the Aboriginal offering to start before beginning its process evaluation, Union should start its evaluation as early as possible in the first year of the low income weatherization offering.

2. Instead of the proposed energy modeling analysis, Union should propose a plan for the OEB to conduct a billing analysis as historical consumption data exist and expected energy savings are likely to be substantial.

3. Union should conduct a review of program materials and tracking records in its proposed process evaluation study.

5.5.4 Low Income Multi-Family: Recommendations

1. Enbridge and Union should consider adding early replacement measures, heating equipment repairs, furnaces, water heaters (including tankless and solar hot water), windows, programmable thermostats, duct sealing, duct insulation, boiler reset control measures and pipe wrap to their offerings.

2. Leverage the existing Low Income Multi-family Working Group to discuss providing a single point of contact for building owners, financing options to augment and/or reduce incentives over time, and a more flexible audit structure to improve program cost effectiveness. Improved cost effectiveness may free up some funds, enabling the working group to consider providing additional program oversight and support to building owners. This would in turn mitigate costs by improving project completion rates.

3. Enbridge and Union should provide reasonably consistent custom incentive offerings, unless differences are merited and explained in plans.

Enbridge

1. Enbridge should clarify whether it plans to offer high efficiency boilers as both a prescriptive and custom measure.

2. In order to find answers to its research issues in its evaluation plan, Enbridge should conduct a process evaluation and investigate the issues.

Union

1. Union should roll out as a full program, rather than as a pilot, its Low Income Multi-Family offering.

2. Union should offer an incentive for operational improvements, similar to Enbridge.

3. In its process evaluation, Union should also interview participating contractors and offering delivery agents to gain a holistic view on the effectiveness of this offering, including how tenants are benefiting from the offering.

4. Union should conduct a review of program materials and tracking records in its proposed process evaluation study.

5.5.5 Aboriginal Offering (Union Only): Recommendations

Enbridge

1. If Enbridge has Aboriginal groups in its service territory, Enbridge should consider offering this program, in coordination with Union, to Aboriginal groups.

5.5.6 Furnace End-of-Life Upgrade Offering (Union Only): Recommendations

Union

1. Consider moving this program within the core low income offerings, similar to Enbridge.

5.6 Residential Market Transformation Programs

5.6.2 Residential New Construction: Recommendations

Enbridge

1. Enbridge could consider expanding its marketing to other stakeholders and decision makers in the new construction market, including architects, developers, contractors, and homebuyers.

2. Enbridge should consider whether it is an appropriate use of program spending to incent builders for up to 50, 100, or 200 energy efficient homes, or whether fewer homes would be as effective.

3. Enbridge could provide additional services related to technical training during the design/build process.

4. Enbridge should follow Union's survey plan for its process evaluation and include homeowners, non-participating builders, program staff, and consultants as surveys.

5. Enbridge should make sure that its process evaluation plan includes a review of program materials and reporting.

Union

1. Union should not turn away builders that are not already enrolled in the program, as doing so would create lost opportunities.

2. Union should commit to continuing support of a new construction offering, whatever the new design may be with the new building code.

3. Union should make sure that its process evaluation plan includes a review of program materials and reporting.

5.6.3 Residential Behaviour: Recommendations

Enbridge

1. Enbridge should work with OPower to ensure they have the customer data needed to individualize the reports to the extent practicable.

2. Enbridge will need to ensure that the emailed reports are actually received by the recipients, and are not captured in email junk mail filters.

3. Enbridge should assess the offering budget to determine whether it can be reduced, or should at least justify the seemingly high amount budgeted for this offering.

4. Enbridge's evaluation plan should follow the impact evaluation approach proposed by Union.

5. Enbridge's survey plan should also include offering delivery agents (e.g., Opower) as well as non-program participants.

6. Enbridge should also conduct a review of offering materials and reporting.

Union

1. Union should provide the Board with an update on the specific offering details once a vendor has been selected, which should include identification of any changes to the program description included in the current plan.

2. Union should assess the offering budget to determine whether it can be reduced, or should at least justify the seemingly high amount budgeted for this offering.

3. Union should conduct a process evaluation study particularly because its behavior offering is new.

Home Rating (Enbridge Only): Recommendations

Enbridge

1. Enbridge should detail the actions it expects to take within this offering so as to determine whether such activities are an appropriate use of program spending.

2. Enbridge should conduct a billing analysis on a sample of offering participants to verify energy savings to the extent the savings are expected to be substantial.

3. Enbridge could investigate whether providing an incentive to homeowners and/or real estate agents that complete a home energy label prior to the sale of the home would

increase adoption of home labeling. Its process evaluation study is an appropriate place for this investigation.

4. Enbridge should include other key players as surveyees, in particular real estate agents and program administrator staff.

5.7 C&I Market Transformation Programs

5.7.2 Commercial New Construction (Enbridge Only): Recommendations

Enbridge

1. Enbridge should set the incentive toward energy modeling at a certain percentage of the total modeling cost (Nowak, Kushler, Witte, & York, 2013).

2. Enbridge should offer performance incentives for both building design teams and building owners under its Commercial Savings by Design offering. We also recommend Enbridge consider adopting tiered or sliding-scale incentives.

3. Enbridge should offer a similar financial assistance for projects achieving net-zero energy buildings or deeper energy savings.

4. Enbridge should provide public recognition to successful projects in this Commercial Savings by Design offering in accordance with best practices in new construction programs. We also recommend Enbridge consider linking the Energy Leaders Initiative offering to this offering.

5. Because the commissioning step is an integral aspect of new construction, Enbridge's proposed new offering should be part of the Commercial SBC offering so that every new construction project participating in the SBC will have an opportunity to enhance their commissioning initiatives.

6. Enbridge should provide more detailed information on their impact evaluation plans for both commercial new construction offerings. Enbridge should propose for the OEB to review all key project data and verify modeled energy savings.

7. Enbridge should also include a plan for the OEB to examine to what extent the new commissioning offering leads to additional savings.

8. We recommend Enbridge consider including in its survey and interview plan other market and program actors including non-participants, offering delivery agents, and program administrator staff. Enbridge should also review program materials and reporting data.

5.7.3 Commercial Behaviour (Enbridge Only): Recommendations

Enbridge

Energy Compass and Small Commercial & Industrial Behavioural

1. Enbridge should conduct process evaluation studies to evaluate the effectiveness of these two offerings. Enbridge should particularly investigate to what extent the offerings increase participation rates in other DSM offerings and programs, as this is one of the core goals for the offerings.

Energy Compass

1. Enbridge should provide evidence that Energy Compass has successfully increased participation in other efficiency offerings.

Small Commercial & Industrial Behavioural

1. Enbridge should provide budget information for this offering.
2. Enbridge should ensure that OPower has the customer data needed to individualize the reports, including information on type of industry and major energy uses.
3. If Enbridge wants to claim savings from this offering, Enbridge should propose a plan for the OEB to engage an external independent evaluator for the pilot very early in the process and allow that evaluator to conduct a randomized control trial to randomly assign customers to treatment and control groups.

5.7.4 Schools (Enbridge Only): Recommendations

Enbridge

1. Enbridge should indicate how goals would be set and who would set them.
2. The offering should explicitly encourage participation by diverse groups of students, members of the faculty and administration, and building operators.
3. The offering should be coupled with other enabling strategies or offerings so that identified opportunities result in a wider range of measures, to make full use of metering and energy management system capabilities.
4. Enbridge's evaluation plan should include an impact analysis.
5. The process evaluation for the School Energy Competition should include investigation of its effect on participation in other DSM offerings, participants' use of the energy management system, and effectiveness of materials. It can do this through interviews with key persons in participating schools, implementation contractors, and program administrator staff, and through review of records, educational materials, marketing materials, and the energy management system.
6. To the extent that the School Energy Competition will reduce electricity consumption, Enbridge should consider coordinating with electric distribution companies on this offering.

5.8 Large Volume Customers Program (Union only): Recommendations

Union

1. To ensure that recommended measures are implemented, Union should (a) if a customer does not implement the recommendations from the technical assistance, then Union should collect the costs for the technical assistance from the customer; (b) require execution of an agreement including customer energy savings commitments, and/or (c) require implementation of all recommended measures that meet certain conditions (e.g., a payback period of 1.5 years or less).

2. It would be appropriate to at least conduct a process evaluation to examine the effectiveness of this offering and identify any modifications for offer training, specialized technical support, and audits by qualified Union Professional Engineers.

5.9 Performance-Based and Market Transformation Programs

5.9.2 Retro-commissioning Recommendations

Enbridge

1. Enbridge should consider requiring that participants implement identified measures with a very short payback (e.g., 1 year or less) without any utility financial incentive, to screen out free riders.

2. Enbridge should consider redesigning the incentive structure consistent with common models by implementing a mechanism to ensure energy performance improvement.

3. Enbridge should provide information about the EMIS, and charges after the first 12 months. It should also consider redesigning the offering to ensure longer-term savings.

4. Enbridge should provide estimates of participation, savings, and payback at the offering level.

5. Enbridge's evaluation plan should include an impact evaluation based on the IPMVP Option C.

6. Enbridge should propose a plan for an evaluation contractor to conduct appropriate measure installation verification activities including desk review of project files and on-site inspection on a sample of projects, as discussed in the Cross Offering Evaluation Issues section above.

7. Enbridge should conduct the following process evaluation tasks: (a) reviews of records, materials, tools, etc., (b) interviews and discussions with program management and staff, implementing contractors, subcontractors, and field staff, and (c) interviews, discussions, surveys and/or focus groups with participants and non-participants.

Union

1. Union should clarify whether or not savings as a result of capital investments would count towards eligible savings.

2. Union should consider a more aggressive participation goal.

3. Union should consider taking into account occupancy and any other important factors to adjust billing meter data.

4. We recommend Union propose a plan an evaluation contractor to conduct on-site audits and inspect operating conditions and installed equipment on a sample of projects.

5. Union should conduct a process evaluation study as a way to identify opportunities for program design and delivery improvement in line with the best practices that are recommended for Enbridge above.

5.9.3 Strategic Energy Management: Recommendations

Enbridge and Union

1. To the extent that SEM activities will save electricity consumption, both Enbridge and Union should consider exploring opportunities to coordinate with electric distribution programs.

Enbridge

1. Enbridge should clearly indicate whether or not savings from capital improvements are excluded from the calculation of eligible savings.

2. Enbridge should provide context for the size of the incentives.

3. If financial incentives are linked to energy savings, then the program design should include elements to encourage participants to sustain energy performance improvement efforts after performance incentives are no longer provided.

4. Enbridge should indicate in its evaluation plan whether or not savings eligible for the performance incentives would be normalized for weather and production.

5. Enbridge should indicate in its evaluation plan that an appropriate M&V method by project will be determined based on the project boundary.

6. Enbridge should conduct the following process evaluation tasks: (a) reviews of records, materials, tools, etc., (b) interviews and discussions with program management and staff, implementing contractors, subcontractors, and field staff, and (c) interviews, discussions, surveys and/or focus groups with participants and non-participants

Union

1. Union should consider using a sliding scale for determining performance incentives.

2. Union should describe customer eligibility and requirements.

3. Union should indicate in its plan that an appropriate M&V method by project will be determined based on the project boundary.

4. Union should conduct a process evaluation study as a way to identify opportunities for program design and delivery improvements, according to the best practices that are recommended for Enbridge above.

Chapter 6. Shareholder Incentives

6.2 Proposed Shareholder Incentive Scorecard and Metrics: Recommendations

1. The Board should continue to allow shareholder incentive metrics that motivate the utilities to save energy and increase customer participation in the DSM programs.

2. The Board should consider requiring the utilities to develop metrics or other mechanisms that focus on program cost-effectiveness. Such a metric would ensure that the utilities keep costs low while achieving significant savings.

3. The utilities' scorecard metrics should be similar to each other where practical and appropriate.

4. Similar to Enbridge, Union should develop separate metrics for lower and higher volume customers within the Resource Acquisition scorecard.

5. Union should include a metric within the Low Income scorecard related to increasing participation in the Low Income program.

6. Union should consider including a scorecard for the Large Volume program to ensure that the costs for that program are appropriately spent.

6.3 Performance Incentive Target Adjustments: Recommendations

1. The Board should reject both Enbridge's and Union's proposed shareholder incentive target adjustment mechanisms because the overall five-year savings goal targets that the utilities are required to achieve should not be adjusted during the course of the plan.

2. The Board should thoroughly investigate whether the initial goals (and therefore shareholder incentive targets) established during this planning process are challenging to achieve to ensure the utilities remain motivated to reach greater savings throughout the plan term.

Chapter 7. Coordination between Gas and Electric Programs: Summary Recommendations

1. Both companies should take a more pro-active role to lead the way for more electricity and gas DSM coordination, in particular in (a) coordinating among themselves; (b) identifying those programs that are most suited to electricity and gas coordination; and (c) offering standard program design templates that electric utilities could select from.

2. With regard to coordinating among themselves, both companies should identify program design issues that both companies could use to coordinate with electric companies, work out some of the details of how the programs will be marketed and delivered to customers, and propose methods for allocating costs and energy savings between electricity and gas utilities

3. Both companies should start by offering coordination for their whole building offerings (e.g., new construction programs, retrofit/audit programs, and retro-commissioning offerings) because such offerings are very good candidates for cross-utility coordination.

4. Both companies should develop standard program design "templates" for coordinating the electric and gas programs so that both gas and electric companies could reduce time and resources required for program coordination activities and develop programs that are more consistent and transparent arrangements between electric and gas utilities

Chapter 8. Customer Financing: Recommendations

Regulatory / Policy

1. Identify a third party to establish and lead a finance working group. The purpose of this group is to:

    a. research how well existing financing offerings meet the needs of customers in each program;

    b. identify opportunities to design new offerings, targeted to specific programs and customers within these programs;

    c. identify additional sources of financing, including third-party and ratepayer funds; and

    d. discuss the value of financing for specific types of customers, such as low income and Aboriginal groups.

Chapter 9. Use of Input Assumptions in Evaluation

9.2 Applying New or Updated Input Assumptions: Recommendations

1. The best, most up-to-date information available, including recent evaluation updates, should be used for (a) reliability needs, (b) regulatory plans and program design; and (c) regulatory reporting, including achieved performance incentives and LRAM.

9.3 Net Savings Assumptions: Recommendations

1. Evaluations for free-ridership and spillover should be conducted on a more frequent, regular basis. The last study was conducted in 2008, and the programs and markets have evolved in the last seven years.

2. The Board should consider conducting a study to determine which methodologies are most appropriate for determining free-ridership and spillover values in C&I programs.

3. The Board should evaluate impacts from both participant and non-participant spillover, and should include the results in future planning efforts.

9.4 Savings Persistence Assumptions: Recommendations

1. The Board should continue to account for savings persistence as part of the EUL of a measure, consistent with best practice.

2. The Board could consider accounting for savings persistence using one or a combination of the methods identified above. This could be considered as part of the upcoming persistence study ordered by the Board in June of 2015.

Chapter 10. Gas Infrastructure Planning: Recommendations

Enbridge

1. Enbridge should investigate the potential for demand response programs to address gas infrastructure needs.

2. Enbridge should investigate the role that new construction programs, both residential and commercial and industrial, can play in addressing infrastructure needs. It should also investigate ways to increase the priority of these programs in its DSM plans.

3. Enbridge should modify the avoided cost inputs to it cost-benefit screening practice, but does not need to develop a new screening test.

4. Enbridge should develop its first integrated resource plan in a timely fashion, and should allow time for stakeholder feedback and input.

5. Enbridge should incorporate best practices from electricity IRP in its gas IRP study, as appropriate.

6. Enbridge should work with Union to develop consistent IRP Scope Studies, and consistent IRP Studies.

Union

1. Union should investigate the potential for demand response programs to address gas infrastructure needs.

2. Union should investigate the role that new construction programs, both residential and commercial and industrial, can play in addressing infrastructure needs. It should also investigate ways to increase the priority of these programs in its DSM plans.

3. Union should modify the avoided cost inputs to it cost-benefit screening practice, but does not need to develop a new screening test.

4. Union should develop its first integrated resource plan in a timely fashion, and should allow time for stakeholder feedback and input.

5. Union should incorporate best practices from electricity IRP in its gas IRP study, as appropriate.

6. Union should work with Enbridge to develop consistent IRP Scope Studies, and consistent IRP Studies.

7. Union should include more detail in its IRP Scope Study, including information on the study scope; the study approach; the study method; the timeline; and a preliminary transition plan.

APPENDIX B: SCOPE OF WORK DOCUMENT

PROJECT NAME: Natural Gas Demand Side Management Expert – Review of the 2015 - 2020 DSM Programs of Natural Gas Distributors

A) **PROJECT BACKGROUND:**

In 2014, the OEB issued its Report on the Demand Side Management Framework for natural gas distributors for 2015 to 2020 (DSM Framework) and the Filing Guidelines to the DSM Framework (Guidelines). The Guidelines provide specific guidance on the development of the gas utilities' 2015-2020 DSM Plans.

Accordingly, Union Gas and Enbridge Gas developed and submitted multi-year DSM Plans to the OEB on April 1, 2015. These applications will be heard in a combined proceeding over the period May to September 2015.

Please refer to the following links for details on the DSM Framework, Guidelines, and DSM Plans:

DSM Framework and Guidelines
2015-2020 DSM Framework http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2014-0134/Report_Demand_Side_Management_Framework_20141222.pdf
2015-2020 DSM Guidelines http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2014-0134/Filing_Guidelines_to_the_DSM_Framework_20141222.pdf

2015-2020 DSM Plans
Union Gas
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/472262/view/
Enbridge Gas
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/472300/view/

Procedural Order No.1 for the DSM Plan Combined Proceeding
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/478501/view/

For a better understanding of key DSM issues, please refer to the following:

Clearance of 2012 DSM Variance Accounts
Union Gas
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/431205/view/
Enbridge Gas
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/440001/view/

Clearance of 2013 DSM Variance Accounts
OEB Staff Submissions
Union Gas
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/474539/view/
Enbridge Gas
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/463515/view/
OEB Decisions
Enbridge Gas
http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/467489/view/
Union Gas – decision currently pending

B) **OBJECTIVES:**

The DSM expert consultant is expected to address the following:

- Review the DSM programs proposed by each of the natural gas distributors in the context of the guiding principles and key priorities outlined in the DSM framework
- Compare the DSM programs proposed by each natural gas distributor with best practices in other leading jurisdictions in DSM and make recommendations for improvement as appropriate
- Review the DSM metrics and targets proposed by each natural gas distributor in the context of their past performance and best practices in other leading jurisdictions
- Review the evaluation plans proposed by the natural gas distributors for their DSM programs and make recommendations for improvement based on the best evaluation practices in other leading jurisdictions and taking into consideration the Conservation First (2015-2020) EM&V Protocols and Requirements of IESO http://www.powerauthority.on.ca/sites/default/files/conservation/Conservation-First-EMandV-Protocols-and-Requirements-2015-2020-Apr29-2015.pdf
- Provide support for the Technical Conference, Oral Hearing, and preparation of the OEB staff's final submission, as required

C) **PURPOSE AND SCOPE:**

1. Provide a detailed report to assist the OEB in reviewing the gas utilities' proposed 2015-2020 DSM Programs. The report will be filed as evidence in the OEB combined proceeding, and will include, at a minimum, the following elements:
   a) Review best practices in DSM program design and delivery in other leading jurisdictions (in North America and internationally) to determine whether there are improvements that could be incorporated in the design and delivery of the natural gas distributors' proposed DSM programs
   b) Assess to what extent the proposed DSM programs have addressed the key priorities and guiding principles set out in the Framework
   c) Review the metrics and targets proposed by the natural gas distributors and identify areas for improvement considering the best practices in other jurisdictions
   d) Based on the best practices in other leading jurisdictions and taking into consideration the structure of the electricity industry in Ontario, review the coordination of DSM and CDM programs proposed by the utilities and suggest improvements
   e) Review the eligibility requirements for customers to participate in DSM programs in order to minimize free ridership and maximize persistence of savings; in particular, examine the role of payback period or other financial criteria in delivery of DSM programs in all three sectors in order to minimize free ridership
   f) Review the evaluation plans proposed by the natural gas distributors for their DSM programs and make recommendations for collecting the appropriate data and improving evaluation methodologies based on the best evaluation practices in other leading jurisdictions and taking into consideration the Conservation First (2015-2020) EM&V Protocols and Requirements
2. Respond to interrogatories relating to the report, as required
3. Participate in a Technical Conference organized as part of the combined proceeding

4. Provide expert testimony on the results of the study before an OEB panel, as required
5. Support the preparation of the OEB staff submission to the Board, as required

Please provide a budget for Part 1 above. Parts 2, 3, 4 and 5 will be addressed on a per diem rate basis.

D) **PROJECT REQUIREMENTS (DESCRIPTION OF SPECIFIC DELIVERABLES / MILESTONES):**

	Milestone	**Target Date**
1	Consultant hired	Week of May 25
2	Project plan approved	Week of June 1
3	Submission of Draft Report	June 26, 2015
4	Submission of Final Report	July 6, 2015
5	Technical Conference	Mid August 2015
6	Oral Hearing	Early September 2015
7	Submission Preparation	Late September 2015

E) **TIMELINES OF PROJECT:**

See Section D above.

F) **MANDATORY REQUIREMENTS:**

a) Experience in DSM program planning and evaluation
b) Knowledge of industry DSM best practices
c) Scheduling flexibility
d) Demonstrated oral and written communication skills
e) Experience providing expert testimony on technical DSM matters

APPENDIX C: SYNAPSE PROPOSAL TO ONTARIO ENERGY BOARD

Filed: 2015-07-27
EB-2015-0029 / EB-2015-0049
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Revised Proposal to Review Union Gas and Enbridge Gas Demand-Side Management Plans

Prepared for the Ontario Energy Board

June 3, 2015

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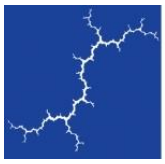

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CONTENTS

1. INTRODUCTION

The Ontario Energy Board (OEB) requires expert review of multi-year demand-side management (DSM) program plans submitted by Union Gas and Enbridge Gas. To ensure that Ontario's natural gas and electric power sectors are in line with international best practices for providing reliable and efficient energy, the OEB has developed parallel strategies for overseeing energy efficiency programs. The province's Conservation and Demand Management code provides regulatory guidance and requirements for electric distribution companies. In 2014, it established a Demand Side Management Framework and corresponding Filing Guidelines for natural gas utilities. As a result of this framework, Union Gas and Enbridge Gas have applied for review and approval of their 2015-2020 DSM Program plans. The OEB is charged with assessing these applications to determine if they meet the goals and targets set out in the framework and also to identify possible improvements based on comparisons to emerging natural gas DSM programs from other regions.

Synapse Energy Economics, Inc. (Synapse) proposes to provide expert consulting services in energy efficiency to assist the OEB in its current combined proceeding, expected to last through September 2015. The services will include review of the proposed natural gas DSM programs, a survey of and comparison to best practices in other regions, recommendations for improving the programs and their evaluation, a written report to be filed as part of the proceeding, expert testimony at an oral hearing, support for a technical hearing, and other tasks as required.

Synapse's project team offers:

► Extensive experience reviewing, critiquing, and developing energy efficiency program designs

This work includes:

- Reviewing gas energy efficiency plans in New Jersey on behalf of the New Jersey Division of Rate Counsel, including litigation support in dockets concerning New Jersey Natural Gas Company, Public Service Electric & Gas Company, Elizabethtown Gas Company, and South Jersey Gas Company
- Assisting the Natural Resources Council of Maine in its review of Efficiency Maine Trust's plan for its first statewide natural gas energy efficiency programs by providing analysis and testimony regarding maximum achievable cost-effective (MACE) savings and budgets, and providing high-level input on implementation issues, gas conservation strategy, and planning best practices
- Providing testimony on Efficiency Nova Scotia's 2013 and 2015 Demand-Side Management Plans on behalf of the Nova Scotia Utility and Review Board

- Assisting clients with reports on best practices in efficiency planning, including *The Resource Value Framework: Reforming Energy Efficiency Cost Effectiveness Screening,* guidelines prepared on behalf of the National Efficiency Screening Project

- Assisting the Regulatory Assistance Project in a collaborative process to achieve a comprehensive overhaul of Arkansas' energy efficiency programs and policies by the Arkansas commission

► A team of professionals with experience providing testimony on the key issues identified by the OEB

The members of our project team are accustomed to preparing and documenting their analyses with the level of detail and transparency required in litigated proceedings, and have provided expert testimony on the key issues identified by the OEB in numerous proceedings throughout the United States and Canada. Our proposed expert witness, Tim Woolf, testified most recently on behalf of Sierra Club before the Missouri Public Service Commission on Ameren Missouri's 2016-2018 Energy Efficiency Plan; on behalf of the Sierra Club before the Florida Public Service Commission regarding setting goals for increasing energy efficiency and the development of demand-side renewable energy systems; before the Kentucky Public Service Commission regarding Louisville Gas and Electric Company and Kentucky Utilities Company's proposed 2015-2018 demand-side management and energy efficiency program plan; and before the Colorado Public Utilities Commission regarding the Public Service Company of Colorado's proposed energy savings goals.

► A proven project manager approach

Our project team will be led by Synapse Vice President Tim Woolf. He will communicate regularly with OEB staff and will lead discussions of assumptions, methods, and objectives early on to ensure that deliverables are completed on time and in a manner that meets the OEB's needs.

2. ABOUT SYNAPSE

Synapse Energy Economics is a research and consulting firm specializing in energy, economic, and environmental topics. Since its inception in 1996, Synapse has grown to become a leader in providing rigorous analysis of the electric power sector for public interest and governmental clients.

Synapse's staff of 30 includes experts in energy and environmental economics, resource planning, electricity dispatch and economic modeling, energy efficiency, renewable energy, transmission and distribution, rate design and cost allocation, risk management, benefit-cost analysis, environmental compliance, climate science, and both regulated and competitive electricity and natural gas markets. Several of our senior-level staff members have more than 30 years of experience in the economics, regulation, and deregulation of the electricity and natural gas sectors. They have held positions as regulators, economists, and utility commission and ISO staff.

Services provided by Synapse include economic and technical analyses, regulatory support, research and report writing, policy analysis and development, representation in stakeholder committees, facilitation, trainings, development of analytical tools, and expert witness services. Synapse is committed to the idea that robust, transparent analyses can help to inform better policy and planning decisions. Many of our clients seek out our experience and expertise to help them participate effectively in planning, regulatory, and litigated cases, and other forums for public involvement and decision making.

Synapse's clients include public utility commissions throughout the United States and Canada, offices of consumer advocates, attorneys general, environmental organizations, foundations, governmental associations, public interest groups, and federal clients such as the U.S. Environmental Protection Agency and the Department of Justice. Our work for international clients has included projects for the United Nations Framework Convention on Climate Change, the Global Environment Facility, and the International Joint Commission, among others.

3. PROJECT MANAGEMENT APPROACH

Tim Woolf will serve as Synapse's project manager for this work. He will be the primary liaison with the OEB for this project, and will be responsible for developing a clear work plan, overseeing the project team, and ensuring that deliverables are provided on schedule and to the satisfaction of the OEB. Our understanding is that Valerie Bennett will serve as the primary point of contact for the OEB for this project.

As noted above, Synapse places a strong emphasis on project management practices. We believe it is essential to:

- **Communicate regularly** throughout the project. Mr. Woolf will provide the OEB with project status updates on a weekly or biweekly basis.
- **Identify key assumptions, technical methodologies, and deliverable outlines** early in the project, to the extent possible. Synapse proposes to work with the OEB to determine a process and a schedule for approving these critical components as part of the project kickoff meeting.
- **Thoroughly review our work.** Synapse uses an internal peer-review system to ensure that our analyses are highly defensible in litigated cases and public forums. We also make a point of hitting interim deadlines so that our clients have sufficient time to review and provide feedback on work products. We ask our clients to consolidate their edits into one document to streamline the feedback process and avoid opportunities for confusion.
- **Be flexible and responsive to changes** as they arise. We understand that the scope, timing, and/or the nature of deliverables often evolve throughout the course of a project, for a variety of reasons. With your approval, we will adapt our approach to meet the changing needs of your project.

4. PROJECT PLAN AND DELIVERABLES

Here we provide a description of our proposed work for Part 1 of the project as described in the scope of work document provided by the OEB. We have broken Part 1 into three tasks. Per the scope of work document, Synapse will bill for Parts 2-5 at per diem rates based on a mutually agreed scope of work as the project unfolds. As such, we have not described the details of Parts 2-5 here.

Task 1: Survey DSM program best practices

In order to survey best practices in DSM programs, we will review documents such as DSM annual reports and industry best practices reports. We will seek best practices that are applicable to Ontario's natural gas DSM programs, and will ensure that our research covers the guiding principles and priorities provided in the DSM Framework and Filing Guidelines documents. The guiding principles and priorities include, but are not limited to:

- Programs that will result in long-term natural gas savings;
- Programs that will prevent lost opportunities;
- Programs that will defer future capital infrastructure investments;
- Programs that will be coordinated and integrated with electricity conservation and demand management (CDM) programs;
- Programs that are evidenced-based and rely on detailed customer data in order to clearly show a customer has lowered consumption levels over the course of different billing periods; and
- Low-income programs that are accessible across the province.

Examples of industry best practices reports we may review include the following:

- York et al. (2015). *Expanding the Energy Efficiency Pie: Serving More Customers, Saving More Energy through High Program Participation.* ACEEE.
- Nowalk et al. (2013). *Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs*. ACEEE.
- York et al. (2013). *Frontiers of Energy Efficiency: Next Generation Programs Reach for High Energy Savings*. ACEEE.
- Regulatory Assistance Project (2012). *Best Practices in Designing and Implementing Energy Efficiency Obligation Schemes – Research Report Task XXII of the International Energy Agency Demand Side Management Programme*.
- York et al. (2012). *A National Review of Natural Gas Energy Efficiency Programs.* ACEEE.
- Neme et al. (2015) *Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments*. Prepared for NEEP: Energy Futures Group.

We have also identified best practices reports on specific program or customer segments as follows:

- Trombley (2014). *One Small Step for Energy Efficiency: Targeting Small and Medium-Sized Manufacturers.* ACEEE.
- Kwatra et al (2014). *The Promise and Potential of Comprehensive Commercial Buildings Retrofit Programs.* ACEEE.
- CNTenergy and ACEEE (2013). *Engaging as Partners in Energy Efficiency: A Primer for Utilities on the Energy Efficiency Needs of Multifamily Buildings and Their Owners.*
- Energy Programs Consortium (2013). *Multifamily Energy Efficiency: Reported Barriers and Emerging Practices*.
- SWEEP (2013). *Utility Strategic Energy Management Programs*.
- SEEAction (2014). *Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector*.
- Rogers (2014). *The Energy Savings Potential of Smart Manufacturing*. ACEEE.

Task 2. Review of proposed 2015-2020 DSM programs

Synapse will review key aspects of the 2015-2020 DSM program plans proposed by Union Gas and Enbridge Gas and will provide recommendations for improvements based on the best practices in other leading jurisdictions, the DSM Framework, and any other province-specific circumstances, such as electric CDM programs and Ontario' electricity market. More specifically, Synapse will evaluate at minimum the following aspects in the proposed DSM plans, as requested by OEB staff in the scope of work document:

- The design and delivery of the proposed programs
- The extent to which the proposed DSM programs have addressed the key priorities and guiding principles set out in the Framework
- The proposed metrics and targets
- Gas DSM and electric CDM coordination
- Customer eligibility criteria in order to minimize free ridership and maximize persistence of savings
- The evaluation plans

Other aspects in the proposed plans we review may include, but are not limited to, customer financing options, DSM rate impacts, shareholder incentives, and lost revenue mechanisms.

Task 3: Prepare a report summarizing Synapse review of proposed 2015-2020 DSM programs

Prior to writing a draft report, we will develop a report outline for review and comment by OEB staff. We will also consult with OEB staff about the appropriate length and level of detail for this report. We will then prepare the first draft report by June 26, and prepare the final report by July 6 after incorporating comments on the draft report by OEB staff. The report will at minimum discuss the

proposed DSM programs by Union Gas and Enbridge Gas, areas for improvements in the proposed programs, and a summary of best practices in natural gas energy efficiency programs from leading utilities, provinces, and states in other regions.

5. MILESTONE SCHEDULE

Our expected timeline for the project (Parts 1-5) is as follows:

Date	Milestone
Week of June 1, 2015	Kickoff meeting via conference call
Week of June 8, 2015	Outline of report sent to OEB for review
Week of June 8, 2015	Outline feedback/approval from OEB due to Synapse
June 26, 2015	First draft of report sent to OEB for review
June 30, 2015	First draft feedback/approval from OEB due to Synapse
July 6, 2015	Final report submitted to OEB
August 5, 2015	Pre-technical conference planning call
Mid-August 2015	Technical conference
	Pre-hearing check-in call
Early September 2015	Oral hearing
	Pre-submission check-in call
Late September 2015	OEB submission

Meeting the deliverable target dates is contingent upon timely delivery of data and completion of review and comments by the OEB. Our proposed budget for this project assumes one round of comments from the OEB on deliverables, consistent with the table above.

We request that the OEB advise Synapse as soon as it becomes aware of any developments that may delay completion of scheduled deliverables, including any changes to the scope of work requested by the OEB. Synapse will work with the OEB to adjust the deliverable target dates accordingly.

6. QUALIFICATIONS AND EXPERIENCE

Energy efficiency and demand response constitute a core area of Synapse's expertise. We assist clients with analyzing costs, energy savings, avoided costs, cost effectiveness, potential studies, rate and bill impacts, price suppression effects, economic and job impacts, and the regulatory policies used to promote and support energy efficiency resources. Our work benefits from a deep understanding of program design and evaluation, measurement, and verification (EM&V) practices; extensive research skills and knowledge of materials useful during portfolio ramp up, including goal setting and identification of potential; and practice integrating energy efficiency into long-term resource planning.

Tim Woolf, Synapse's project manager for this work, has reviewed and critiqued utility energy efficiency programs and policies in more than a dozen states and Canadian provinces, and has led several national and regional studies addressing energy efficiency program and policy issues. As a commissioner at the Massachusetts Department of Public Utilities, Mr. Woolf played a key role in developing energy efficiency policies that helped make that state a nationally recognized leader in energy efficiency.

Mr. Woolf will be supported in this project by Kenji Takahashi, Associate, Alice Napoleon, Senior Associate, and Erin Malone, Associate. Mr. Takahashi has significant experience in the analysis of energy efficiency measures and programs, and recently presented direct testimony to the New Jersey Board of Public Utilities regarding Public Service Electric and Gas Company's request for an extension of its Energy Efficiency Economic Stimulus program. Ms. Napoleon's work at Synapse focuses on review and development of energy efficiency programs, encompassing program design, administration, budgeting, cost recovery, ratemaking, marketing, and cost-benefit analyses. Ms. Malone assesses energy efficiency policy, program design, and implementation, with a particular focus on energy efficiency cost-effectiveness, rate and bill impacts, participation analysis, avoided costs, performance incentives, and best practices for energy efficiency.

Our team is ready to begin work immediately, and has sufficient time available throughout the project timeframe to conduct the scope of work discussed in this proposal.

Brief bios for each key team member are provided below. Resumes can be found in Appendix A.

6.1. Project Team

Tim Woolf, Vice President

Tim Woolf has more than 30 years of experience analyzing technical and economic aspects of energy and environmental issues. Before returning to Synapse in 2011, he served four years as a commissioner at the Massachusetts Department of Public Utilities (DPU), where he played a leading role in developing the Commonwealth's aggressive clean energy policies.

Mr. Woolf's primary areas of focus include electricity industry regulation and planning, energy efficiency program design and policy analysis, technical and economic analyses of electricity systems, renewable resource technologies and policies, clean air regulations and policies, and many aspects of consumer and environmental protection.

A large portion of Mr. Woolf's career has been dedicated to the review and development of energy efficiency programs and regulatory policies. His current work encompasses all aspects of energy efficiency program planning and implementation, including program design, avoided cost analyses, cost-benefit analyses, cost recovery, decoupling, utility performance incentives, integrated resource planning, and other relevant regulatory policies.

Mr. Woolf has reviewed and critiqued utility energy efficiency programs and policies in more than a dozen states and Canadian provinces—including Arkansas, British Columbia, Colorado, Delaware, Florida, Kentucky, Louisiana, Maine, Massachusetts, Minnesota, Missouri, Nevada, New York, Nova

Scotia, Rhode Island, Québec, and Vermont—and has led several national and regional studies addressing energy efficiency program and policy issues. He is currently the lead technical advisor for the National Efficiency Screening Coalition, and he recently co-chaired a working group to prepare a study addressing the cost-effectiveness of demand response programs around the country on behalf of the U.S. Department of Energy and the Federal Energy Regulatory Commission.

Mr. Woolf has testified as an expert witness in more than 45 state regulatory proceedings, and has authored more than 60 reports on electricity industry regulation and restructuring. He represents clients in collaboratives, task forces, and settlement negotiations, and has published articles on electric utility regulation in *Energy Policy*, *Public Utilities Fortnightly*, *The Electricity Journal*, *Local Environment, Utilities Policy*, *Energy and Environment*, and *The Review of European Community and Environmental Law*.

Mr. Woolf holds an MBA from Boston University, a Diploma in Economics from the London School of Economics, and a BS in Mechanical Engineering and a BA in English from Tufts University.

Kenji Takahashi, Associate

Kenji Takahashi conducts economic, environmental, and policy analysis of electric system technologies, policies, and regulations associated with both supply- and demand-side resources. He has significant experience in the analysis of integrated resource plans, renewable energy policies, distributed generation, demand response (including advanced metering infrastructure), and energy efficiency measures and programs. Recently, Mr. Takahashi presented direct testimony to the New Jersey Board of Public Utilities regarding Public Service Electric and Gas Company's request for an extension of its Energy Efficiency Economic Stimulus program. Mr. Takahashi has also:

- Analyzed the performance, costs, benefits, and potential of renewable energy technologies and resources, as well as energy efficiency measures—including state-of-art measures such as cold climate heat pumps, deep energy retrofits, and net zero energy buildings;
- Assessed the design and impact of numerous utility energy efficiency program plans in utility program filings and integrated resource planning documents;
- Assisted several states—including Colorado, Maryland, South Carolina, Alaska, and Massachusetts—with developing and analyzing state climate change action plans;
- Assessed load forecasts and resource analyses in utility integrated resource planning documents; and
- Evaluated various renewable energy and distributed generation policies, and assessed and developed feed-in-tariffs.

Prior to joining Synapse in 2004, Mr. Takahashi was a research associate at the Center for Energy and Environmental Policy (CEEP) of the University of Delaware. In one of his research projects at CEEP, he investigated the impacts of different distribution rate designs on the development of distributed energy resources (e.g., renewable energy, distributed generation, energy efficiency, and demand response). Mr.

Takahashi eventually turned this research into a report prepared for Delmarva Power Company. He has also held research positions for the Delaware Division of Public Advocate and for Resources for the Future.

Mr. Takahashi holds an MA in Urban Affairs and Public Policy with a concentration in Energy and Environmental Policy from the University of Delaware, and a BA in Law with a concentration in Public Administration from Kansai University in Osaka, Japan.

Alice Napoleon, Senior Associate

Alice Napoleon conducts economic and policy analysis of electric systems and emissions regulations. She researches demographic and economic data, federal and state regulations, and rulemakings and legal precedent; writes reports, discovery questions and responses, and expert testimony; and conducts analysis in support of testimony. Her most recent work has focused on review of energy efficiency programs, encompassing program design, administration, budgeting, cost recovery, ratemaking, marketing, and cost-benefit analyses. In addition to strong analytical skills, Ms. Napoleon has expertise and extensive experience with facilitating collaborative stakeholder processes.

In collaboration with the Industrial Energy Analysis group of Lawrence Berkeley National Laboratory, Ms. Napoleon is managing the development of a toolkit for energy efficiency program administrators to incorporate the U.S. Department of Energy's Superior Energy Performance™ (SEP) into their portfolios. For this effort, Ms. Napoleon and her team are developing materials for communicating why program administrators would offer SEP to their industrial customers, guidance on program design (including incentives, outreach, monitoring and verification, and savings attribution), a package of information for regulators, and case studies of existing energy efficiency program offerings that support implementation of strategic energy management.

In addition to industrial energy efficiency, Ms. Napoleon has been specializing in low-income energy efficiency. In 2014, she provided written testimony regarding Efficiency Nova Scotia's (ENS) 2015 Demand-Side Management Plan. Her testimony focused on ENS's proposal to discontinue certain low-income energy efficiency services, and the proposal by Nova Scotia Power, Inc. to fund these services by charitable donation to a third party. She has also conducted extensive research on current low-income electric energy efficiency program efforts in the United States. Based on an analysis of funding and energy savings, the research–conducted with colleague Jennifer Kallay–examined whether and how the level of funding and cost of saved energy differs for groups of states with higher poverty rates (i.e., above the national average) as compared to groups of states with lower poverty rates (i.e., below the national average).

Ms. Napoleon has provided extensive and ongoing support for the State of New Jersey regarding its state- and utility-administered residential, low-income, commercial, and industrial energy efficiency and combined heat and power programs. As a part of this effort, she conducted expert analysis, drafted testimony, and provided litigation support for the state regarding program design, budgets, performance, marketing, evaluation, cost-benefit analysis, and overlap between utility- and state-administered programs.

Ms. Napoleon previously worked at Resource Insight, Inc. where she supported investigations of electric, gas, steam, and water resource issues, primarily in the context of reviews by state utility regulatory commissions. She holds an MA in Public Administration from the University of Massachusetts at Amherst and a BA in Economics from Rutgers University.

Erin Malone, Associate

Erin Malone specializes in assessing energy efficiency policy, program design, and implementation. Since joining Synapse in early 2012, much of her work has focused on energy efficiency cost-effectiveness, rate and bill impacts, participation analysis, avoided costs, performance incentives, and best practices for energy efficiency.

Ms. Malone has played a key role in developing expert testimony on demand-side management (DSM) performance incentives in Missouri, DSM as an alternative to purchasing a coal-fired resource in Kentucky, and energy efficiency rate and bill impacts in Colorado and Nova Scotia. She provides ongoing support to the Cape Light Compact—the municipal aggregator for Cape Cod and Martha's Vineyard—including support for the development of annual reports, energy efficiency recovery rate filings, and issue-specific technical analyses.

In 2013, Ms. Malone coauthored a major study for the National Home Performance Council recommending a comprehensive set of best practices to ensure that energy efficiency cost-effectiveness tests are properly and consistently applied, in order to account for the full benefits of energy efficiency programs. The study, *Best Practices in Energy Efficiency Program Screening*, is particularly relevant to the increasing number of U.S. states requiring program administrators to pursue all cost-effective energy efficiency. Her recent work also includes developing a robust bill impact model, capable of being applied to each state across the country, and surveying several U.S. states on their cost-effectiveness practices and policies.

Prior to joining Synapse, Ms. Malone served as an economist in the Electric Power Division at the Massachusetts Department of Public Utilities, specializing in the review of electric utilities' energy efficiency activities. Ms. Malone holds a bachelor's degree in economics from Boston College, and is accredited as a LEED Green Associate.

6.2. Relevant Project Descriptions

The following project descriptions represent a sample of our ongoing and recent work that is related to the OEB's current need.

Review Efficiency Maine's Natural Gas Energy Efficiency Plan *Client: Natural Resources Council of Maine*
In Maine, the Efficiency Maine Trust plans for and administers all energy efficiency programs across the state in an integrated fashion, including those funded from electric and natural gas ratepayers, in accordance with three-year plans that must be approved by the Maine Public Utilities Commission. Synapse is assisting the Natural Resources Council of Maine in its review of the Trust's 2014 plan for its first statewide natural gas energy efficiency programs by providing analysis and testimony

regarding maximum achievable cost-effective (MACE) savings and budgets, and providing high-level input on implementation issues, gas conservation strategy, and planning best practices. Project ongoing.

Efficiency Nova Scotia's 2015 Demand-Side Management Plan
Client: Nova Scotia Utility and Review Board

On behalf of the Nova Scotia Utility and Review Board, Synapse provided testimony on Efficiency Nova Scotia's (ENS) 2015 Demand-Side Management Plan. Testimony focused on ENS's proposal to discontinue providing certain low-income energy efficiency services, and the proposal by Nova Scotia Power Inc. to fund these services by charitable donation to a third party. Project completed July 2014.

New Jersey Gas Utilities' Petition to Continue Conservation Incentive Program
Client: New Jersey Division of the Rate Counsel

Synapse helped the New Jersey Division of Rate Counsel analyze the request by New Jersey Natural Gas Company and South Jersey Gas Company to continue their respective Conservation Incentive Programs, under which they are allowed to retain a portion of the gas supply capacity savings avoided as a result of reductions in customer usage due to the utilities' efficiency programs. Project completed June 2014.

PSE&G 2013 Energy Efficiency Economic Stimulus Program Analysis
Client: New Jersey Division of the Rate Counsel

On behalf of the New Jersey Division of the Rate Counsel, Synapse analyzed, reviewed, and issued discovery requests regarding the electric and natural gas energy efficiency and demand response components of the Public Service Electric and Gas (PSE&G) filing to adjust its Green Programs Recovery Charges. Key issues included program performance and cost effectiveness. Project completed in February 2014.

ETG 2012 Energy Efficiency Program Extension Filing
Client: New Jersey Division of the Rate Counsel

The Elizabethtown Gas Company (ETG) filed a petition in October 2012 to extend and modify its energy efficiency programs, some of which sought to offer monetary incentives additional to incentives for the same measures available through New Jersey's Clean Energy Program, and to extend funding for ETG's programs. On behalf of the New Jersey Division of the Rate Counsel, Synapse issued discovery requests, analyzed and reviewed the petition and discovery responses, and provided support to the client during settlement discussions. Primary issues included cost-benefit analysis inputs and demonstration of incremental program benefits when more than one efficiency program targets the same market. Project completed in August 2013.

Nova Scotia 2014 IRP
Client: Nova Scotia Utility and Review Board

Synapse provided technical support and expert modeling to the Nova Scotia Utility and Review Board (NS UARB) during the course of the 2014 Integrated Resource Plan (IRP) development by Nova Scotia Power. In collaboration with Nova Scotia Power and the staff and other consultants of the NS UARB, Synapse helped to develop an analysis plan, critiqued Strategist model input assumptions, provided

alternative assumptions, conducted modeling of alternative Candidate Resource Plans, and filed detailed comments with the NS UARB on NSP's final 2014 IRP. Synapse's work contributed towards development of an approved long-term IRP that contained a "mid-level" investment by NSP into demand-side management (DSM) resources. Project completed in 2014.

Energy Efficiency in Nova Scotia
Client: Nova Scotia Utility and Review Board

On behalf of the Nova Scotia Utility and Review Board, Synapse reviewed and commented on the Electricity Demand Side Management 2013 Plan and an energy efficiency potential study filed by Efficiency Nova Scotia Corporation, an independent efficiency program administrator. Synapse provided expert testimony regarding rate and bill impacts. Project completed March 2013.

Energy Efficiency Programs for the Municipal Aggregator on Cape Cod
Client: Cape Light Compact

The Massachusetts restructuring law enables municipal aggregators to implement energy efficiency programs with funds raised from all customers through a system benefits charge. More than 13 years ago, Synapse designed the energy efficiency programs that are being provided by the Cape Light Compact, the municipal aggregator on Cape Cod. Since then, Synapse has assisted the Cape Light Compact (the Compact) with energy efficiency plan, annual report, and energy efficiency charge reconciliation filing preparation, including energy efficiency data reporting and analysis and policy support. Energy efficiency data reporting and analysis includes processing of data from the Compact's database into tables for plans and reports and analysis of the plans and reports, preparation of the exhibits for the energy efficiency charge reconciliation filing, and drafting of memos on key aspects of filings as needed to inform stakeholder review. Policy support includes implementing key outcomes of Massachusetts Department of Public Utility (MA DPU) Orders, developing positions in open dockets, representing the Compact in stakeholder working groups, and providing expert testimony before the MA DPU. Project ongoing.

Energy Efficiency Programs and Policies in Arkansas
Client: Regulatory Assistance Project

Synapse was part of a team of efficiency experts organized by the Regulatory Assistance Project (RAP) to assist with a comprehensive overhaul of the energy efficiency programs and policies in Arkansas. Synapse focused on comprehensive energy efficiency program design; efficiency savings targets; utility shareholder incentives for efficiency programs; energy efficiency program reporting; program evaluation, measurement and verification (EM&V); a collaborative process for stakeholder input; and integrated resource planning rules. Synapse worked directly with staff at the Arkansas commission to assist in developing policies and writing commission orders. Project completed July 2013.

Support for the Rhode Island Consumer Advocate on Energy Efficiency
Client: Rhode Island Division of Public Utilities and Carriers

Synapse is providing technical and policy support to the Rhode Island Division of Public Utilities and Carriers. Much of the support includes full participation in the RI Energy Efficiency Collaborative. The work includes all aspects of energy efficiency program design, implementation, and review related to the Narragansett Electric programs, which are some of the most aggressive and successful efficiency programs in the United States. It also includes a comprehensive analysis of the rate, bill, and

participation impacts of the energy efficiency programs. Tim Woolf has also prepared testimony on behalf of the DPUC supporting a settlement among multiple parties on the design and funding for natural gas demand-side management programs in the state for 2007-2008. This groundbreaking settlement will result in increased energy efficiency in Rhode Island and offers to help increase efficiency of delivery of both electric and gas DSM programs, which will be jointly developed and implemented for future years. Project ongoing.

2013 Avoided Energy Supply Cost Study
Client: AESC Study Group

Synapse and a team of subcontractors developed projections of marginal energy supply costs that would be avoided due to reductions in electricity, natural gas, and other fuels resulting from energy efficiency programs offered to customers. The report provides projections of avoided costs of electricity and natural gas by year from 2014 through 2028 with extrapolated values for another 15 years. In addition to projecting the costs of energy and capacity avoided directly by program participants, the report provides estimates of the Demand Reduction Induced Price Effect (DRIPE) of efficiency programs on wholesale market prices for electric energy, electric capacity, and natural gas. The report also provides a projection of non-embedded environmental costs associated with emissions of CO_2. The 2013 AESC study was sponsored by a group representing all of the major electric and gas utilities in New England as well as efficiency program administrators, energy offices, regulators, and advocates. Synapse conducted prior AESC studies in 2007, 2009, and 2011. Project completed July 2013.

Review of Low-Income Assistance Programs
Client: Ontario Energy Board

Together with subcontractor Nancy Brockway, Synapse assisted the Ontario Energy Board in developing options for the design and implementation of a ratepayer-funded, long-term rate assistance program for low-income electricity consumers. Project completed 2014.

APPENDIX D: RESUMES OF SYNAPSE STAFF

Tim Woolf, Vice President

Synapse Energy Economics I 485 Massachusetts Avenue, Suite 2 I Cambridge, MA 02139 I 617-453-7031
twoolf@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Vice President*, 2011 – present.

Provides expert consulting on the economic, regulatory, consumer, environmental, and public policy implications of the electricity and gas industries. The primary focus of work includes technical and economic analyses, electric power system planning, climate change strategies, energy efficiency programs and policies, renewable resources and related policies, power plant performance and economics, air quality, and many related aspects of consumer and environmental protection.

Massachusetts Department of Public Utilities, Boston, MA. *Commissioner*, 2007 – 2011.

Oversaw a significant expansion of clean energy policies as a consequence of the Massachusetts Green Communities Act, including an aggressive expansion of ratepayer-funded energy efficiency programs; the implementation of decoupled rates for electric and gas companies; an update of the DPU energy efficiency guidelines; the promulgation of net metering regulations; review of smart grid pilot programs; and review of long-term contracts for renewable power. Oversaw six rate case proceedings for Massachusetts electric and gas companies. Played an influential role in the development of price responsive demand proposals for the New England wholesale energy market. Served as President of the New England Conference of Public Utility Commissioners from 2009-2010. Served as board member on the Energy Facilities Siting Board from 2007-2010. Served as co-chair of the Steering Committee for the Northeast Energy Efficiency Partnership's Regional Evaluation, Measurement and Verification Forum.

Synapse Energy Economics Inc., Cambridge, MA. *Vice President*, 1997 – 2007.

Tellus Institute, Boston, MA. *Senior Scientist, Manager of Electricity Program*, 1992 – 1997.

Association for the Conservation of Energy, London, England. *Research Director*, 1991 – 1992.

Massachusetts Department of Public Utilities, Boston, MA. *Staff Economist*, 1989 – 1990.

Massachusetts Office of Energy Resources, Boston, MA. *Policy Analyst*, 1987 – 1989.

Energy Systems Research Group, Boston, MA. *Research Associate*, 1983 – 1987.

Union of Concerned Scientists, Cambridge, MA. *Energy Analyst*, 1982-1983.

EDUCATION

Boston University, Boston, MA
Master of Business Administration, 1993

London School of Economics, London, England
Diploma, Economics, 1991

Tufts University, Medford, MA
Bachelor of Science in Mechanical Engineering, 1982

Tufts University, Medford, MA
Bachelor of Arts in English, 1982

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Whited, M., T. Woolf, A. Napoleon. 2015. *Utility Performance Incentive Mechanisms: A Handbook for Regulators*. Synapse Energy Economics for the Western Interstate Energy Board.

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Woolf, T., E. Malone, C. Neme. 2014. *Regulatory Policies to Support Energy Efficiency in Virginia*. Synapse Energy Economics and Energy Futures Group for the Virginia Energy Efficiency Council.

Woolf, T., M. Whited, E. Malone, T. Vitolo, R. Hornby. 2014. *Benefit-Cost Analysis for Distributed Energy Resources: A Framework for Accounting for All Relevant Costs and Benefits.* Synapse Energy Economics for the Advanced Energy Economy Institute.

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Stanton, E. A., S. Jackson, G. Keith, E. Malone, D. White, T. Woolf. 2013. *A Clean Energy Standard for Massachusetts.* Synapse Energy Economics for the Massachusetts Clean Energy Center and the Massachusetts Departments of Energy Resources, Environmental Protection, and Public Utilities.

Woolf, T., K. Saul-Rinaldi, R. LeBaron, S. Cowell, P. Stanton. 2013. *Recommendations for Reforming Energy Efficiency Cost-Effectiveness Screening in the United States.* Energy Efficiency Screening Coalition for the National Home Performance Council.

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Raab Associates and Synapse Energy Economics. 2013. *Massachusetts Electric Grid Modernization Stakeholder Working Group Process: Report to the Department of Public Utilities from the Steering Committee.* Prepared for the Massachusetts Department of Public Utilities. DPU 12-76.

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Woolf, T. 2013. “Energy Efficiency Screening: Accounting for ‘Other Program Impacts’ & Environmental Compliance Costs.” Presentation for Regulatory Assistance Project Webinar, March 2013.

Woolf, T. 2013. “Energy Efficiency: Rates, Bills, Participants, Screening, and More.” Presentation at Connecticut Energy Efficiency Workshop, March 2013.

Woolf T. 2013. “Best Practices in Energy Efficiency Program Screening.” Presentation for SEE Action Webinar, March 2013.

Woolf, T. 2013. “Energy Efficiency Screening: Application of the TRC Test.” Presentation for Energy Advocates Webinar, January 2013.

Woolf, T. 2012. “Best Practices in Energy Efficiency Program Screening.” Presentation for American Council for an Energy-Efficient Economy Webinar, December 2012.

Woolf, T. 2012. “In Pursuit of All Cost-Effective Energy Efficiency.” Presentation at Sierra Club Boot Camp, October 2012.

Woolf, T. 2012. “Best Practices in Energy Efficiency Program Screening.” Presentation at NARUC Summer Meetings – Energy Efficiency Cost-Effectiveness Breakfast, July 2012.

Woolf, T. 2011. “Energy Efficiency Cost-Effectiveness Tests.” Presentation at the Northeast Energy Efficiency Partnerships Annual Meeting, October 2011.

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Woolf, T. 2008. “Promoting Demand Resources in Massachusetts: A Regulator’s Perspective.” Presentation at the Energy Bar Association, Northeast Chapter Meeting, June 2008.

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Woolf T. 2002. “A Renewable Portfolio Standard for New Brunswick.” Presentation to the New Brunswick Market Design Committee, January 10, 2002.

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Woolf, T. 1998. “New England Tracking System Project: An Electricity Tracking System to Support a Wide Range of Restructuring-Related Policies.” Presentation at the Ninth Annual Energy Services Conference and Exposition in Orlando, FL, December 1998.

Woolf, T. 2000. “Comments of the Citizens Action Coalition of Indiana.” Presentation at Workshop on Alternatives to Traditional Generation Resources, June 2000.

Woolf, T. 1996. “Overview of IRP and Introduction to Electricity Industry Restructuring.” Training session provided to the staff of the Delaware Public Service Commission, April 1996.

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TESTIMONY

Nova Scotia Utility and Review Board (Matter No. M06733): Direct testimony on EfficiencyOne’s 2016-2018 demand-side management plan. On behalf of the Nova Scotia Utility and Review Board. June 2, 2015.

Missouri Public Service Commission (Case No. ER-2014-0370): Direct and surrebuttal testimony on the topic of Kansas City Power and Light’s rate design proposal. On behalf of Sierra Club. April 16, 2015 and June 5, 2015.

Missouri Public Service Commission (File No. EO-2015-0055): Rebuttal and surrebuttal testimony on the topic of Ameren Missouri’s 2016-2018 Energy Efficiency Plan. On behalf of Sierra Club. March 20, 2015 and April 27, 2015.

Florida Public Service Commission (Dockets No. 130199-EI et al.): Direct testimony on the topic of setting goals for increasing the efficiency of energy consumption and increasing the development of demand-side renewable energy systems. On behalf of the Sierra Club. May 19, 2014.

Massachusetts Department of Public Utilities (Docket No. DPU 14-__): Testimony regarding the cost of compliance with the Global Warming Solution Act. On behalf of the Massachusetts Department of Energy Resources and the Department of Environmental Protection. May 16, 2014.

Kentucky Public Service Commission (Case No. 2014-00003): Direct testimony regarding Louisville Gas and Electric Company and Kentucky Utilities Company's proposed 2015-2018 demand-side management and energy efficiency program plan. On behalf of Wallace McMullen and the Sierra Club. April 14, 2014.

Maine Public Utilities Commission (Docket No. 2013-168): Direct and surrebuttal testimony regarding policy issues raised by Central Maine Power's 2014 Alternative Rate Plan, including recovery of capital costs, a Revenue Index Mechanism proposal, and decoupling. On behalf of the Maine Public Advocate Office. December 12, 2013 and March 21, 2014.

Colorado Public Utilities Commission (Docket No. 13A-0686EG): Answer and surrebuttal testimony regarding Public Service Company of Colorado's proposed energy savings goals. On behalf of the Sierra Club. October 16, 2013 and January 21, 2014.

Kentucky Public Service Commission (Case No. 2012-00578): Direct testimony regarding Kentucky Power Company's economic analysis of the Mitchell Generating Station purchase. On behalf of the Sierra Club. April 1, 2013.

Nova Scotia Utility and Review Board (Matter No. M04819): Direct testimony regarding Efficiency Nova Scotia Corporation's Electricity Demand Side Management Plan for 2013 – 2015. On behalf of the Counsel to Nova Scotia Utility and Review Board. May 22, 2012.

Missouri Office of Public Counsel (Docket No. EO-2011-0271): Rebuttal testimony regarding IRP rule compliance. On behalf of the Missouri Office of the Public Counsel. October 28, 2011.

Nova Scotia Utility and Review Board (Matter No. M03669): Direct testimony regarding Efficiency Nova Scotia Corporation's Electricity Demand Side Management Plan for 2012. On behalf of the Counsel to Nova Scotia Utility and Review Board. April 8, 2011.

Rhode Island Public Utilities Commission (Docket No. 3790): Direct testimony regarding National Grid's Gas Energy Efficiency Programs. On behalf of the Division of Public Utilities and Carriers. April 2, 2007.

North Carolina Utilities Commission (Docket E-100, Sub 110): Filed comments with Anna Sommer regarding the Potential for Energy Efficiency Resources to Meet the Demand for Electricity in North Carolina. Synapse Energy Economics on behalf of the Southern Alliance for Clean Energy. February 2007.

Rhode Island Public Utilities Commission (Docket No. 3765): Direct and Surrebuttal testimony regarding National Grid's Renewable Energy Standard Procurement Plan. On behalf of the Division of Public Utilities and Carriers. January 17, 2007 and February 20, 2007.

Minnesota Public Utilities Commission (Docket Nos. CN-05-619 and TR-05-1275): Direct testimony regarding the potential for energy efficiency as an alternative to the proposed Big Stone II coal project. On behalf of the Minnesota Center for Environmental Advocacy, Fresh Energy, Izaak Walton League of America, Wind on the Wires and the Union of Concerned Scientists. November 29, 2006.

Rhode Island Public Utilities Commission (Docket No. 3779): Oral testimony regarding the settlement of Narragansett Electric Company's 2007 Demand-Side Management Programs. On behalf of the Division of Public Utilities and Carriers. November 24, 2006.

Nevada Public Utilities Commission (Docket Nos. 06-04002 & 06-04005): Direct testimony regarding Nevada Power Company's and Sierra Pacific Power Company's Renewable Portfolio Standard Annual Report. On behalf of the Nevada Bureau of Consumer Protection. October 26, 2006

Nevada Public Utilities Commission (Docket No. 06-06051): Direct testimony regarding Nevada Power Company's Demand-Side Management Plan in the 2006 Integrated Resource Plan. On behalf of the Nevada Bureau of Consumer Protection. September 13, 2006.

Nevada Public Utilities Commission (Docket Nos. 06-03038 & 06-04018): Direct testimony regarding the Nevada Power Company's and Sierra Pacific Power Company's Demand-Side Management Plans. On behalf of the Nevada Bureau of Consumer Protection. June 20, 2006.

Nevada Public Utilities Commission (Docket No. 05-10021): Direct testimony regarding the Sierra Pacific Power Company's Gas Demand-Side Management Plan. On behalf of the Nevada Bureau of Consumer Protection. February 22, 2006.

South Dakota Public Utilities Commission (Docket No. EL04-016): Direct testimony regarding the avoided costs of the Java Wind Project. On behalf of the South Dakota Public Utilities Commission Staff. February 18, 2005.

Rhode Island Public Utilities Commission (Docket No. 3635): Oral testimony regarding the settlement of Narragansett Electric Company's 2005 Demand-Side Management Programs. On behalf of the Division of Public Utilities and Carriers. November 29, 2004.

British Columbia Utilities Commission. Direct testimony regarding the Power Smart programs contained in BC Hydro's Revenue Requirement Application 2004/05 and 2005/06. On behalf of the Sierra Club of Canada, BC Chapter. April 20, 2004.

Maryland Public Utilities Commission (Case No. 8973): Oral testimony regarding proposals for the PJM Generation Attributes Tracking System. On behalf of the Maryland Office of People's Counsel. December 3, 2003.

Rhode Island Public Utilities Commission (Docket No. 3463): Oral testimony regarding the settlement of Narragansett Electric Company's 2004 Demand-Side Management Programs. On behalf of the Division of Public Utilities and Carriers. November 21, 2003.

California Public Utilities Commission (Rulemaking 01-10-024): Direct testimony regarding the market price benchmark for the California renewable portfolio standard. On behalf of the Union of Concerned Scientists. April 1, 2003.

Québec Régie de l'énergie (Docket R-3473-01): Direct testimony with Philp Raphals regarding Hydro-Québec's Energy Efficiency Plan: 2003-2006. On behalf of Regroupment national des Conseils régionaux de l'environnement du Québec. February 5, 2003.

Connecticut Department of Public Utility Control (Docket No. 01-10-10): Direct testimony regarding the United Illuminating Company's service quality performance standards in their performance-based ratemaking mechanism. On behalf of the Connecticut Office of Consumer Counsel. April 2, 2002.

Nevada Public Utilities Commission (Docket No. 01-7016): Direct testimony regarding the Nevada Power Company's Demand-Side Management Plan. On behalf of the Bureau of Consumer Protection, Office of the Attorney General. September 26, 2001.

United States Department of Energy (Docket Number-EE-RM-500): Comments with Bruce Biewald, Daniel Allen, David White, and Lucy Johnston of Synapse Energy Economics regarding the Department of Energy's proposed rules for efficiency standards for central air conditioners and heat pumps. On behalf of the Appliance Standards Awareness Project. December 2000.

US Department of Energy (Docket EE-RM-500): Oral testimony at a public hearing on marginal price assumptions for assessing new appliance efficiency standards. On behalf of the Appliance Standards Awareness Project. November 2000.

Connecticut Department of Public Utility Control (Docket No. 99-09-03 Phase II): Direct testimony regarding Connecticut Natural Gas Company's proposed performance-based ratemaking mechanism. On behalf of the Connecticut Office of Consumer Counsel. September 25, 2000.

Mississippi Public Service Commission (Docket No. 96-UA-389): Oral testimony regarding generation pricing and performance-based ratemaking. On behalf of the Mississippi Attorney General. February 16, 2000.

Delaware Public Service Commission (Docket No. 99-328): Direct testimony regarding maintaining electric system reliability. On behalf of Delaware Public Service Commission Staff. February 2, 2000.

Delaware Public Service Commission (Docket No. 99-328): Filed expert report ("Investigation into the July 1999 Outages and General Service Reliability of Delmarva Power & Light Company," jointly authored with J. Duncan Glover and Alexander Kusko). Synapse Energy Economics and Exponent Failure Analysis Associates on behalf the Delaware Public Service Commission Staff. February 1, 2000.

New Hampshire Public Service Commission (Docket No. 99-099 Phase II): Oral testimony regarding standard offer services. On behalf of the Campaign for Ratepayers Rights. January 14, 2000.

West Virginia Public Service Commission (Case No. 98-0452-E-GI): Rebuttal testimony regarding codes of conduct. On behalf of the West Virginia Consumer Advocate Division. July 15, 1999.

West Virginia Public Service Commission (Case No. 98-0452-E-GI): Direct testimony regarding codes of conduct and other measures to protect consumers in a restructured electricity industry. On behalf of the West Virginia Consumer Advocate Division. June 15, 1999.

Public Service Commission of West Virginia (Case No. 98-0452-E-GI): Filed expert report ("Measures to Ensure Fair Competition and Protect Consumers in a Restructured Electricity Industry in West Virginia," jointly authored with Jean Ann Ramey and Theo MacGregor) in the matter of the General Investigation to determine whether West Virginia should adopt a plan for open access to the electric power supply market and for the development of a deregulation plan. Synapse Energy Economics and MacGregor Energy Consultancy on behalf of the West Virginia Consumer Advocate Division. June 1999.

Massachusetts Department of Telecommunications and Energy (DPU/DTE 97-111): Direct testimony regarding Commonwealth Electric Company's energy efficiency plan, and the role of municipal aggregators in delivering demand-side management programs. On behalf of Cape and Islands Self-Reliance Corporation. January 1998.

Delaware Public Service Commission (DPSC 97-58): Direct testimony regarding Delmarva Power and Light's request to merge with Atlantic City Electric. On behalf of Delaware Public Service Commission Staff. May 1997.

Delaware Public Service Commission (DPSC 95-172): Oral testimony regarding Delmarva's integrated resource plan and DSM programs. On behalf of the Delaware Public Service Commission Staff. May 1996.

Colorado Public Utilities Commission (5A-531EG): Direct testimony regarding the impact of proposed merger on DSM, renewable resources and low-income DSM. On behalf of the Colorado Office of Energy Conservation. April 1996.

Colorado Public Utilities Commission (3I-199EG): Direct testimony regarding the impacts of increased competition on DSM, and recommendations for how to provide utilities with incentives to implement DSM. On behalf of the Colorado Office of Energy Conservation. June 1995.

Colorado Public Utilities Commission (5R-071E): Oral testimony on the Commission's integrated resource planning rules. On behalf of the Colorado Office of Energy Conservation. July 1995.

Colorado Public Utilities Commission (3I-098E): Direct testimony on the Public Service Company of Colorado's DSM programs and integrated resource plans. On behalf of the Colorado Office of Energy Conservation. April 1994.

Delaware Public Service Commission (Docket No. 96-83): Filed comments regarding the Investigation of Restructuring the Electricity Industry in Delaware (Tellus Institute Study No. 96-99). On behalf of the Staff of the Delaware Public Service Commission. November 1996.

Colorado Public Utilities Commission (Docket No. 96Q-313E): Filed comments in response to the Questionnaire on Electricity Industry Restructuring (Tellus Institute Study No. 96-130-A3). On behalf of the Colorado Governor's Office of Energy Conservation. October 1996.

State of Vermont Public Service Board (Docket No. 5854): Filed expert report (Tellus Institute Study No. 95-308) regarding the Investigation into the Restructuring of the Electric Utility Industry in Vermont. On behalf of the Vermont Department of Public Service. March 1996.

Pennsylvania Public Utility Commission (Docket No. I-00940032): Filed comments (Tellus Institute Study No. 95-260) regarding an Investigation into Electric Power Competition. On behalf of The Pennsylvania Office of Consumer Advocate. November 1995.

New Jersey Board of Public Utilities (Docket No. EX94120585Y): Initial and reply comments ("Achieving Efficiency and Equity in the Electricity Industry Through Unbundling and Customer Choice," Tellus Institute Study No. 95-029-A3) regarding an investigation into the future structure of the electric power industry. On behalf of the New Jersey Division of Ratepayer Advocate. September 1995.

Resume dated June 2015

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc, Cambridge, MA. *Senior Associate, 2015 – present, Associate*, 2004 – 2015.

Analyze technologies, policies, and regulations associated with supply and demand side energy resources. Assess potentials of electric and natural gas energy efficiency measures. Examine economic and environmental implications of clean energy policies and programs associated with energy efficiency, demand response, distributed generation, and renewable energy. Examine ratemaking issues such as standby rates for distributed generation and decoupling rate mechanisms for energy efficiency measures. Investigate electricity and natural gas market price trends and fluctuations. Prepare expert testimony and reports for regulatory proceedings.

Center for Energy and Environmental Policy, University of Delaware, Newark, DE. *Research Associate*, 2002 – 2004.

Researched the market potential of distributed resources under different electric distribution rate designs (Report prepared for Conectiv Power Delivery Company). Investigated the potential of the Clean Development Mechanisms (CDM) in Asian developing countries and the Japanese government's policy for CDM. Contributed to a market penetration study for photovoltaic technologies in comparison with the predicted oil production from the oil reservoirs in the Arctic National Wildlife Refuge (Report prepared for Astropower, Inc.). Analyzed the installation of PV and generation-set options for the Assateague Beach Coastal Guard Station at the Assateague Island National Seashore (Maryland) (Report prepared for the US National Park Service).

Delaware Division of Public Advocate, Wilmington, DE. *Research Intern*, 2003.

Researched and wrote reports on states' policies regarding (1) energy efficiency/load management programs in order to identify cost-effective programs for implementation in Delaware; (2) electric standard offer service/default service (rate designs) for those who do not choose alternative suppliers under the deregulation process; (3) electric universal service and system benefit charges for protecting consumers from risks associated with electricity restructuring; and (4) Contributions and Advances-in-Aid-of-Construction for water supply extensions.

Resources for the Future, Washington DC. *Research Intern*, 2002.

Investigated current and planned wind power capacity for the United States. Analyzed the EPA and EIA market models to estimate technical and economic potential of wind power in the United States.

Researched the status of renewable energy supply in Japan's electricity sector (Prepared for the Economic and Social Research Institute, Cabinet Office, Government of Japan).

Citizens' Alliance for Saving the Atmosphere and the Earth (CASA), Osaka, Japan. *Volunteer and Researcher*, 1999 – 2001.

Worked as a newsletter writer, editor, and event organizer. Wrote a report on the first experimental biomass energy facility in Japan and the photovoltaic system at Yagi Junior High School in Kyoto, Japan. Participated in a research project to investigate renewable energy potential and policies in Japan. Wrote a report on problems of nuclear power plants affecting communities in Fukui prefecture, Japan.

EDUCATION

Center for Energy and Environmental Policy, University of Delaware, Newark, DE
Master of Arts in Urban Affairs and Public Policy with a concentration in Energy and Environmental Policy, 2003. Master's thesis: *Policies to Support Distributed Resources under Different Electricity Restructuring Models*. Courses in energy economics, energy and environmental policy, electricity policy and planning, political economy of environment, solar electric technology, cost-benefit and decision making analyses, and geographic information system.

Kansai University, Osaka, Japan
Bachelor of Arts in Law with a concentration in Public Administration, 2000.

AWARDS AND SCHOLARSHIPS

- Director's Citation, Department of Urban Affairs and Public Policy, University of Delaware, May 2003.
- NEC scholarship for an environmental education leader-training program funded by one of the leading Japanese computer companies, NEC, November 2000.

ADDITIONAL SKILLS

Software: MS Office, Minitab, Analytica, RETScreen, and REM/Rate™
Language: Japanese, Cantonese, and Spanish

CONFERENCES

- 2013 ACEEE National Conference on Energy Efficiency as a Resource, September 22-24, 2013.
- 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'13), September 11-13, 2013.

- Energy Measure Verification Workshop (sponsored by Massachusetts Department of Energy Resources), September 2013.
- Smart Building: High Performance Homes: A Workshop for building professionals, June 22, 2011.
- NESEA Building Energy 11 Conference, March 8-10, 2011.
- Build Boston 2010 on Residential Design and Construction, November 17, 2010.
- ACI New England Conference 2010, October 6, 2010.
- 2010 ACEEE Summer Study on Energy Efficiency in Buildings, August 18-20, 2010.
- NESEA BuildingEnergy 10 Conference, March 8-10, 2010.
- 5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'09), June 24, 2009.
- 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 21, 2008.
- Tufts University Clean Distributed Energy Workshop, June 8, 2006.
- The 2006 Northeast Energy Efficiency Summit, May 17.
- The 2006 Distributed Generation & Interconnection Conference held by DTE Energy, April 26-28, 2006.
- United Nations Climate Change Conference at its eleventh session / Twenty-third sessions of the Subsidiary Bodies and COP/MOP 1, December 2005.

OTHER RELEVENT WORK

- Assisting U.S. EPA with its analysis for and preparation for technical support documents on energy efficiency associated with U.S. EPA's Clean Power Plan under 111(d) regulation
- Assisting New Jersey Division of Rate Counsel with reviewing and commenting on various energy related proposals and documents in New Jersey including utility and the state energy efficiency programs and the state's energy plans. 2009 to present.
- Assisted Nova Scotia Utility and Review Board with a review of energy efficiency potential and integrated resource planning for Nova Scotia Power's jurisdiction. 2013
- Assisting the Hawaii Division of Consumer Advocacy in proceedings to develop and review IRPs for three electric companies and to review the state's energy efficiency programs. 2012 to present.
- Assisted the Arkansas Public Service Commission staff with (a) reviewing and assessing utility integrated resource planning and energy efficiency program proposals, and (b) drafting regulatory orders on comprehensive energy efficiency program designs and reporting methods. 2012 to 2013.

- Assumed a general contractor role for renovating an existing multi-family house into an ultra-low energy use house equipped with state-of-art energy efficiency measures (such as R-7 windows, R-60 roof insulation, a 95% efficient energy recovery ventilation system, cold climate heat pumps) and a 5 kW solar photovoltaic system. December 2012.
- Assisted Nova Scotia Utility and Review Board with developing Community Based Feed-In Tariffs (COMFITs) for five different technologies: small wind projects, medium-sized wind projects, small hydro, small tidal, and biomass CHP projects. April 2011.
- Analyzed existing deep energy retrofit (DER) project data, and analyzed potential energy savings from model partial DER projects (e.g., attic, above-grade wall, windows, basement wall) using REM/Rate building energy software and Synapse's own spreadsheet building energy model being developed for this research project. The result from our analysis were used to project energy savings from and to set incentive levels for partial DER projects as part of National Grid's 2013-2015 efficiency program filing.
- Assisted several states, including Alaska, Colorado, Florida, Maryland, Massachusetts, and South Carolina with developing and analyzing their state climate change action plans; evaluated costs and benefits of demand and supply-side policy options, including quantifying expected greenhouse emission reductions. 2007 to 2010.
- Arranged meetings for Union Fenosa/Gas Natural, a Spanish electric and gas company, with Japanese and Korean organizations to study energy efficiency technologies, programs and policies in those countries; Visited Japanese organizations with the delegates of Union Fenosa, provided them technical and translation assistance on energy efficiency in Japan. July 26 to July 31, 2009.

PUBLICATIONS

Biewald, B., J. Daniel, J. Fisher, P. Luckow, A. Napoleon, N. R. Santen, K. Takahashi. 2015. *Air Emissions Displacement by Energy Efficiency and Renewable Energy.* Synapse Energy Economics.

Takahashi, K. 2015. "Boost Appliance Efficiency Standards." Ed. John Shenot. In *Implementing EPA's Clean Power Plan: A Menu of Options.* National Associate of Clean Air Agencies.

Takahashi, K., A. Napoleon. 2015. "Pursue Behavioral Efficiency Programs." Ed. John Shenot. In *Implementing EPA's Clean Power Plan: A Menu of Options.* National Associate of Clean Air Agencies.

Takahashi, K., J. Fisher, T. Vitolo, N. R. Santen. 2015. *Review of TVA's Draft 2015 Integrated Resource Plan*. Synapse Energy Economics for Sierra Club.

Comings, T., S. Jackson, K. Takahashi. 2015. *Comments on Indianapolis Power & Light Company's 2014 Integrated Resource Plan*. Synapse Energy Economics for the Sierra Club.

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, E. Karaca, G. Keith, E. Malone, W. Ong, P. Peterson, L. Silvestrini, K. Takahashi, R. Wilson. 2015. *Massachusetts Low Gas Demand Analysis: Final Report.* Synapse Energy Economics for the Massachusetts Department of Energy Resources.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Alabama's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Georgia's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Alternate Scenarios for 111(d) Implementation in North Carolina*. Synapse Energy Economics for the Southern Environmental Law Center.

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, G. Keith, E. Malone, P. Peterson, L. Silverstrini, K. Takahashi. 2014. *Feasibility Study for Low Gas Demand Analysis.* Synapse Energy Economics for the Massachusetts Department of Energy Resources.

Takahashi, K., T. Comings, A. Napoleon. 2014. *Maximizing Public Benefit through Energy Efficiency Investments.* Synapse Energy Economics for Sierra Club.

Vitolo, T., J. Fisher, K. Takahashi. 2014. *TVA's Use of Dispatchability Metrics in Its Scorecard.* Synapse Energy Economics for Sierra Club.

Comings, T., S. Fields, K. Takahashi, G. Keith. 2014. *Employment Effects of Clean Energy Investments in Montana.* Synapse Energy Economics for Montana Environmental Information Center and Sierra Club.

Keith, G., S. Jackson, J. Daniel, K. Takahashi. 2014. *Idaho's Electricity Sources: Current Sources and Future Potential.* Synapse Energy Economics for the Idaho Conservation League.

Malone, E. T. Woolf, K. Takahashi, S. Fields. 2013. "Appendix D: Energy Efficiency Cost-Effectiveness Tests." *Readying Michigan to Make Good Energy Decisions: Energy Efficiency*. Synapse Energy Economics for the Council of Michigan Foundations.

Takahashi, K. et al. 2013. *Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in U.S. Cities*. Proceeding of the 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'13), September 12, 2013.

Comings, T., K. Takahashi, G. Keith. 2013. *Employment Effects of Investing in Select Electricity Resources in Washington State.* Synapse Energy Economics for Sierra Club.

Woolf, T., E. Malone, J. Kallay, K. Takahashi. 2013. *Energy Efficiency Cost-Effectiveness Screening in the Northeast and Mid-Atlantic States.* Synapse Energy Economics for Northeast Energy Efficiency Partnerships, Inc. (NEEP).

Stanton, E. A., T. Comings, K. Takahashi, P. Knight, T. Vitolo, E. Hausman. 2013. *Economic Impacts of the NRDC Carbon Standard.* Synapse Energy Economics for the Natural Resources Defense Council (NRDC).

Woolf, T., W. Steinhurst, E. Malone, K. Takahashi. 2012. *Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs.* Synapse Energy Economics for Regulatory Assistance Project and Vermont Housing Conservation Board.

Woolf, T., M. Whited, T. Vitolo, K. Takahashi, D. White. 2012. *Indian Point Energy Center Replacement Analysis: A Plan for Replacing the Nuclear Plant with Clean, Sustainable, Energy Resources.* Synapse Energy Economics for National Resources Defense Council and Riverkeeper.

Keith, G., T. Woolf, K. Takahashi. 2012. *A Clean Electricity Vision for Long Island: Supplying 100% of Long Island's Electricity Needs with Renewable Power.* Synapse Energy Economics for Renewable Energy Long Island.

Fisher, J., K. Takahashi. 2012. *TVA Coal in Crisis: Using Energy Efficiency to Replace TVA's Highly Non-Economic Coal Units*. Synapse Energy Economics for Sierra Club.

Woolf, T., E. Malone, K. Takahashi, W. Steinhurst. 2012. *Best Practices in Energy Efficiency Program Screening: How to Ensure that the Value of Energy Efficiency is Properly Accounted For*. Synapse Energy Economics for National Home Performance Council.

Takahashi, K., W. Steinhurst. 2012. A Preliminary Analysis of Energy Impacts from Partial Deep Energy Retrofit Projects in National Grid's Jurisdiction. Synapse Energy Economics for National Grid, USA.

Synapse Energy Economics. 2012. *Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in US Cities.* Prepared for a HVAC manufacture company.

Hornby, R., D. White, T. Vitolo, T. Comings, K. Takahashi. 2012. *Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky*. Synapse Energy Economics for Mountain Association for Community Economic Development and The Kentucky Sustainable Energy Alliance.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2011. *Toward a Sustainable Future for the US Power Sector: Beyond Business as Usual 2011.* Synapse Energy Economics for Civil Society Institute.

Synapse Energy Economics. 2011. *Electricity Scenario Analysis for the Vermont Comprehensive Energy Plan 2011.* Prepared for Vermont Department of Public Service.

Bourgeois, T., D. Hall, W. Steinhurst, K. Takahashi. 2011. *Deployment of Distributed Generation for Grid Support and Distribution System Infrastructure: A Summary Analysis of DG Benefits and Case Studies***.**

Pace Energy and Climate Center and Synapse Energy Economics for New York State Energy Research and Development Authority (NYSERDA).

Peterson, P., V. Sabodash, K. Takahashi. 2010. *Demand Side Resource Potential: A Review of Global Energy Partners' Report for Midwest ISO.* Synapse Energy Economics for Project for Sustainable FERC Energy Policy.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2010. *Beyond Business as Usual: Investigating a Future Without Coal and Nuclear Power in the US.* Synapse Energy Economics for Civil Society Institute.

Napoleon, A., W. Steinhurst, M. Chang, K. Takahashi, R. Fagan. 2010. *Assessing the Multiple Benefits of Clean Energy: A Resource for States*. US Environmental Protection Agency with research and editorial support from Stratus Consulting, Synapse Energy Economics, Summit Blue, Energy and Environmental Economics, Inc., Demand Research LLC, Abt Associates, Inc., and ICF International.

James, C., K. Takahashi, W. Steinhurst. 2009. *North Dakota Energy Efficiency Potential Study Report.* Synapse Energy Economics for Plains Justice.

James, C., K. Takahashi, W. Steinhurst. 2009. *South Dakota Energy Efficiency Potential Study Report.* Synapse Energy Economics for Plains Justice.

James, C., J. Fisher, K. Takahashi, B. Warfield. 2009. *No Need to Wait: Using Energy Efficiency and Offsets to Meet Early Electric Sector Greenhouse Gas Targets*. Synapse Energy Economics for Environmental Defense Fund.

Takahashi, K., D. Nichols. 2009. *The Costs of Increasing Electricity Savings through Utility Efficiency Programs: Evidence from US Experience*. Proceeding of the 5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'09), June 24, 2009.

Hurley, D., K. Takahashi, B. Biewald, J. Kallay, R. Maslowski. 2008. *Cost and Benefits of Electric Utility Energy Efficiency in Massachusetts*. Synapse Energy Economics for Northeast Energy Efficiency Council.

Takahashi, K., D. Nichols. 2008. *The Sustainability and Costs of Increasing Efficiency Impacts: Evidence from Experience to Date*. Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 20, 2008.

Hornby, R., C. Salamone, S. Perry, D. White, K. Takahashi. 2008. *Advanced Metering Infrastructure-Implications for Residential Customers in New Jersey*. Synapse Energy Economics for New Jersey Division of the Ratepayer Advocate.

Hornby, R., C. James, K. Takahashi, D. White. 2008. *Increasing Demand Response in Maine.* Synapse Energy Economics for the Maine Public Utilities Commission.

Hausman, E., R. Fagan, D. White, K. Takahashi, A. Napoleon. 2007. *LMP Electricity Markets: Market Operations, Market Power, and Value for Consumer.* Synapse Energy Economics for the American Public Power Association.

Zalcman, F.,K. Takahashi, G. Keith, W. Steinhurst. 2006. *A Comprehensive Process Evaluation of Early Experience under New York's Pilot Program for Integration of Distributed Generation in Utility System Planning.* Synapse Energy Economics and Pace Law School Energy Project for New York State Energy Research and Development Authority (NYSERDA).

Chernick, P., J. Wallach, W. Steinhurst, T. Woolf, A. Sommer, and K. Takahashi. 2006. *Integrated Portfolio Management in a Restructured Supply Market*. Resource Insight, Inc. and Synapse Energy Economics for Ohio Consumers' Counsel.

Steinhurst, W., A. Napoleon, K. Takahashi. 2006. *Energy in the Northern Forest Region: A Situation Analysis*. Synapse Energy Economics for Northern Forest Center and The North Country Council.

Synapse Energy Economics. *Ensuring Delaware's Energy Future: A Response to Executive Order Number 82*. Technical assistance for Delaware Cabinet Committee on Energy.

Hausman, E., K. Takahashi, D. Schlissel, B. Biewald. 2006. *The Proposed Broadwater LNG Import Terminal - An Analysis and Assessment of Alternatives*. Prepared for Connecticut Fund for the Environment and Save the Sound.

Synapse Energy Economics. 2006. *The Glebe Mountain Wind Energy Project: Assessment of Project Benefits for Vermont and the New England Region*. Prepared for Glebe Mountain Wind Energy, LLC.

Hausman, E., K. Takahashi, B. Biewald. 2006. *The Deerfield Wind Project: Assessment of the Need for Power and the Economic and Environmental Attributes of the Project*. Synapse Energy Economics for Deerfield Wind, LLC.

Fagan, R., A. Napoleon, A. Rochelle, A. Sommer, W. Steinhurst, D. White, K. Takahashi. 2006. *Mohave Alternatives and Complements Study: Assessment of Carbon Sequestration Feasibility and Markets.* Sargent & Lundy and Synapse Energy Economics, Inc. for Southern California Edison.

Johnston, L., K. Takahashi, F. Weston, and C. Murray. 2005. *Rate Structures for Customers with Onsite Generation: Practice and Innovation*. Synapse Energy Economics and Regulatory Assistance Projects for National Renewable Energy Laboratory.

Woolf, T., K. Takahashi, G. Keith, A. Rochelle, P. Lyons. 2005. *Feasibility Study of Alternative Energy and Advanced Energy Efficiency Technologies for Low-Income Housing in Massachusetts*. Synapse Energy Economics for Low-Income Energy Affordability Network (LEAN) and Action for Boston Community Development, and Action Inc.

Steinhurst, W., R. McIntyre, B. Biewald, C. Chen, K. Takahashi. 2005. *Economic Impacts and Potential Air Emission Reductions from Renewable Generation & Efficiency Programs in New England.* Prepared for Regulatory Assistance Project.

Keith. G., B. Biewald, K. Takahashi. 2004. *The Searsburg/Readsboro Wind Project: An Analysis of Project Economics and An Analysis of Need*. Synapse Energy Economics for enXco Inc.

Takahashi, K. 2003. “The Clean Development Mechanism and Energy Efficiency Upgrades in Developing Countries: The Case of the Residential Sector in Selected Asian Countries.” Proceedings of the 3rd International Conference on Energy Efficiency in Domestic Appliances and Lighting, October 1-3, 2003.

TESTIMONY PREPARATION AND ASSISTANCE

Filed direct testimony before the New Jersey Board of Public Utilities (Docket No. EO14080897) regarding Public Service Electric and Gas Company’s petition to continue its Energy Efficiency Economic Extension program. On behalf of the New Jersey Division of Rate Counsel. November 7, 2014.

Assisted in the preparation of the following testimony: Tim Woolf, testifying before the Colorado Public Utilities Commission (Docket No. 13A-0686EG) regarding setting energy efficiency goals for the Public Service Company of Colorado’s demand-side management plan. On behalf of Sierra Club. October 16, 2013.

Assisted in the preparation of the following testimony: Tim Woolf, testifying before the Florida Public Service Commission (Docket No. 130199-EI – No. 130205-EI) regarding setting goals for increasing the efficiency of energy consumption and increasing the development of demand-side renewable energy systems in Florida utilities. On behalf of Sierra Club. May 19, 2014.

Assisted in the preparation of the following testimony: Tim Woolf, testifying before the Kentucky Public Service Commission (Case No. 2012-00578) regarding Kentucky Power Company’s economics analysis of the proposed purchase of the Mitchell Generating Station. On behalf of Sierra Club. April 1, 2013.

Assisted in the preparation of the following testimony: Robert Fagan, testifying before the State of New Jersey Board of Public Utilities (Docket No. GO11070399) regarding Elizabethtown Gas Company's Proposed Energy Efficiency Program. On behalf of New Jersey Division of the Ratepayer Advocate. December 16, 2011.

Assisted in the preparation of the following testimony: David Nichols, testifying before the State of New Jersey Board of Public Utilities (BPU DOCKET No. GR10030225) regarding New Jersey Natural Gas Company's Proposed Energy Efficiency Program. On behalf of New Jersey Division of the Ratepayer Advocate. July 9, 2010.

Assisted in the preparation of the following testimony: David Nichols, testifying before the Pennsylvania Public Utility Commission (Docket Nos. R-2009-2139884 and P-2009-2097639) regarding Philadelphia Gas Works' Proposed Energy Efficiency Plan. On behalf of Pennsylvania Office of Consumer Advocate. March 26, 2010.

Assisted in the preparation the following testimony: William Steinhurst, testifying before the Florida Public Service Commission (DOCKET NO. 080407-EG, DOCKET NO. 080408-EG, DOCKET NO. 080409-EG, DOCKET NO. 080410-EG, DOCKET NO. 080411-EG, DOCKET NO. 080412-EG, DOCKET NO. 080413-EG) regarding Florida Demand Side Management Policy and Planning. On behalf of Natural Resources Defense Council (NRDC) and Southern Alliance for Clean Energy. July 6, 2009.

Assisted in the preparation of the following testimony: Chris James, testifying before Iowa Utilities Board (DOCKET NO. EEP-08-01) regarding Interstate Power and Light Company's Proposed Energy Efficiency Program. On behalf of Community Coalition and Plains Justice. August 29, 2008.

Assisted in the preparation of the following testimony: Bruce Biewald and David Nichols, testifying before the Nova Scotia Utility and Review Board (Case No. M00208) regarding Nova Scotia Power Inc's Demand Side Management Plan. Oh behalf of The Utility and Review Board Staff f. March 17, 2008.

Assisted in the preparation of the following testimony: Timothy Woolf, testifying before the Public Utilities Commission of Nevada (Docket No. 06-06051) regarding the review of the Nevada Power Company's Demand Side Management Plan in the 2006 Integrated Resource Plan. On behalf of Nevada Bureau of Consumer Protection. September 13, 2006.

Assisted in the preparation of the following testimony: Amy Roschelle, testifying before the Public Utilities Commission of California (Application A.04-06-024) regarding the review of Pacific Gas and Electric's Application to Establish a Demonstration Climate Protection Program and Tariff Option. On behalf of The Utility Reform Network (TURN). May 5, 2006.

Assisted in the preparation of the following testimony: Timothy Woolf, testifying before the Public Service Commission of Nevada (Docket No. 05-10021) regarding the Sierra Pacific Power Company's Gas Demand-Side Management Plan. On behalf of Nevada Bureau of Consumer Protection. February 22, 2006.

PRESENTATIONS

Takahashi, K. 2014. “Expected U.S. Climate and Environmental Policy: The Future of Coal Power and Clean Energy.” Presentation at the Citizen's Alliance for Saving the Atmosphere and the Earth (CASA) seminar in Osaka, Japan on July 10, 2014.

Takahashi, K. and J. Fisher. 2013. “Greening TVA: Leveraging Energy Efficiency to Replace TVA’s Highly Uneconomic Coal Units.” Presentation at the 2013 ACEEE National Conference on Energy Efficiency as a Resource, September 23, 2013.

Takahashi, K. 2013. “Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in U.S. Cities.” Presentation at the 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL’13), September 12, 2013.

Takahashi K. 2011. “Jiyuka-dakedenai-america-no-denryokuseisaku-no-saishin-doukou (Recent Trends in U.S. Electric Power Regulation and Policy).” Presentation at CASA and Hinodeya Eco-life Research Institute in Osaka, Japan Workshop to discuss (1) US electricity regulation, (2) the impact of the Fukushima nuclear event on the US nuclear power industry, and (3) energy efficiency policies and programs in the US, November 21, 2011.

Takahashi, K. 2010. “Review of Utility-Owned Distributed Generation Models for New York.” Presentation at the Northeast CHP Initiative Meeting, April 13, 2010.

Takahashi, K. and D. Nichols. 2009. “The Costs of Increasing Electricity Savings through Utility Efficiency Programs: Evidence from US Experience.” Presentation at the 5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL’09), June 24, 2009.

Takahashi, K. 2008. “The Sustainability and Costs of Increasing Efficiency Impacts: Evidence from Experience to Date.” Presentation at the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 21, 2008.

Takahashi, K. 2005. Discussant at the World Bank Expert Workshop on CDM methodologies and Technical Issues Associated with Power Generation and Power Saving Activities, December 3, 2005.

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Alice Napoleon, Senior Associate

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. *Senior Associate*, June 2013 – present; *Associate*, July 2008 – June 2013; *Research Associate*, April 2005 – July 2008.

- Conduct expert analysis, draft testimony, and provide litigation support regarding energy efficiency program implementation and extension, cost recovery and incentive mechanisms, budgeting, evaluation, cost-effectiveness screening, potential studies, and plans.
- Support the development of a toolkit for energy efficiency program administrators to incorporate Superior Energy Performance™ into new or existing programs to help their industrial customers meet efficiency targets. Develop case studies of existing energy efficiency program offerings that support implementation of strategic energy management by industrial customers.
- Provide ongoing expert consulting for the State of New Jersey regarding its state-administered residential, low-income, commercial, and industrial energy efficiency and combined heat & power programs, including review, analysis, and comments on the following: program performance, designs, and budgets; long-term program funding; cost-benefit analysis; market potential studies; program evaluation; design of the societal benefits charge credit program (a self-directed energy efficiency program); marketing; and overall administrative structure.
- Facilitate residential, commercial, and industrial policy working groups and manage supporting technical analysis of working group recommendations to reduce greenhouse gas emissions in Colorado, South Carolina, and Maryland.
- Research historical emissions of criteria and hazardous air pollutants, greenhouse gases, and coal combustion wastes. Research and develop potential state and local emissions mitigation strategies, such as for reducing ambient fine particulates in New York City.
- Conduct surveys of regional, state, and utility policies and practices regarding ratemaking for energy efficiency, power procurement, risk management, and fuel diversity.
- Research federal, regional, and state case histories on integrated resource planning, power procurement, power plant operations, renewable portfolio standards, and market power.
- Monitor and analyze electricity, coal, and emissions allowance market data, models, and projections, as well as economic and policy developments that impact these markets.
- Write and edit reports, expert testimony, and discovery questions and responses.

Resource Insight, Inc., Arlington, MA. *Research Assistant*, 2003-2005.

Responsible for conducting research and analysis on electric, gas, steam, and water resource issues. Conducted discounted cash flow analysis for asset valuation; developed market-price benchmarks for analysis of power-supply bids using market and regulated prices for energy, capacity, ancillary services, transmission, and ISO services and adjusting for load shape, assignment of transmission rights, and losses. Prepared discovery responses, formal objections, comments, and testimony; collaboratively wrote and edited reports; created and formatted exhibits. Participated in drafting an Energy Plan for New York City. Edited solicitation for competitive power supply to serve aggregated municipal load.

University of Massachusetts, Amherst, MA. *Teaching Assistant*, 2001-2002.

Developed and taught lessons on applied math to a diverse group of incoming graduates; tutored students in microeconomic theory and cost benefit analysis; graded problem sets and memoranda.

International Council for Local Environmental Initiatives, Berkeley, CA. *Cities for Climate Protection Intern for the City of Northampton, MA*, 2001.

Compiled primary and secondary source data on energy consumption and solid waste generation by the municipal government, city residents, and businesses; applied emissions coefficients to calculate total greenhouse gas (GHG) emissions; identified current and planned municipal policies that impact GHG emissions; researched the predicted effects of global warming locally; gathered public feedback to provide acceptable and proactive policy alternatives. Composed a GHG emissions inventory describing research findings; wrote and distributed a policy report and press releases; gave newspaper and radio interviews; addressed public officials and the public during a televised meeting.

University of Massachusetts, Amherst, MA. *Research Assistant*, 2000-2001.

Located federal data sources, identified changes, and updated a research database to evaluate the Habitat Conservation Program; proofread articles and white papers; composed a literature review on land use modelling. Collaboratively administered, tested, and proposed interface enhancements for a web-based data warehouse of regional habitat change research; formally presented the system to an independent research group.

Court Square Data Group, Inc., Springfield, MA.

Administration Manager, 1998-2000.

Analysed profitability and diversity of income sources; managed cash flow, expense, and income data; created budgets; devised and implemented procedures to increase administrative efficiency; implemented new accounting system with minimal disruption to workflow.

Project Administrator, 1996-1998.

Coordinated implementation of software features; identified opportunities for future development; monitored problem resolution; wrote and coordinated production of a user's manual and questionnaires; edited technical proposals and a business plan.

EDUCATION

University of Massachusetts, Amherst, MA
Master of Public Administration, 2002

Rutgers University, New Brunswick, NJ
Bachelor of Arts in Economics, 1995

Syracuse University, Syracuse, NY, 1994

PUBLICATIONS

Biewald, B., J. Daniel, J. Fisher, P. Luckow, A. Napoleon, N. R. Santen, K. Takahashi. 2015. *Air Emissions Displacement by Energy Efficiency and Renewable Energy.* Synapse Energy Economics.

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Daniel, J. A. Napoleon, T. Comings, S. Fields. 2015. *Comments on Entergy Louisiana's 2015 Integrated Resource Plan*. Synapse Energy Economics for Sierra Club.

Whited, M., T. Woolf, A. Napoleon. 2015. *Utility Performance Incentive Mechanisms: A Handbook for Regulators*. Synapse Energy Economics for the Western Interstate Energy Board.

Takahashi, K. 2014. *Maximizing Public Benefit through Energy Efficiency Investments.* Synapse Energy Economics for Sierra Club.

Keith, G., S. Jackson, A. Napoleon, T. Comings, J. Ramey. 2012. *The Hidden Costs of Electricity: Comparing the Hidden Costs of Power Generation Fuels.* Synapse Energy Economics for Civil Society Institute.

Keith, G., B. Biewald, K. Takahashi, A. Napoleon, N. Hughes, L. Mancinelli, E. Brandt. 2010. *Beyond Business as Usual: Investigating a Future without Coal and Nuclear Power in the US.* Synapse Energy Economics for Civil Society Institute.

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Resume dated July 2015

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Associate*, June 2013 – present, *Research Associate*, January 2012 – June 2013.

- Conducts research and performs analysis with a special focus on energy efficiency topics, including: energy efficiency research and development; efficiency standards and building codes; ratepayer-funded efficiency programs; energy efficiency as a central component in utility integrated resource planning; and the role of efficiency in addressing climate change.
- Assists in the evaluation of energy efficiency program design and implementation, including: efficiency technology assessment; program design and budgeting; cost-benefit analyses; avoided cost analyses; and regulatory policies, including program cost recovery, utility performance incentives, and revenue decoupling.
- Creator of several proprietary Excel-based models designed to forecast the impacts of energy efficiency, including its impact on customers' rates and bills, expected savings and benefits, and budget forecasting.

Massachusetts Department of Public Utilities, Boston, MA. *Economist in Electric Power Division*, July 2008 – December 2011.

- Specialized in the review of electric utilities' energy efficiency activities
- Established efficiency policy by recommending decisions to the Commission on issues related to cost-effectiveness, cost-recovery, and utility performance incentives. Managed timely approval of Massachusetts utilities' 2008-2012 efficiency plans and 2006-2010 efficiency reports by analyzing program implementation and reviewing evaluation studies.
- Created a model that analyzes all impacts of efficiency on consumers' rates and bills. Led stakeholder working groups, and investigated energy efficiency as a central component in utility integrated resource planning.

EDUCATION

Boston College, Chestnut Hill, MA
Bachelor of Arts in Economics, 2008. *Cum Laude*.

LEED Green Associate Accreditation, March 2012

PUBLICATIONS

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, E. Karaca, G. Keith, E. Malone, W. Ong, P. Peterson, L. Silvestrini, K. Takahashi, R. Wilson. 2015. *Massachusetts Low Gas Demand Analysis: Final Report.* Synapse Energy Economics for the Massachusetts Department of Energy Resources.

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