Exhibit L.GEC.1

Before the Ontario Energy Board

EB-2015-0029 and EB-2015-0049

Union and Enbridge 2015-2020 DSM Plans

Prepared by:

Chris Neme
Energy Futures Group

For:
The Green Energy Coalition
David Suzuki Foundation
Greenpeace Canada
Sierra Club of Canada

July 29, 2015

I. Introduction

Both Enbridge Gas Distribution and Union Gas recently filed six year Demand-Side Management (DSM) plans, covering the period 2015 through 2020. Those plans were informed by the Ontario government's "conservation first" policy and by the 2015-2020 Gas DSM Framework[1] and Filing Guidelines[2] produced by the Ontario Energy Board (OEB) on December 22, 2015 in response to the Ontario Energy Minister's Directive on that policy.[3]

This report critiques several key aspects of the utilities' DSM filings. It focuses particular attention on the following topics identified for consideration in this case by the OEB:

- The adequacy and reasonableness of the utilities' proposed savings and other targets (Topic 2);
- The adequacy and reasonableness of the utilities' proposed budgets (Topic 3);
- The reasonableness of the utilities proposed shareholder incentive structures and metrics (Topic 4, also related to Topic 2);
- The utilities' proposed approach to governance of evaluation, measurement and verification (Topic 6); and
- The adequacy and reasonableness of the utilities' proposed approaches to assessing the potential role of DSM in addressing future infrastructure capacity needs (Topic 12).

With respect to the first three of the bullets above, my focus is specifically on the 2016-2020 period.

The development of this evidence was coordinated with the development of evidence filed on behalf of the Green Energy Coalition (GEC) by Paul Chernick of Resource Insight. In particular, it relies on Mr. Chernick's assessment of the magnitude of avoided costs that benefit all gas ratepayers to inform discussion of reasonable future DSM budget levels.

Mr. Neme, the author of this report, has more than 20 years of experience with the design, implementation and evaluation of energy efficiency programs and policies. He previously filed testimony on DSM/CDM issues before the Ontario Energy Board on numerous occasions over the past two decades (EBRO 487, EBRO 493/494, EBRO 497, EBRO 499, RP-1999-0001, RP-1999-0017, RP-2001-0029, RP-2001-0032, RP-2002-0133, RP-2003-0063, RP-2003-0203, EB-2005-0211, EB-2005-0001, EB-2005-0523, EB-2006-0021, EB-2008-0346, EB-2010-0279; EB-2012-0337; EB-2013-0451), as well as before similar regulatory bodies in Quebec, Connecticut, Illinois, Maine, Maryland, Michigan, New Jersey, Ohio and Vermont. Mr. Neme is also intimately familiar with Enbridge's and Union's current and past DSM efforts from serving on the current Ontario Technical

[1] Ontario Energy Board, Demand-Side Management Framework for Natural Gas Distributors (2015-2020), EB-2014-0134 Report of the Board, December 22, 2014.
[2] Ontario Energy Board, Filing Guidelines to the Demand Side Management Framework for Natural Gas Distributors (2015-2020), EB-2014-0134, December 22, 2014.
[3] Directive from Energy Minister Bob Chiarelli to the Ontario Energy Board, March 31, 2014.

Evaluation Committee (TEC), from serving on all but one of Enbridge's annual DSM Audit Committees since they were first formed in 2000 as well as several past Union Audit Committees, and from having played a lead role in negotiating the settlement agreements between both Enbridge and Union and stakeholder groups on both utilities' 2012-2014 DSM plans. In addition to his work in Ontario for the GEC, Mr. Neme has consulted on DSM issues for clients in several other Canadian provinces, more than 25 different U.S. states, and several countries in Europe. That includes extensive experience with the integration of DSM into system planning which culminated earlier this year in an updated publication of a report on North American experience with the use of energy efficiency to defer electric transmission and/or distribution system investments.[4] Mr. Neme's Curriculum Vitae is provided as Appendix A.

[4] Neme, Chris and Jim Grevatt (Energy Futures Group), *"Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments"*, published by Northeast Energy Efficiency Partnerships, January 9, 2015. (see: http://www.neep.org/initiatives/emv-forum/forum-products#Geotargeting).

II. Testimony Summary

My analysis of both the evidence presented by Enbridge and Union in their 2015-2020 DSM plans, as well as analysis of relevant data and information from other jurisdictions, leads me to a number of key conclusions. Those conclusions are presented in this section. More detailed analysis supporting the conclusions is provided in ensuing sections.

1. Savings Targets and Budgets (Issues 2 and 3)

A. **Both utilities' proposed savings goals are inconsistent with the province's "conservation first" policy**. Both companies have proposed savings levels over the 2016-2020 period that are roughly half of what leading jurisdictions have already achieved.[5] Though Enbridge's proposed savings are higher than their programs have achieved in recent years, Union's are dramatically lower, with the result being that annual savings province-wide will actually be lower in every year from 2016 to 2020 than they were in every year from 2012 to 2014. Both utilities are also continuing to forecast extremely low participation rates for a number of key efficiency technologies and programs.

At a high level, there are four factors that underpin the utilities' low savings targets:

- **a.** **Budget constraints** – both utilities limit their DSM budgets to the levels suggested in the Board's recent gas DSM framework and guidelines;
- **b.** **Union's cancelling of its large industrial program** – Union followed the framework's/guidelines' suggestion to stop offering its self-direct program;
- **c.** **Greater emphasis on smaller customers** – both utilities propose placing greater emphasis on treating efficiency opportunities from residential and smaller business customers, from which savings are typically more expensive to acquire (though still cost-effective); and
- **d.** **Conservative savings estimates** – both utilities appear to have used conservative assumptions regarding the savings yields from some of their proposed programs.

B. **The utilities should have higher budgets to acquire greater savings.** The utilities argue that their budgets are appropriate because they follow the Board's guidelines to limit spending to the equivalent of approximately $2 per month per residential customer. There are several problems with that argument:

a. **New Provincial policy commitments to carbon emission reductions should render 2014 budget guidance obsolete.** The policy landscape has changed since

[5] Note that throughout this evidence I often refer to annual savings rather than the lifetime savings that are the focus of the utilities' performance metrics. That is done simply to make comparisons across jurisdictions possible, as many jurisdictions do not report lifetime savings. Lifetimes savings is a better metric of performance and should still be the basis for assessments of utility performance.

December 2014, the month that the Board's framework/guidelines were completed. In particular, the province of Ontario has made several critically important commitments to reducing carbon emissions and addressing climate change. That includes joining Quebec, British Columbia, California, and other sub-national jurisdictions in re-affirming a commitment to at least an 80% carbon emission reduction by 2050;[6,7] the establishment of a new commitment to a 37% carbon emission reduction in the province by 2030;[8] and the commitment to imposing a carbon "cap-and-trade" policy to meeting those requirements.[9] The cost of carbon emission reductions will be borne by all customers, including DSM non-participants. Thus, if carbon emission reductions from efficiency are constrained by a $2 per month spending cap, gas customers (including non-participants in DSM programs) will have to pay for more carbon emission allowances and/or for other (likely more expensive) approaches to reducing emissions.

b. **Even if $2 per month per non-participating residential customers were an appropriate limit for the impact of gas DSM, the limit should be expressed as $2 per month *net of both DSM spending and DSM benefits to non-participants*.** Gas DSM produces several system-wide benefits – including reduced capital expenditures on transmission and distribution, commodity price suppression effects, the ability to purchase less of the more expensive gas and reduced carbon regulation compliance costs – that put offsetting downward pressure on rates. Thus, even if it were appropriate to cap the level of DSM spending in order to limit the impact on the average non-participating residential customer to $2 per month, the cap should be set such that the impact on non-participants is $2 per month from the *combined effects* of DSM spending and system-wide benefits. Mr. Chernick's analysis suggests that, in aggregate, the magnitude of the system-wide benefits for the utilities' proposed DSM plans is equal to 1½ times (or more) the size of the budgets in those plans. Put another way, the combined effect on rates of both the DSM spending and the system-wide benefits from the utilities proposed plans should be a *reduction* of about $1 per month over the over the life of the efficiency measures funded. Clearly, significant additional DSM spending – which will produce additional system-wide benefits – could be pursued without crossing a $2 per month *net* rate impact on consumers.

c. **OEB Guidelines are not requirements.** Indeed, the utilities' proposed plans

[6] California, Ontario, Quebec, British Columbia, "Joint Statement on Climate Change", December 2014 (see: http://www.ontario.ca/document/joint-statement-climate-change?_ga=1.184104870.1411524858.1437404779)
[7] SustainableBusiness.com News, "Under 2 MOU signed by 12 Governments", 05/20/2015 (see: http://www.sustainablebusiness.com/index.cfm/go/news.display/id/26305)
[8] Ontario Ministry of the Environment and Climate Change, "Ontario First Province in Canada to Set 2030 Greenhouse Gas Pollution Reduction Target", May 14, 2015 press release (http://news.ontario.ca/ene/en/2015/05/ontario-first-province-in-canada-to-set-2030-greenhouse-gas-pollution-reduction-target.html)
[9] Office of the Ontario Premier, "Cap and Trade System to Limit Greenhouse Gas Pollution in Ontario", April 3, 2015 press release. (see: http://news.ontario.ca/opo/en/2015/04/cap-and-trade-system-to-limit-greenhouse-gas-pollution-in-ontario.html)

selectively deviate from the guidelines in a variety of other ways.[10] To the extent the utilities found that sticking to the guidelines would leave large volumes of cost-effective savings untapped and/or made it more costly to address future carbon regulations, they should have proposed larger budgets. Indeed, the Board's guidelines called for the utilities to assess alternative budgets.

C. **Union Gas should continue its current large industrial "self direct" program (though with some modifications to improve its design).** This program accounted for roughly half of Union's total 2013 and 2014 savings – *even after adjusting for an assumed free rider rate of 54%*. Thus, the scrapping of this program is the single biggest reason for the dramatic decline in forecast gas savings for both Union and the province. In its framework and guidelines, the Board articulated two reasons for not requiring the large industrial customers to participate in funding efficiency programs: (1) that there are concerns about "one customer subsidizing business improvements of another";[11] and (2) that the large customers were both sufficiently sophisticated and motivated to invest in efficiency on their own. However, the Self Direct program model that Union adopted for these customers starting in 2013 already effectively eliminated the concern about cross-participant subsidies. There is also no empirical evidence – from Ontario or any other jurisdiction – to suggest that large customers pursue all cost-effective efficiency measures absent efficiency programs. Thus, scrapping the program effectively means foregoing some of the largest and most cost-effective savings Union and the province could acquire. That is not to say that the self-direct program needs to stay unchanged. For example, it could:

- be made more flexible by allowing for multi-year budgets and projects as I discussed in my EB-2012-0337 testimony;
- be designed to reduce potential concerns about free ridership by limiting the range of measures it could be used to fund;
- include, as a couple of other jurisdictions have done, an opt out provision for those customers that can truly demonstrate that they have already comprehensively addressed all cost-effective efficiency opportunities – e.g. if an independently hired auditor can demonstrate that all efficiency measures with less than a 10 year payback have already been implemented.

D. **While it is appropriate to use some additional budget to better serve historically under-served customers, it is inappropriate to actually reduce savings from the most cost-effective sources at a time when budgets are doubling**. Both utilities' DSM plans, but particularly Enbridge's, embody significant shifts in emphasis towards addressing efficiency opportunities for smaller customers. As a general matter, doing more to address harder-to-reach customer segments is a reasonable objective. However, in Union's case, that is being done at the expense of acquiring still relatively

[10] Examples include Union's proposal to earn its maximum performance incentive when it meets 125% of its targets instead of the 150% suggested by the guidelines, Union's proposal to include Rate T1 in its C&I program portfolio, Union's refusal to present a transition plan for integrating DSM into infrastructure planning and Enbridge's proposal to allocate a little more than 40% of funding to the residential class. Some of those proposals have merit.

[11] OEB DSM Framework, p. 27.

inexpensive savings from large customers. Not only is Union terminating its large industrial program, it is also planning to reduce savings from its next largest commercial and industrial (C&I) customers. Needless to say, an even larger budget would make it easier for the utilities to better address the otherwise competing objectives of maximizing acquisition of inexpensive savings while both bringing the benefits of DSM to a wider swath of customers and promoting deeper, more comprehensive savings.

E. **The utilities' analyses of the impacts of alternative budget scenarios are fraught with problems and woefully inadequate.** Neither utility reported the impact of changes in spending levels on net economic benefits. Neither attempted to optimize where additional spending would go. Neither explicitly considered changes to their base program designs, let alone how such changes might impact free rider levels. Union's analysis was particularly limited in scope. And the estimates of changes in savings that it did provide were understated because of unreasonable assumptions about administrative costs and what it would take to increase participation in its home retrofit program. Though Enbridge's analysis was more systematic than Union's, it made the fundamental mistake of relying on its flawed potential study to estimate how much additional savings more spending would produce. It then compounded that mistake by developing a formula for estimating savings that had a basic mathematical error which rendered the Company's savings estimates not reflective of even its flawed potential study results.

F. **The utilities could at least double their proposed levels of savings within a couple of years, with substantial economic benefits for their ratepayers**. Though a detailed, program-by-program build-up would be necessary to fully develop estimates of the magnitude of the incremental economic benefits such increases would produce, they are likely to be on the order of several hundred million dollars of TRC net benefits for every year at that higher level of savings. The same detailed analysis would be needed to precisely estimate the magnitude of the increased budget required to produce the additional savings. However, even if the added cost of acquiring the additional savings was twice what the utilities are estimating for the savings in their filed plans (and they could be less expensive than that), the system-wide benefits from total savings that the spending would achieve would be approximately equal to the upward pressure on rates from DSM spending. Put another way, there would be roughly zero impact on rates from the combined lifecycle impact of those two factors.

2. Shareholder Incentive Structure and Metrics

G. **Some of the utilities' proposed performance metrics appear reasonable given the shift in emphasis to smaller customers; others are problematic:**

   a. **Enbridge's Resource Acquisition and Low Income metrics appear mostly reasonable, but may require some tweaks**. At a high level, Enbridge's proposed savings levels for most of its resource acquisition programs and low income programs appear reasonable given the Company's past experience with similar programs and the changes in direction planned

for the next several years. The only possible exception is its proposed cost per unit of savings from its small business direct install program. Enbridge should be required to justify why that program appears more expensive than those of other gas utilities before its small customer savings target is accepted. Enbridge's low income single family savings target also seems a little low. The other concern I have is keeping both a very inexpensive large customer savings metric and much more expensive small customer savings targets in the same scorecard. That invites "gaming" (i.e. shifting emphasis to less expensive savings once the plan is approved). A potential alternative to splitting the metrics into two scorecards is to put a limit (i.e. 150% of its weight) to how much any metric can contribute to a multi-metric scorecard score. That would also address other problems experienced in the past.

b. **Enbridge's Market Transformation and Energy Management metrics should be changed in several ways.** Several of the programs in this portfolio are not conducive to performance metrics because they are either primarily designed to improve general customer awareness of efficiency or to test new program concepts. Also, several of the specific proposed metric values appear unreasonably low.
c. **Union's Resource Acquisition and Low Income metrics require further scrutiny.** The implicit cost per unit of savings in its Resource Acquisition portfolio has increased by a factor of more than two. While about half of that change is attributable to a significant expansion of more expensive residential programs, the rationale for the other half is less clear. In particular, there does not appear to be any basis for reducing C&I custom savings relative to 2014 levels while increasing spending per unit of savings from the program.
d. **Union's Market Transformation portfolio.** The lone metric proposed for just 2016 is reasonable. However, the absence of any market transformation programs after that is troubling.
e. **Union's "Performance-Based" programs and metrics should not be in a separate scorecard.** These programs are designed to generate savings, so they should ultimately be included in the Resource Acquisition portfolio. It might be reasonable to keep them in a separate "pilot programs" category for a year or two while they are tested and developed. However, it does not make sense to put performance metrics on pilot programs.

3. EM&V Governance

H. **The current Technical Evaluation Committee (TEC) and Audit Committee (AC) processes work fairly well and should be retained with some important modifications**. Much has been learned through the utility-stakeholder collaboration on EM&V over the past 15 years, particularly in the past two to three years. Those learnings have been institutionalized in the current TEC and ACs. However, several refinements to those processes would be welcome:

a. Adding Board staff to all of the committees.
b. Removing the last vestiges of control of the Custom Project Savings

Verification (CPSV) processes from the utilities; ideally the Auditor should now hire and manage the CPSV work.

c. Establishing a streamlined process for addressing the few situations in which consensus is not reached in the TEC.

4. Using DSM to Address Future Infrastructure Capacity Needs

I. **Enbridge proposed approach to advancing the consideration of DSM in infrastructure planning has merit, but needs refinement**. In particular, its approach to selecting case studies for analysis needs to be better defined and structured, consistent with industry best practices.

J. **Union's proposed approach to advancing the consideration of DSM in infrastructure planning is woefully inadequate.** The Company did not submit what could reasonably be called a scope of work for its study. Worse still, it refused to present a preliminary transition plan. Finally, it appears to have explicitly violated the Board's order in the GTA case to consider DSM as an alternative to infrastructure investment in all future leave–to-construct cases.

III. Benchmarking Utilities' Savings Targets

1. Overview of the Utilities' Proposed Savings Levels

Consistent with the Board's new gas DSM framework and guidelines, both Enbridge's and Union's plans for 2015 are essentially "roll-overs" of their 2014 plans. Both utilities propose substantial increases in DSM spending in 2016 with much more modest increases in subsequent years. The average proposed spending levels over the 2016-2020 period are within 2% of the annual spending levels suggested in the Board's DSM framework (i.e. $75 million per year for Enbridge and $60 million per year for Union, excluding shareholder incentives). In Enbridge's case, spending roughly 2½ times more in 2020 than in 2014 is forecast to produce an 81% increase in incremental annual savings and a 64% increase in lifetime savings. In Union's case, a near doubling of spending from 2014 to 2020 is forecast to result in a 40% to 50% *reduction* in both incremental annual savings and lifetime savings. The net impact for the province as a whole is a net reduction in both incremental annual savings (a little more than 10% less in 2020 than in 2014) and lifetime energy savings (nearly 20% less from the 2020 spending than was achieved in 2014).

Put simply, the utilities' proposed savings targets are not even close to being consistent with the notion of a "conservation first" policy. The following subsections discuss a number of benchmarks that support those conclusions.

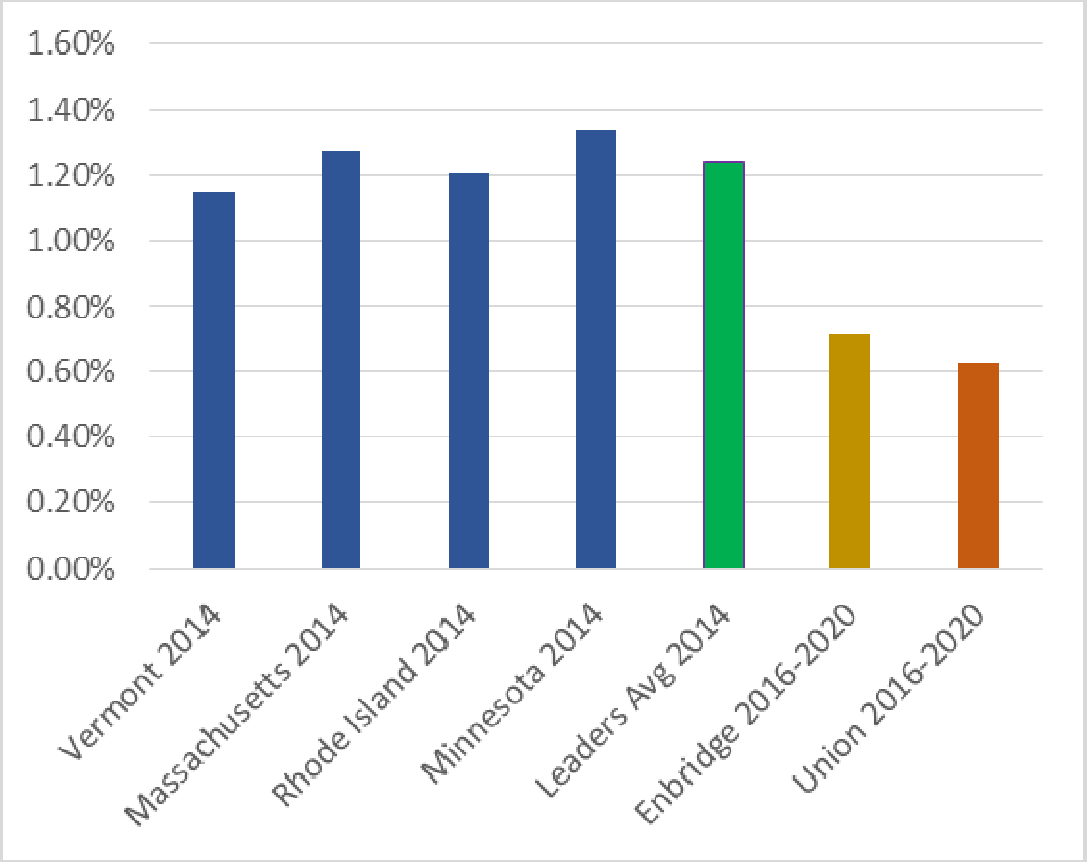
2. Savings Will Be Well Below Leading Jurisdictions

The incremental annual savings forecast by Ontario's utilities equates to approximately 0.6% (Union) to 0.7% (Enbridge) of annual sales to customers other than electric generators over the 2016-2020 period.[12] As Figure 1 shows, leading jurisdictions have already achieved savings levels (actuals for 2014) that are on the order of twice the average of what Enbridge and Union are forecasting to achieve annually over the 2016-2020 period.[13] Like the Ontario utilities, utilities in these jurisdictions all have both cold winter climates and very long histories of running gas efficiency programs.

[12] I focus in this section on savings from and sales to customers other than electric power generators to facilitate "apples to apples" comparisons between utilities. When one includes sales to electric power generators, Union's projected incremental annual savings as a percent of sales is only 0.5%.

[13] I focus on this five year period in their plans because we are already well into 2015, and the Board essentially required a continuation of past programs this year, so it really cannot be considered anything other than a "bridge year" to a new plan.

Figure 1: Annual Savings as % of 2012 Residential, Commercial & Industrial Sales[14]

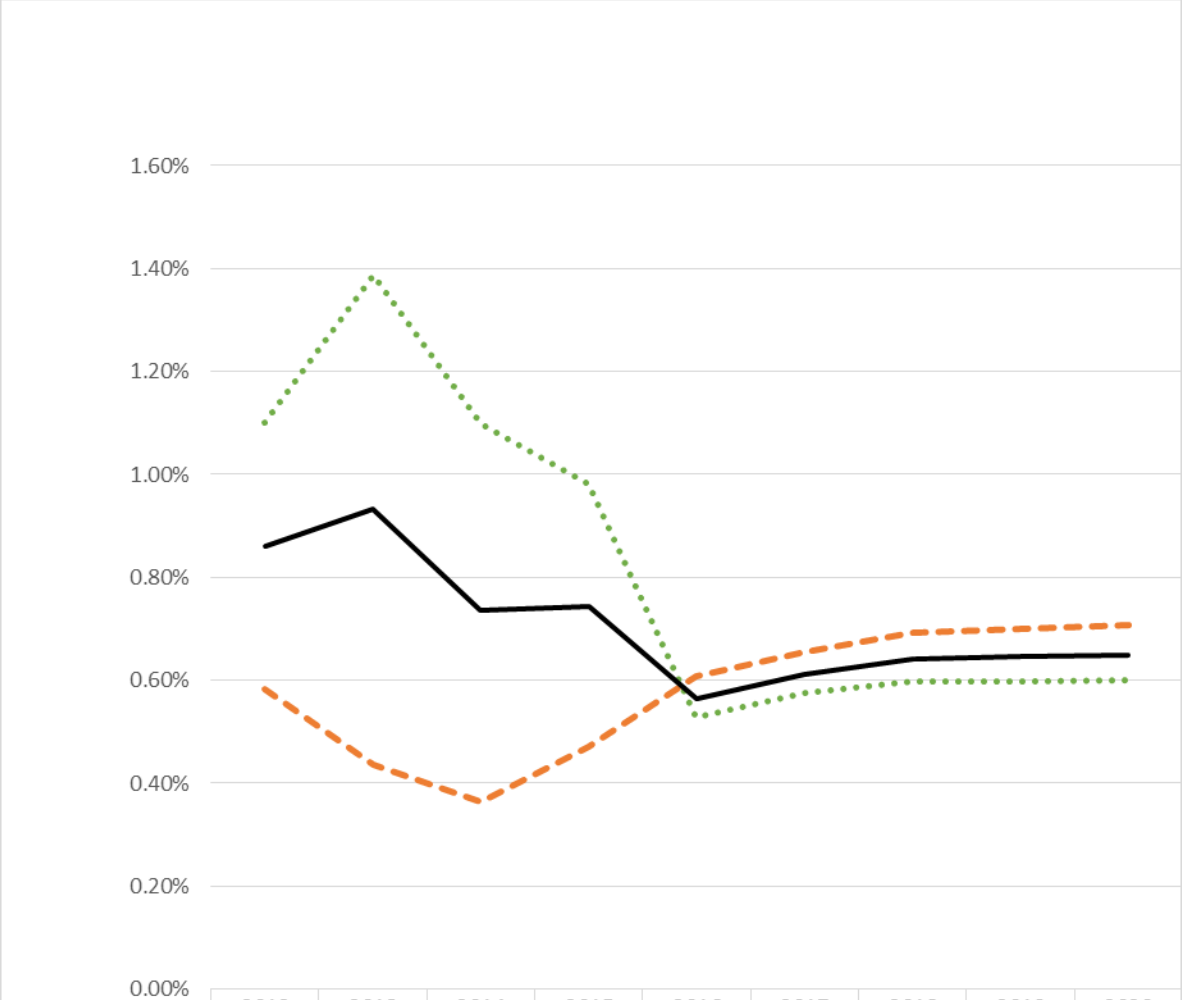


3. Total Ontario Gas Savings will Actually Decline under Utilities' Plans

As noted above, Enbridge is forecasting that its savings over the 2016-2020 period will be substantially higher than in 2014, though savings will not grow as quickly as spending does. Union is forecasting a substantial reduction in savings. As Figure 2 shows, the net effect at the provincial level (the black line) will be a reduction in savings relative to historic levels. Specifically, savings as a percent of annual sales will be lower in every year from 2016 to 2020 than they were in every year from 2012 to 2014. On average savings in the 2016 to 2020 period will be about 25% below the combined utilities' 2012-2014 average savings levels.

[14] Savings in the years indicated are compared to 2012 sales to normalize across jurisdictions to a year for which sales data are readily available. Normalizing to a historic year ensures that variances related to such factors as the severity of winters are minimized. 2012 sales volumes for leading jurisdictions are from the U.S. Energy Information Administration (form 176 data). For Massachusetts, data covers Eversource, National Grid, Unitil, Liberty, and Berkshire Gas (the utilities jointly filing DSM plans). For Minnesota, it covers Centerpoint, Great Plains, Interstate Power and Light, Minnesota Energy Resources and Xcel (utilities for which savings data were readily available). In both Vermont and Rhode Island, all gas is sold by just one regulated utility (Vermont Gas and National Grid, respectively). 2014 savings estimates for Vermont, Rhode Island and Massachusetts are from their utilities' annual reports; 2014 savings estimates for the Minnesota utilities were accessed via E-Source (which gets them from the utilities annual reports).

Figure 2: Ontario Gas Savings as % of Sales (2012-2020)[15]



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Enbridge	0.58%	0.44%	0.36%	0.47%	0.61%	0.66%	0.69%	0.70%	0.71%
Union	1.10%	1.39%	1.10%	0.98%	0.53%	0.58%	0.60%	0.60%	0.60%
Ontario	0.86%	0.93%	0.74%	0.74%	0.57%	0.61%	0.64%	0.65%	0.65%

3. Utilities Forecasting Very Low Market Penetrations for Many Measures

Another set of indicators of the aggressiveness or comprehensiveness of the utilities' efficiency program proposals are the levels of market penetration that they are proposing to achieve. Of course, estimating market penetrations requires that one first estimate the size of the eligible market. That can be a challenging exercise, particularly in the context of a proceeding like this one in which there is a wide range of issues to address, there are significant time constraints and prudency in resource expenditure preclude primary data

[15] All values are for savings and sales to customers other than electric power generators. In this graph, savings are compared to actual (2012-2014), forecast gas sales for 2015-2016 by both utilities and forecast gas sales for 2017 by Union. Enbridge has not forecast gas sales after 2016; Union has not forecast sales after 2017. For subsequent years, we assume that the average rate of growth will be equivalent to the most recent year for which each utility provided an estimate.

collection. However, relying on existing information, I have estimated market shares for a diverse selection of efficiency measures which both utilities could or already do include in their prescriptive commercial and industrial rebate programs. The measures addressed include a water heating measure, a ventilation measure, a building envelop measure and Energy Star commercial cooking equipment.[16]

The results of my analysis are presented in Tables 1 and 2 below. As the tables show, both Enbridge and Union are proposing participation levels for each of the measures analyzed that represent less than 15% market penetrations in every case and less than 5% in several cases. These results further support the notion that the utilities' proposed plans will leave enormous amounts of cost-effective savings untapped.

Table 1: Market Shares for Selected Enbridge C&I Measures

Measure	Potential annual market	2017 participants proposed	2017 participation rate
Commercial roof insulation when reroofing[17]	4,680	0	0.0%
Commercial condensing hot water tanks[18]	2,964	0	0.0%
Demand controlled kitchen ventilation[19]	1,793	143	8.0%
Commercial cooking equipment[20]	2,286	278	12.2%

[16] I also attempted to estimate market shares for one or more space heating technologies but that proved to be impossible given data that were readily available.

[17] Enbridge's roughly 156,000 commercial customers ("Commercial Market Segmentation" provided during Enbridge March 2015 Consultations). If roof insulation has a 25 year replacement cycle this would be 4% or an annual market of 6,240. However Union's Conservation Potential study used ~3% of the commercial customer base for this measure (Union's Achievable Potential (EB-2011-0327, Exhibit A, Tab 1, Appendix K) so I do the same. No participation is specifically forecasted in Enbridge's C/I program (I.T5.EGDI.GEC.22). It is possible that some jobs may occur within custom projects. However, my experience in reviewing custom projects as part of the Enbridge Audit Committees suggests such cases are likely to be extremely rare.

[18] NRCan indicates 13,000 commercial tank type water heaters are sold annually in Canada. (http://www.nrcan.gc.ca/energy/regulations-codes-standards/bulletins/7191) With 38% of Canada's population in Ontario (http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo02a-eng.htm), and Enbridge serving ~60% of Ontario's population the market is roughly 2,964 units per year. Participation from I.T5.EGDI.GEC.22 b (i) and b (ii).

[19] Market size for Demand Controlled Kitchen Ventilation starts with the Consortium for Energy Efficiency's estimate that 89,000-125,000 new kitchen ventilation systems are sold in the US each year. I use 100,000. (http://library.cee1.org/sites/default/files/library/6091/CEE_CommKit_ProgramDesignGuidanceCKV_5Oct2010.pdf.) Canada has 11% of the US population and Ontario is 38% of Canada, suggesting 4,180 may be sold in Ontario annually. NRCan shows 72.3% of Ontario households are gas heated (http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=on&rn=14&page=0). Enbridge's share of these is assumed to be proportional to the Union/Enbridge residential customer count of 1.3 million / 1.9 million. 1.9/(1.3+1.9) = 59.4% * 72.3% * 4180 = 1793.

[20] Cooking equipment measures include fryers, convection ovens, broilers and steam cookers. Potential markets are derived from the ratio of Enbridge's to Union's commercial customer counts and Union's potential market as shown in Table 2. Union's 114,355 commercial customers (See Union Exh A/T1 Appendix A Sch 5) and Enbridge's 156,021 from "Commercial Market Segmentation" provided during March 2015 Consultations suggests Enbridge has a 36.4% larger market. 2017 participants from I.T5.EGDI.GEC.22 b (i) and b (ii).

Table 2: Market Shares for Selected Union C&I Measures

Program & Measure	Potential annual market	2017 participants proposed	2017 participation rate
Commercial roof insulation when reroofing[21]	3,200	0	0%
Commercial condensing hot water tanks[22]	1,900	280	14.7%
Demand controlled kitchen ventilation[23]	1,229	50	4.1%
Commercial cooking equipment[24]	1,676	170	10.1%

[21] Re Insulation market size; EB-2011-0327, Exhibit A, Tab 1, Appendix K. ICF MARBEK NATURAL GAS ENERGY EFFICIENCY POTENTIAL STUDY, Commercial Sector Report Appendix F page 1, Union Gas July 2011. No insulation participants are reported in 2014 or specifically forecasted in Union's C/I program. Although some jobs may occur within the Custom projects, GEC's experience with review of custom projects through the Union Audit Committees suggests such cases are likely to be very rare.

[22] Re Commercial hot water tank market NRCan indicates 13,000 commercial tank type water heaters are sold annually in Canada. (http://www.nrcan.gc.ca/energy/regulations-codes-standards/bulletins/7191). With 38% of Canada's population in Ontario (http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo02a-eng.htm), and Union serving ~40% of Ontario's population the market is roughly 1,900 units per year. 2017 participants from B2.T2.Union.GEC.45a (vi).

[23] Market size for Demand Controlled Kitchen Ventilation starts with the Consortium for Energy Efficiency's estimate that 89,000-125,000 new kitchen ventilation systems are sold in the US each year. I use 100,000. (http://library.cee1.org/sites/default/files/library/6091/CEE_CommKit_ProgramDesignGuidanceCKV_5Oct2010.pdf.) Canada has 11% of the US population and Ontario is 38% of Canada, suggesting 4,180 may be sold in Ontario annually. NRCan shows 72.3% of Ontario households are gas heated (http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=on&rn=14&page=0). Union's share of these is assumed to be proportional to the Union/Enbridge residential customer count of 1.3 million / 1.9 million. 1.3/(1.3+1.9) = 40.6% * 72.3% * 4180 = 1229.
Union Gas 2017 participants from B2.T2.Union.GEC.45a (vi)

[24] Food service measures included are fryers, broilers, convection ovens and steam cookers. Potential markets from B.T13.Union.GEC.28 Attachment 5, page viii Table 0-2. 2017 participants from B2.T2.Union.GEC.45a (vi).

4. Key Reasons for Low Forecast Savings

At a high level, there are four factors that appear to drive the utilities' relatively low savings targets:

1. **Budget constraints –** both utilities' limit their DSM budgets to the levels suggested in the Board's recent gas DSM framework and guidelines;
2. **Union's cancelling of its large industrial program –** Union followed the framework's/guidelines' suggestion to stop offering its self-direct program;
3. **Greater emphasis on smaller customers –** both utilities' propose placing greater emphasis on treating efficiency opportunities from residential and smaller business customers, from which savings are typically more expensive to acquire (though still cost-effective); and
4. **Conservative savings estimates –** both utilities appear to use conservative assumptions regarding the savings yields from some of their proposed programs.

Each of these are discussed in more detail below.

IV. Utility Budget Proposals

1. Benchmarking 2016-2020 Ontario Gas DSM Budgets

As noted above, both Enbridge and Union have proposed budgets for the 2016-2020 period that are consistent with the Board's December 2014 gas DSM framework and filing guidelines which suggested that budgets be capped at approximately $2 per month per residential customer (and the equivalent for business customers). The result is proposed spending levels that are low compared to leading jurisdictions.

Consider, for example, the American Council for an Energy Efficient Economy's (ACEEE's) most recent state efficiency scorecard.[25] Among other indicators, the scorecard ranks states by the size of their gas efficiency program budgets. The metric that they use is spending per residential customer. The top 8 states in 2013 – those to which ACEEE gave its highest score on this metric – spent an average of $91 CDN per residential customer.[26] That is more than double what both Enbridge ($35) and Union ($41) are forecasting they will spend per residential customer (in 2015 dollars) over the 2016-2020 period. Even the lowest spending of those eight leading states (New York) was spending about 80% more in 2013 than the average the Ontario utilities have collectively proposed to spend annually over the 2016-2020 period. Put another way, Enbridge's and Union's proposed average spending levels for 2016-2020 would have put them in ACEEE's 3rd tier of states in 2013.[27]

2. Implications of Ontario Climate Policy for DSM Budgets

In 2007, the Ontario government adopted the following set of greenhouse gas emission reductions targets:

- 6% reduction below 1990 levels by 2014;
- 15% reduction below 1990 levels by 2020; and
- 80% reduction below 1990 levels by 2050.[28]

In subsequent years, additional climate policies, including the "conservation first" policy, were adopted. More recently additional significant policy commitments have been made. For example, the province recently joined Quebec, British Columbia, California, and other sub-national jurisdictions in re-affirming a commitment to at least an 80% carbon emission reduction by 2050.[29,30] In the Spring of 2015 it also established a new commitment to a

[25] Gilleo, Annie et al., "The 2014 State Energy Efficiency Scorecard", ACEEE Report Number U1408, October 2014.
[26] The average was $68.51 in 2013 U.S. dollars. That value is escalated by 2.4% to convert to 2015 USD and then by 30.3% to convert to 2015 Canadian dollars.
[27] There are only five tiers, and the fifth tier is essentially for the states that are not doing anything with gas DSM.
[28] Ontario Ministry of the Environment and Climate Change, "Ontario's Climate Change Update 2014", p. 4.
[29] California, Ontario, Quebec, British Columbia, "Joint Statement on Climate Change", December 2014 (see: http://www.ontario.ca/document/joint-statement-climate-change?_ga=1.184104870.1411524858.1437404779)
[30] SustainableBusiness.com News, "Under 2 MOU signed by 12 Governments", 05/20/2015 (see:

37% carbon emission reduction in the province by 2030[31] and committed to imposing a carbon "cap-and-trade" policy to meet those requirements.[32]

These policy decisions, including the most recent commitments made just several months ago, raise questions about whether the OEB's 2014 gas DSM budget guidelines are outdated. Though the province was expected to meet its 2014 target, it is currently expected to fall about 30% (about 19 megatonnes) short of the emission reductions required to meet its 2020 target.[33,34] Absent new policies or programs (i.e. with the current Climate Change Action Plan as the baseline), the province is currently projected to see its emissions gradually increase back to 1990 levels.[35] Thus, the province will need much greater reductions – on the order of 67 megatonnes – to meet its new 2030 target. That translates to about 4.5 megatonnes reduction per year, which is on the order of 2.5% annually, for each of the next 15 years. Natural gas accounts for approximately 30% of all greenhouse gas emissions in the province, so some portion of the additional future emission reductions will almost certainly have to come from the natural gas sector.

Given the seriousness and aggressiveness of the Province's greenhouse gas emission reduction commitments, one could argue that investment in gas efficiency programs should be constrained only by the cost-effectiveness of such programs (rather than by any arbitrary spending limits). While it is the role of government to develop a carbon emission reduction plan for Ontario, including allocation of reductions across sectors, it is clear that maximizing reductions that have no net cost or even substantial net economic benefits (cost-effective conservation) before investing in more expensive options will minimize the Provincial cost of carbon emission control.

It should also be recognized that any constraints on DSM spending – and by extension, constraints on how much cost-effective energy savings will be acquired – impose additional costs on gas ratepayers in the form of either additional greenhouse gas emission allowances that must be purchased and/or additional costs to reduce emissions through other means. Mr. Chernick's preliminary estimates are that the value of carbon allowances can be expected to be on the order of $20 USD per ton per year at the start of a carbon cap and trade system, and increase to more than double that amount by the end of a an average gas efficiency measure's 15 to 20 year life. Based on those estimates, the net present value of an m^3 of annual gas savings that lasts 16 years (a typical average measure life) is close to $1. Both Enbridge and Union are projecting that their filed plans will achieve average incremental annual savings of about 75 million m^3 over the 2016-2020 period. Thus, the

---

http://www.sustainablebusiness.com/index.cfm/go/news.display/id/26305)

[31] Ontario Ministry of the Environment and Climate Change, "Ontario First Province in Canada to Set 2030 Greenhouse Gas Pollution Reduction Target", May 14, 2015 press release (http://news.ontario.ca/ene/en/2015/05/ontario-first-province-in-canada-to-set-2030-greenhouse-gas-pollution-reduction-target.html)

[32] Office of the Ontario Premier, "Cap and Trade System to Limit Greenhouse Gas Pollution in Ontario", April 3, 2015 press release. (see: http://news.ontario.ca/opo/en/2015/04/cap-and-trade-system-to-limit-greenhouse-gas-pollution-in-ontario.html)

[33] Ontario Ministry of the Environment and Climate Change, "Ontario's Climate Change Update 2014", p. 4.

[34] Environmental Commissioner of Ontario, "Feeling the heat: Greenhouse Gas Progress Report 2015", July 2015.

[35] Ontario Ministry of the Environment and Climate Change, "Ontario's Climate Change Update 2014", p. 16.

value of avoided carbon emissions would be enough to roughly offset the entire Enbridge DSM budget and to more than offset the entire Union DSM budget. As discussed further below, those are benefits that accrue to all gas ratepayers, including non-participants, once a carbon cap-and-trade regulation is put in place in Ontario.

3. Implications of System-Wide Benefits of Efficiency for DSM Budgets

In establishing its DSM budget guideline as the equivalent of $2 per month per residential customer, the OEB appeared to be attempting to put a limit on the adverse effects that DSM spending would have on non-participants in efficiency programs. However, it also appears that in setting that guideline the Board did not have before it evidence on the magnitude of offsetting benefits that put downward pressure on rates. As Mr. Chernick's evidence demonstrates, there are at least four categories of such benefits:

1. Reductions in the cost of complying with greenhouse gas emission regulations (discussed above);
2. Commodity price suppression effects;
3. Reduced purchases of higher priced gas (a by-product of the fact that the marginal price of gas is higher than the average price reflected in rates); and
4. Avoided capital investment in distribution system infrastructure.

The value of these system-wide benefits, expressed in lifecycle net present value terms per annual m^3 saved, are provided in Table 3 below.

Table 3: Efficiency Benefits that Put Downward Pressure on Rates

		NPV of Lifetime Benefits per Annual m^3 Saved[36]		Average Annual Value from Utilities'2016-2020 DSM Plans (millions $)[37]		Benefits as a % of Average Annual (2016-2020) DSM Plan Budget[38]	
Benefit		**Enbridge**	**Union**	**Enbridge**	**Union**	**Enbridge**	**Union**
1	Avoided carbon regulation costs[39]	$0.98	$0.98	$72.6	$73.3	95%	121%
2	Price suppression effects[40]	$0.08	$0.08	$6.2	$6.2	8%	10%
3	Reduce purchase of most expensive gas[41]	$0.10	$0.03	$7.2	$2.5	9%	4%
4	Avoided distribution system costs[42]	$0.38	$0.24	$28.1	$18.2	37%	30%
	Total	**$1.53**	**$1.33**	**$114.0**	**$100.1**	**150%**	**166%**

[36] Assumes an average measure life of 16 years. All values in 2015 Canadian dollars (CDN).
[37] This is NPV of benefits per annual m3 saved multiplied by the average incremental annual m^3 savings forecast for the 2016-2020 period by Enbridge (74.4 million m^3) and Union (75.1 million m^3).
[38] Enbridge's average annual budget from 2016-2020 is $76.2 million; Union's is $60.4 million.
[39] Valued at Mr. Chernick's estimate of avoided costs of carbon emission regulations. As noted above, Mr. Chernick suggests such values would start at approximately $20 (2014 USD) per ton of CO_2 or $1.18 USD per MBtu of natural gas in the first year of a regulatory scheme. The values per m^3 of reduction are the same for both Enbridge and Union as the market clearing price unit of emissions is likely to be a provincial price.
[40] Mr. Chernick estimates that a 1 billion m^3 reduction in annual gas demand would produce a $0.00027 reduction in price per m^3. Over the 2016-2020 period, I assume that average annual gas sales in Ontario will be approximately 27 billion m^3. Thus, the price reduction benefit to Ontario gas users from a 1 billion m^3 reduction in gas demand would be worth approximately $7.2 million. That equates to a benefit of approximately $0.0072 for one year's worth of a single m^3 of demand reduction. That, in turn translates to a benefit of approximately $0.083 for 16 years (the average measure life) of one m^3 of demand reduction. The magnitude of this benefit is assumed to be the same (per m^3 of savings) for both utilities.
[41] Mr. Chernick estimates that this benefit is equal to approximately $0.013 per m^3 of space heating gas saved per year and $0.011 per m^3 of combined space heating and water heating energy saved per year; there are essentially no such savings from baseload measures (industrial and water heating). Data on the mix of end use gas saved in the utilities' proposed plans were not included in their filing. Thus, I have assumed that the mix (in percentage terms) will be the same as in 2014 for Enbridge and the same as in 2014 for Union excluding the T2/Rate 100 savings. The total benefit per m^3 saved is much greater for Enbridge than for Union because Enbridge got a much larger fraction of its savings in 2014 from space heating measures (over 60%) than Union (less than 30%, even after subtracting out T2/R100 savings). To the extent that the utilities will get more of their savings in future years from space heating these estimated benefits will be conservatively low.
[42] Enbridge used estimates of avoided distribution system costs developed for the Company by Navigant Consulting (Exh. C/T1/S4). The magnitude of those avoided costs varied by a factor of 4, depending on whether the savings were from space heating or from baseload measure end uses like water heating or industrial process efficiency improvements (See Navigant Table 7). Mr. Chernick has found that Enbridge's avoided distribution costs are actually three to five times higher than Navigant estimated for the Company. I have used the mid-point (factor of four) of that range. In this case, I estimated the lifetime NPV of an annual savings of an m^3 using a nominal discount rate (i.e. the 4% real discount rate adjusted for an assumed annual inflation rate of 1.68%) because Navigant estimates were expressed in constant nominal dollars. A weighted average value for the entire Enbridge portfolio was estimated based on the Company's 2014 distribution of savings by end use. Absent better information, the values for Union were assumed to be the same as for Enbridge per end use. However, because Union's savings are assumed to be more baseload heavy and less space heating focused, the weighted average value per m^3 is estimated to be lower for Union.

As Table 3 shows, under the utilities filed plans, the system-wide benefits that accrue to all gas ratepayers, participants and non-participants alike, are more than one and a half times greater than the magnitude of the DSM budgets necessary to produce them. Put another way, the combined effects on rates of *both* DSM budgets *and* the system-wide benefits they produce (under the spending and savings levels the Companies have proposed) would be on the order of $1 per month *reduction* over the life of the efficiency measures installed. Thus, if the Board were to determine that a rate impact of $2 per month is still as large as it was comfortable accepting, there is clearly much more room for increase in DSM spending and savings before that level is reached.

V. Budget Sensitivity Analyses

Both Enbridge and Union present the results of sensitivity analyses that they conducted. However, both utilities' analyses are fraught with problems. To some extent that is understandable because the utilities had relatively little time to develop extensive new plans that were responsive to a number of different new directions given to them by the Board. Nevertheless, their sensitivity analyses provide very little, if any value, in understanding what the impacts of significant variations in DSM budgets might be.

1. Union's Sensitivity Analyses

Union examined three budget sensitivity scenarios – one in which it spends several million dollars less in 2020, another in which it spends approximately $5 million more (as well as all of its 15% DSMVA) and a third in which it spends about $10 million more (as well as all of its 15% DSMVA).[43] In the case of the two increased budget scenarios, the Company identified three existing programs on which it would increase spending, with resulting increases in participation and savings, and one new program it would launch for which it estimated only the cost (suggesting savings could not be estimated because the program was not sufficiently defined). There are a number of concerns with Union's analysis:

- The range of potential budget increases examined is far too limited. The largest budget increase considered - $10 million – represents only about a 17% increase in budget. Even if one includes the 15% DSMVA, the maximum increase considered is only 32%.
- The economic impacts – i.e. the TRC economic benefits of the increased spending, which should be one of the most important considerations when deciding whether the additional spending was warranted – were not reported to the Board.
- Union assumes that 20% of all increased spending would need to go towards administration and evaluation because that is the portion of its base budget that is allocated to those overhead items. This is a highly problematic assumption. The costs of evaluating a program will not change because higher rebates were offered and/or because participation increased. The only thing that might increase evaluation costs is the launch of a new program, and Union included only one very small new program in their analysis. Similarly, the costs of administering programs will not go up – at least not significantly, and certainly not linearly – because rebates are increased and/or participation increases. Thus, Union's sensitivity analysis significantly understates the additional savings that could be acquired by over-estimating how much of the increased spending would go towards items that do not produce savings.

[43] Exh A/T3/Appendix G. All of these amounts are expressed in 2015 dollars, unadjusted for inflation.

- The Company's estimates of the volume of additional participation and savings it could achieve from increase rebate levels for its home retrofit program are unsupportable. In its base budget, the Company has estimated that it would only have 5000 participating homes in 2020. In contrast, Enbridge exceeded that number with its home retrofit program in 2014 and is forecasting that it will have approximately 13,500 participants in 2020. Even after adjusting for the fact that Enbridge has roughly 50% more residential customers, Enbridge's forecast participation is nearly twice the participation rate Union has forecast for its own program with comparable incentive levels. Thus, Union should be able to achieve significant additional participation in this program without raising rebate levels.

2. Enbridge's Sensitivity Analyses

Enbridge also analyzed three budget sensitivity scenarios – one that represented 25% less spending than in its base plan, one that represented 25% greater spending than in its base plan and a third that represented 50% greater spending than in its base plan. Enbridge appeared to approach the sensitivity analysis in a more structured way than Union. In particular, it started by assessing each of its programs to determine which were "scalable" (i.e. could grow with additional funds) and which were not. Nine different program offerings were deemed to be scalable.[44]

The Company then developed estimates of how much of the increased budget would be allocated to different functions and programs. To Enbridge's credit (and in contrast with Union), only a small portion of the increased budget was assumed to be needed for additional overhead costs (e.g. evaluation and administration), so the 25% budget increase was assumed to be more like a 30% increase for programs. Note that because only a portion of programs are assumed to be scalable, the percent increase for the scalable programs is estimated to be even larger than that.

For the programs that generate trackable savings, Enbridge then developed and applied a formula that was supposed to correlate increased spending with increased savings. The formula was supposedly based on the relationship between changes in spending and changes in savings from Enbridge's recently completed potential study. Unfortunately, there are numerous and important problems with the approach that Enbridge took that render its sensitivity scenarios virtually useless:

- Additional budget is allocated to "scalable programs" in the same proportion as it was allocated to those programs in the Company's base budget. No effort was made

[44] Exh B/T1/S5.

to optimize how additional spending would be allocated – either to maximize additional savings or to address other strategic goals. Again, this is somewhat understandable given the very limited time the Company had to develop a complex filing of which the sensitivity analysis was only one part. However, the fact that it is understandable does not change the fact that it is problematic.

- Related to the point above, Enbridge assumed that its market transformation budget would increase in the same proportion as its resource acquisition and low income budgets – all to support the existing base budget programs. For example, of the roughly $32 million increase in spending in 2016 under the 150% budget scenario, Enbridge assumed that nearly $7 million would go to market transformation programs (none of which produce immediately quantifiable savings). That does not make sense. For the programs that are truly designed to transform markets (e.g. the residential and commercial new construction programs),[45] the base budget should already have been designed to be sufficient to put the targeted markets on a path to market transformation.
- Any formulaic reliance on its potential study estimates of declining yield per dollar spent is problematic. First, even well done efficiency potential studies are inherently conservative.[46] Second, the potential study estimated gross savings potential, not net potential after adjusting for free riders. However, free ridership typically declines as financial incentives for efficiency measures – one of the key drivers to increased budgets – increase. Thus, the relationship of increased savings to increased spending that Enbridge tried to derive from the potential study results inherently understates the magnitude of increased *net* savings (the only metric that matters). Third, and probably most importantly, Enbridge's recent potential study is fraught with so many methodological problems that it has almost no value for informing conclusions regarding achievable savings potential. A few illustrative examples are as follows:
    - In analyzing efficiency potential at the time that new products are being purchased, one needs to estimate how many products are sold each year. Typically, potential studies develop such estimates by assessing the number of a particular type of product in use and dividing by the average measure life for that product. For example, if there are 100,000 commercial boilers in use and the average boiler has a measure life of 25 years, then approximately 4000 boilers are being replaced each year and efficiency programs have the opportunity to influence whether the most efficient boilers are being

[45] Enbridge has some programs in its "market transformation" portfolio that are not really about transforming markets. They are arguably more like resource acquisition programs, or customer education programs (e.g. OPower and Run it Right).

[46] Goldstein, David, "Extreme Efficiency: How Far Can We Go If We Really Need To?", Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, Volume 10, pp. 44-56.

purchased at the time of those replacements. However, Navigant's potential study makes what I consider to be a mathematical error that implicitly leads it to assume that the number of replacement products being sold each year is declining.[47] The result is that it understates the size of equipment replacement markets in the 10th year of its analysis by about 33% for measures with 25 year lives, by about 50% for measures with a 15 year life and by more than 60% for measures with a 10 year life. Needless to say, those underestimates lead to significant under-estimates of savings potential.

- Navigant estimates that economic potential in the commercial and industrial sectors is 96% of technical potential. In other words, virtually all efficiency that is technically feasible is also cost-effective under current (relatively low) avoided costs. That conclusion strongly suggests that the analysis did not truly look at a full range of potential efficiency measures; rather, it just looked at the measures that the utilities were already pursuing and/or anticipating that they might pursue and which are already known to be cost-effective. Put simply, it is not plausible that the supply curve of efficiency is a gradual upward slope to the current cost-effectiveness threshold and then becomes almost vertical.
- Navigant does not appear to have analyzed potential from industry-specific and/or facility-specific custom industrial measures. Indeed, in reviewing the stratified random sample of industrial projects analyzed under Enbridge's 2014 Custom Project Savings Verification process I found that approximately half of the projects employed measures that do not appear to have been addressed in the Navigant study. I should note that is not uncommon for potential studies. They tend to assess only relatively common measures. However, that is an important limitation that makes such studies' conclusions regarding efficiency potential very conservative.
- Navigant appears to have estimated the maximum technical potential for

[47] Rather than taking the entire existing stock of equipment and dividing it by the measure life to get an annual turnover rate for each year of its analysis, Navigant apparently does that only for the first year. For the second year it adjusts the size of the existing stock downward by the number of units replaced in year 1 and divides that smaller number by the measure life, producing a smaller eligible market in year 2. The farther out in time one goes, the smaller the eligible market becomes under this flawed approach. Navigant suggests this approach is reasonable because not all equipment lasts exactly the same amount of time (JT1.22). I concur with that statement. For equipment that has an average measure life of 25 years, a very small number will last only a few years (the "lemons"), some will last 15 years, some 20, some 30 and some 40 or 50 or more. However, what Navigant fails to realize in its analysis is that distribution applies to all products installed 10, 20, 30, 40, and 50 years ago. Thus, all other things being equal (the climate, the economy, etc.) the turnover this year, and next and the year after are all likely to be very similar. There is absolutely no basis for thinking the number of units sold for use in existing buildings will decline over time (except to the extent the existing building stock is demolished, which is only a very small fraction of buildings per year). More importantly, there is no evidence from sales data of major appliances, HVAC equipment, etc. that sales of replacement products decline over time.

operational efficiency improvements in commercial buildings to be no more than about 3%.[48] That is implausibly low.[49]

- Navigant's estimate of savings from do-it-yourself residential air sealing measures (e.g. caulking, weatherstripping, outlet gaskets, etc.) is implausibly high. The level of savings estimated is achievable, but only through more sophisticated blower-door guided air sealing by professionals. In other words, Navigant got the savings about right, but grossly under-estimated what it would cost to acquire.

- Even if one were to ignore all of the concerns about the use of the potential study, Enbridge made a basic mathematical error in developing the formula it used to apply the decline in savings yield per additional dollar spent derived from its potential study (what the Company calls its "decay factor"). The Company starts by noting that at the level of its base plan budget, the potential study suggests that for every 9% increase in budget there is approximately a 4% increase in savings.[50] It then makes the mistake of using those assumptions in a formula that not only adjusts savings from new spending but adjusts the base level of savings as well. The result is a formula that mistakenly suggests that it is impossible to achieve more than 17% more savings than Enbridge has forecast and that savings would actually start to decline once budgets were increased by about 70%. Those conclusions are inconsistent with the results of the flawed potential study that Enbridge's formula was designed to represent. More importantly, they are inconsistent with the experience of the leading jurisdictions discussed above.

3. Opportunities for Utilities to Acquire Substantial Additional Savings

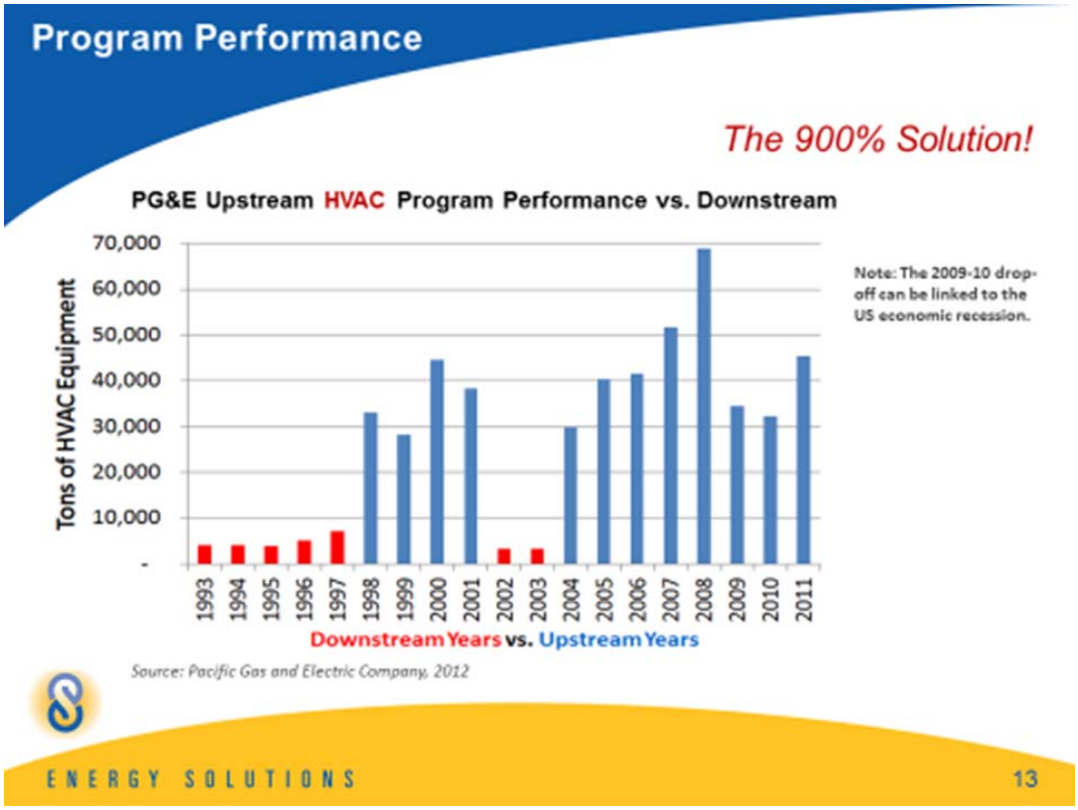
There are a number of ways in which the utilities could acquire significant additional cost-effective savings. These include:

- **Beginning to use "upstream incentive" program designs.** Upstream incentives – that is, incentives paid to manufacturers, distributors, contractors and/or other key players in the supply chain rather than to the end use customers – can have several advantages. Most importantly, they typically lead to much higher market penetration rates for efficient equipment. That can be seen in Figure 3, which shows that a commercial cooling equipment upstream incentive program (blue bars) run by Pacific Gas and Electric in California for over a decade achieved nine times the level of participation that its former "downstream" customer rebate program design

[48] Exh C/T1/S2 p. 18.
[49] See EB-2012-0451, Exhibit L.EGD.ED.1
[50] Enbridge response to GEC.42.

(red bars) achieved. Interestingly, when the program design was changed back to a customer rebate after four years of the upstream model, participation plummeted again. After two years of that much lower participation rate, the upstream incentive approach was re-initiated and participation skyrocketed again.

Figure 3: Upstream vs. Downstream Incentive Approaches[51]



Very similar results have been achieved in California for commercial gas boilers and other products.[52] Similarly, in September 2013 Efficiency Vermont launched an upstream incentive for high efficiency circulator pumps for boilers and saw the market share (from one of the leading HVAC wholesalers) for those products increase from 2% or less to about 50% in the span of just one year. It took about six months to get the program off the ground, but it continues to grow steadily.[53] These types of increases in market penetration happen for several reasons. First, it is generally easier to inform and work with a relatively small number of strategic market actors who influence (through their own stocking and sales practices) the purchases of thousands of end use customers. Second, because the cost of products is typically marked up at every step in the supply chain, a financial incentive paid to a distributor will cover a

[51] Hanna, James, et al., "The 900% Solution: Supercharging HVAC Efficiency Portfolios", Presentation at the 2012 ACEEE Summer Study (informal session), August 16, 2012.
[52] Personal communication between Jim Hanna (Energy Solutions) and Jim Grevatt (Energy Futures Group), who was collecting this information under my direction, July 2015.
[53] Personal communication with Jake Marin, Efficiency Vermont, July 2015.

higher fraction of the incremental cost of a product (making it easier to persuade the distributor to stock and promote it) than the same financial incentive paid to an end use customer. Third, upstream incentives are easy to set up in ways that eliminate the need for filling out of rebate forms and/or other paperwork that "downstream" players often hate. HVAC contractors are particularly notorious for their disdain for completing rebate forms, to the point, in my personal experience, where some will actually dissuade their customers from purchasing efficient equipment just so the contractor can avoid the paperwork. To be sure, launching an upstream program requires effort to build relationships with distributors and to reach agreement with them on how the program will work. However, once the relationships are established and the program systems are in place, the program can also reduce marketing and administrative costs. Moreover, once an upstream program for one type of equipment is in place, it is much easier to launch similar initiatives for other products sold by the same distributors (or other upstream market actors).

- **Launching an aggressive commercial new construction program**. Enbridge has a market transformation program targeted to this market. However, Union does not. Nor does Union have a resource acquisition program targeted to this market. That is a huge missed opportunity in a key "lost opportunity" market. It is worth noting that the gas utilities in Massachusetts, one of the leading gas DSM jurisdictions, got roughly one-third of their total C&I savings from commercial new construction projects in 2014.[54]
- **Increasing small commercial direct install program participation**. At this point, Union Gas has committed only to running a pilot program. Enbridge has committed to a full scale program and is forecasting that it will serve approximately 1700 small businesses per year. That represents approximately 1.2% of its eligible small business customers each year.[55] In contrast Commonwealth Edison's current small business direct install program in Illinois is expecting to serve 5% its eligible customers this year and forecast to serve over 6% next year,[56] suggesting much higher participation rates than those forecast by Enbridge are possible.
- **Increasing home retrofit program participation.** As noted above, even after normalizing for numbers of residential customers, Enbridge is proposing to ramp up to participation levels that are roughly double what Union is proposing. Moreover, Enbridge's proposed participation levels (between 0.6% and 0.7% of residential customers in 2020), though substantial, are still a factor of at least two or three below the annual participation levels achieved in Ontario at the end of the ecoEnergy program[57] or in other leading jurisdiction such as the United Kingdom.[58]

[54] See "Gas Statewide Summary" at http://ma-eeac.org/results-reporting/.
[55] Enbridge has between 140,000 and 150,000 small business customers (2012-2014 Commercial Market Segmentation Power Point presentation presented to stakeholders March 2015).
[56] Commonwealth Edison has approximately 200,000 small business customers; 10,000 are forecast to participate in its program this year and 12,500 are forecast to participate next year (personal communications with Edward Musz, Commonwealth Edison, July 27, 2015).
[57] In the 2010-2011 program year, approximately 170,000 ecoEnergy jobs were completed in Ontario (program data from NRCAN). That represented approximately 4.4% of the eligible low rise housing stock in the province. However, probably only one-third to one-half of the jobs could be characterized as multi-measure whole house retrofits (interpretation of program data from Environmental Commissioner of Ontario, "Re-thinking Energy Conservation in Ontario – Results: Annual Energy Conservation Progress Report – 2009 (Volume 2)", November 2010.

- **Continuing Union's large industrial program for T2/R100 customers.** Experience from 2013 and 2014 suggests that would – by itself – roughly double Unions forecast savings for 2016 to 2020.
- **Increasing other large custom C&I participation and savings.** Both Union and Enbridge are proposing to offer financial incentives for custom C&I projects that are well below industry norms. Union's planned incentive offerings are $0.10 per annual m^3 saved for contract customers and $0.20 per annual m^3 saved for general service customers. Enbridge's incentives for industrial customers are also only $0.10 per annual m^3 saved. Enbridge has proposed a sliding scale of incentives for commercial customers, starting at $0.10 per annual m^3 saved for projects that produce savings up to 10% and increasing to as much as $0.30 per annual m^3 saved for customers saving more than 20%. A benchmarking study commissioned by Union suggests that both utilities' incentive levels are well below those of most other North American gas DSM programs:[59]

    - SoCalGas (California): $0.47 per m^3
    - PG&E (California): $0.47 per m^3
    - Nicor Gas (Illinois): $0.35 to $0.47 per m^3
    - Ameren (Illinois): $0.47 per m^3
    - Manitoba Hydro: $0.30 per m^3
    - Consumers Energy (Michigan): $0.36 per m^3
    - Xcel (Minnesota): $0.24 per m^3
    - Centerpoint (Minnesota): $0.34 per m^3

    That, in turn, suggests that both utilities are unlikely to be realizing the full savings potential from large customers. Moreover, both utilities' incentive structures are less than ideal in that they continue to base their incentive offerings on the magnitude of *annual* savings, rather than the *lifetime* savings upon which their performance metrics are based. On the other hand, Enbridge's proposal to increase the incentive for commercial customers as the savings increase is a welcome change that should encourage greater depth of savings from that customer segment.
- **More aggressively and systematically addressing opportunities to help customers improve on-going operational efficiency**. For example, the continuous energy management programs the utilities are proposing to deliver to a very small number of large customers could be significantly expanded over the six-year time horizon that the utilities' plans cover.

Based on the experience of leading jurisdictions discussed earlier, I estimate that Enbridge could increase its proposed level of savings by between 75% and 100% by aggressively tapping the opportunities identified above.[60] I also estimate that Union could increase its

[58] Neme, Chris et al., "Residential Efficiency Retrofits: A Roadmap for the Future", published by the Regulatory Assistance Project, May 2011.

[59] Exhibit B.T2.Union.GEC.26, Attachment 7. Note that I have converted values expressed in U.S. Dollars to Canadian dollars for more accurate comparisons.

[60] As noted above, these jurisdictions have similar winter climates and long histories of DSM. Their customer mix is very similar to Enbridge. The Massachusetts, Minnesota, Rhode Island and Vermont gas utilities all sold between 37% (Vermont) and 50% (Massachusetts) of their gas to residential customers. Enbridge is in the

savings by a factor of 2½. Roughly two-thirds of that increase would come from just continuing its large industrial self-direct program.

To be sure, such increased levels of savings would require increased budgets. My very preliminary estimate – based on the experience of leading jurisdictions, the Ontario utilities' own past history and the nature of some emerging opportunities for acquiring savings – is that budgets would likely need to increase by a factor of 2 to 2½ (i.e. to on the order of $150 to $200 million per year for Enbridge and $125 to $150 million for Union per year). However, it is important to recognize that while leading jurisdictions are all achieving very similar levels of savings, the costs that they are experiencing to acquire those savings vary quite considerably,[61] suggesting that it would be difficult to definitively extrapolate their costs to Ontario. Put another way, to estimate with confidence how much the Ontario gas DSM budgets would have to increase to achieve leading levels of savings would require a bottoms up, program-by-program assessment of how the additional savings would be achieved. Such an assessment would need to address the extent to which different programs could be expanded; the potential impacts of changing program designs (e.g. moving to upstream incentives); the impacts of increasing incentive levels – including not only increased participation and incentive costs but also the likelihood of lower free rider rates; and the degree to which fixed costs of administering programs would be spread over a larger volume of savings. That kind of analysis was beyond my ability to perform for this proceeding given time and resource constraints, as well as the wide range of issues to address.

Similarly, to definitely estimate the increase in net economic benefits that would accrue from the kind of much more aggressive DSM portfolio savings levels that I suggest above would require a program-by-program build-up of how the additional savings would be derived. That said, there is every reason to believe that the additional net economic benefits would be substantial.

For example, Enbridge has estimated that its program plan would generate an average of about $225 million in TRC benefits per year over the 2016-2020 period at an average annual TRC cost of about $95 million for an average annual TRC net benefit of about $130 million.[62] If its savings increased by 80%, the increase was roughly proportionally the same across all its programs,[63] and non-incentive costs per m^3 saved did not change (probably a conservative assumption),[64] the additional savings would generate approximately $105 million per year (roughly $525 million over the 2016-2020 time period) in additional net economic benefits when using Enbridge's estimates of avoided costs.[65] As Mr. Chernick

---

same range (between 40% and 50% in 2012 per its response to GEC.1).

[61] Their costs per unit of savings vary from a little lower costs than those proposed in the Ontario utilities' plans in Minnesota to roughly triple those proposed in the Ontario utilities' plans in Massachusetts.

[62] Exh B/T2/S3 corrected.

[63] This purely a simplifying assumption for the sake of this preliminary calculation. As noted above, a more aggressive program portfolio should be developed in a systematic way, with priority placed on programs that meet strategic objectives such as maximizing savings while addressing customer equity concerns.

[64] As noted above, one should expect administration costs to decline per unit of savings.

[65] It is important to remember that most of the increase in budget associated with the more aggressive efficiency program portfolio I have suggested would be associated with increased financial incentives for efficiency measures and/or projects. Increased incentives simply offset customer contributions to measures

notes, Enbridge's estimates of avoided costs are too low, so the additional net economic benefit of a more aggressive DSM portfolio could be even greater than these values suggest.

Union has estimated that the TRC net benefits from its 2015-2020 DSM plan are approximately $1 billion, or approximately $170 million per year. Thus, if it were to increase its savings over that time period by a factor of 2½ the additional net economic benefit could be on the order of an additional $250 million per year. Again, one would need to develop a detailed program-by-program build-up of the new savings target to develop more precise estimates of additional net benefits. However, since the majority of the increase in savings I would expect from Union would come from T2/R100 customers, which have historically provided the most cost-effective savings in Union's portfolio, it is possible if not likely that the estimate of additional net benefits for Union are even greater than my simple extrapolation suggests. It is also important to note that Mr. Chernick is suggesting that Union's estimates of avoided costs are too low. That also suggests that the rough estimate of additional net benefits may be too low.

costs under the TRC test, so it is only budgetary increases in non-incentive costs that can adversely affect TRC – and therefore societal – net benefits.

VI. Union's Large Industrial Customers

As noted above, Union Gas' proposed annual savings targets for 2016 to 2020 period are on the order of about half of what they achieved annually from 2012 to 2014, despite a near doubling of its DSM budget. Put another way, its forecast savings yield per budget dollar is more than 70% lower in its proposed plan than what it achieved annually from 2012 through 2014. The single biggest reason for this decline is Union's decision to terminate (after 2015) its large industrial self-direct program. That program accounted for roughly half of Union's total 2013 and 2014 savings – *even after adjusting for an assumed free rider rate of 54%*. Union's decision to terminate the program appears to have been based on the OEB's guidance in its December 2014 gas DSM framework.

In its framework and guidelines, the Board articulated two reasons for not requiring the large industrial customers to participate in funding efficiency programs: (1) that there are concerns about "one customer subsidizing business improvements of another";[66] and (2) that the large customers were both sufficiently sophisticated and motivated to invest in efficiency on their own. However, the Board's guidelines were developed under considerable time pressure and without the advantage of a full testing of concerns in an evidentiary proceeding.

It should be noted that the Self Direct program model that Union adopted for its largest customers starting in 2013 already effectively eliminated the Board's first concern about cross-participant subsidies by effectively setting aside the majority of DSM budget generated by each customer specifically for their individual use.[67]

There is also no empirical evidence, from Ontario or any other jurisdiction, to support the hypothesis underlying the Board's second concern – that large customers would pursue all cost-effective efficiency investments on their own. While it is true that there will be free ridership in programs offered to large customers, that is true to varying degrees for all programs. Moreover, the savings that Union has claimed from this program are already discounted by 54% to account for an estimate of free ridership. The remaining 46% of savings that the utility claimed still represented roughly half the savings it produced from its entire portfolio of efficiency programs in 2013 and 2014, suggesting that there are enormous cost-effective[68] savings that their large customers would not be pursuing on their own.

---

[66] OEB DSM Framework, p. 27.

[67] The remaining funds were allocations to cover Union's costs of managing and evaluating the program and to contribute to low income efficiency program offerings. There was also the potential for the utility to earn a shareholder incentive for meeting or exceeding its goals.

[68] Benefit-cost ratios were 8.74 to 1 in 2013 and 4.8 to 1 in 2014 (see B.T6.Union.GEC.4 Excel Attachment 2 – 2013 Audit tool 20150623 and B.T6.Union.GEC.4 Excel Attachment 3 – 2014 Audit Tool 20150623)

While Union's estimate of free ridership is admittedly based on an outdated study, its implicit conclusion that there are substantial cost-effective savings that large customers would not pursue absent efficiency programs is consistent with assessments from other jurisdictions. For example, a recent jurisdictional scan conducted by Navigant Consulting for the Ontario gas Technical Evaluation Committee found that the average free rider rate from evaluations of twenty-four different gas utility Custom C&I programs – which are typically targeted to the largest customers – was between 30% and 40% (meaning 60% to 70% of savings would not have occurred without the utility programs).[69]

ACEEE reached a similar though more qualitative conclusion in its 2012 report on Self Direct programs for large industrial customers:

> *"Another assumption frequently made during the development of opt-out and self-direct programs is that industrial customers will always do all cost-effective energy efficiency because doing so makes good business sense…While industrial firms in the U.S. have continued to become more energy efficient per unit of product output, they have not necessarily captured all cost-effective energy efficiency. Again, opt-out and self-direct programs have proven this to be true. In Utah, Wyoming and Oregon, customers can opt out of all or part of their CRM (cost-recovery mechanism) fees if they can prove that they have in fact done all cost-effective energy efficiency. In the case of Utah and Wyoming, "cost-effective" means that a project has a simple payback of eight years or less; in Oregon it is ten years. To date, no company has taken advantage of these exemptions in any of these states, because there are always some cost-effective projects that could be identified during an energy audit (Helmers 2011, Stipe 2011)."*[70]

In EB-2012-0337, after the OEB heard evidence from APPrO and others, the Board itself came to a similar conclusion when it stated that industrial DSM programs "have shown to be efficient and to have societal benefits with respect to reducing greenhouse gas emissions and encouraging wiser energy usage."

That conclusion is born out again by a recent evaluation of free ridership and net-to-gross (NTG) ratio for Utah's large customer self-direct program. It concluded that free ridership was only 1% and that spillover effects were 5%, leading to an NTG of 1.04.[71]

---

[69] Brannan, Debbie et al. (Navigant), "Custom Free Ridership and Participant Spillover Jurisdictional Review", prepared for Sub-Committee of the Ontario Technical Evaluation Committee, May 29, 2013. (http://www.ontarioenergyboard.ca/documents/TEC/Evaluation%20Studies%20and%20Other%20Reports/Ontario%20NTG%20Jurisdictional%20Review%20-%20Final%20Report.pdf)

[70] Chittum, Anna, "Follow the Leaders: Improving Large Customer Self-Direct Programs", ACEEE Report Number IE112, October 2011.

[71] Navigant Consulting and EMI Consulting, "Evaluation Report for Utah's Self-Direction Credit Program (PY

It should also be noted that virtually all of Union's eligible large industrial customers are participating in its Self-Direct program. Indeed, 95% of eligible customers representing 99% of throughput of eligible customers participated in the program in just 2014.[72] That information, which was also not available to the Board when it developed its December 2014 guidelines, should address concerns about rate impacts on non-participants. Moreover, because the utility cost of acquiring the savings from these large customers is so much less than the cost of acquiring savings from smaller customers, the net impacts on rates for the affected large industrial customers – from the combined effects of DSM spending and the system-wide benefits described above – appears to be much better than for the average residential or small business customer. And because the rate reducing impacts from price suppression, reduced purchases of expensive gas, reduced investment in T&D and reduced GHG mitigation costs are shared among customer groups, the cancellation of this program would harm all customers.

Put simply, allowing Union to terminate its large industrial program would mean foregoing a huge portion of achievable savings and – because these savings tend to be more cost-effective than those that can be acquired from other, smaller customers – an even larger portion of economic benefits.

All that is not to say that the self-direct program cannot be improved. At a high level, there are at least three things the Board could require in the way of program changes that could improve its effectiveness in delivering savings, addressing customer needs, reducing free ridership and/or addressing concerns of the likely very few customers who believe that they have already pursued all cost-effective efficiency:

1. **Allow self-direct funds to be spent over a multi-year period**. As noted in my testimony in EB-2012-0337, that would give customers much greater flexibility.
2. **Limit the range of measures the self-direct program could fund**. For example, the program could impose a minimum payback of 1.5 or 2 years, particularly (or perhaps exclusively) for operational improvements. That is an imperfect instrument for addressing free ridership concerns because many customers have measures with very short paybacks that they do not pursue without DSM program support. Nevertheless, on average, it would likely reduce free rider rates and could avoid contentious savings claims.
3. **Include an opt-out or payback option for those customers that can truly demonstrate that they have already comprehensively addressed all cost-**

2012 through 2013), prepared for Rocky Mountain Power (a division of Pacificorp), March 18, 2015.
[72] Union response to GEC.54.

effective efficiency opportunities. For example, the customer could opt out of the program if an independently hired auditor can demonstrate that all efficiency measures with less than a 10 year payback have already been implemented. As noted above, this approach has been used in a couple of other jurisdictions. If an "opt out" is deemed to be procedurally problematic because of concerns about treating different customers in the same rate class differently (as the Board noted in its EB-2012-0337 Decision), it may be possible to adopt an alternative that achieves the same end, such as a payback mechanism.

VII. Shareholder Incentive Mechanisms and Metrics

1. Enbridge

A. Resource Acquisition

Enbridge has proposed separate lifetime savings metrics for large customers and smaller customers, as well as for numbers of home retrofit participants. Given its intention to shift greater attention to smaller customers that have historically not participated as substantially in its programs, it seems appropriate to have such metrics. However, given that savings per dollar that it is forecasting for large C&I customers is three times as great as for small C&I customers and six times as great as for residential customers, there is potential for the Company to "game" the system by shifting resources from the more expensive smaller customers to larger customers once the plan is approved. Thus, it may be appropriate to consider whether the metric for larger C&I customers should be part of a separate scorecard.

An alternative would be to refine the way that scorecard scores are calculated. Specifically, if a performance metric has a weight of 40%, the score for that metric could be capped at 60% (i.e. 150% of the target level). That mitigates the "gaming" risk discussed above. It also mitigates the risk associated with a metric that is inadvertently set far too low, as has clearly been done on occasion in the past.[73]

With respect to the specific proposed metric values, Enbridge's proposal for large C&I customers appears consistent with its historic experience in terms of savings per budget dollar (in real, inflation adjusted, terms).[74] The same is true of the home retrofit program savings forecast.[75]

However, the cost per unit of lifetime savings that the Company is forecasting for its small C&I customers is more than three times what it achieved in the past.[76] A big part of the reason is the launch of its Direct Install program, which is always a more expensive way to generate savings but which is also widely viewed in the industry as a necessary vehicle for addressing many smaller businesses that would otherwise not participate in DSM programs. Enbridge's cost per lifetime m^3 saved from its proposed program (a little more than $0.08) appears to be roughly 20% greater than what other gas utilities are paying for small business direct install savings.[77] That difference could be a function of the mix of measures included

[73] Consider, for example, Enbridge's 2014 resource acquisition scorecard. The utility achieved only 67% of its lifetime savings target, falling well below even the lower bound of performance for a metric that was assigned 92% of the scorecard weight. The other metric in the scorecard – participation in its home retrofit program – was assigned the other 8% of the weight. However, because the Company exceeded the home retrofit participation target by a factor of more than 12 (i.e. it achieved more than 1300% of the goal), its overall scorecard score was 138%. Put another way, even though its home retrofit program participation metric was assigned only an 8% weight, its result for that program alone produced 106% of the total 138% scorecard score (the other 32% of the score came from the lifetime savings results).

[74] JT1.36 Attachment 1.

[75] JT1.36 Attachment 1.

[76] JT1.36 Attachment 1.

[77] This conclusion is based on a search for actual results for gas small business direct install programs on E-

in the program. I have not analyzed the other programs to determine whether that is the case.

B. Low Income

Enbridge's proposed low income single family (part 9) savings metrics implicitly assume savings will cost 10-15% more than in 2014. It appears as if that is because Enbridge used the average cost per unit of savings over the three-year 2012 to 2014 period.[78] The 2012 savings were considerably more expensive than either 2013 or 2014 savings. It is unclear why that is the case. It is also unclear why the 2012 experience is as applicable to future results as the more recent 2014 experience. Absent an explanation, the savings target would appear a little low.

Enbridge's proposed multi-family (part 3) performance metrics appear to implicitly assume that savings will cost 10-20% more than in 2014.[79] Enbridge suggests that this is predicated on the presumption that a greater emphasis on private multi-family buildings will increase average costs. That is consistent with my understanding of the utility's recent experience.

C. Market Transformation and Energy Management

Enbridge includes eight different initiatives in its Market Transformation and Energy Management (MTEM) portfolio. Each of those, except for the residential new construction program (Residential Savings by Design) are assigned a single performance metric as part of the Company's proposed MTEM scorecard; Residential Savings by Design is given two metrics. Of the eight initiatives, only three really appear to be intended to transform markets: Residential Savings by Design, Commercial Savings by Design and Home Ratings. The other five programs appear designed to either educate consumers and/or to test new program design concepts.

I have several concerns regarding both the design of the scorecard and/or the specific metrics proposed. My biggest concern is that there is no clear rationale for providing a performance incentive for the five non-market transformation programs. If the principle purpose of those programs is to either directly or indirectly drive savings, then they belong in the Resource Acquisition portfolio supporting the Resource Acquisition performance metrics. If their purpose is primarily to provide general education to key customers groups, as may be the case with Home Health Reports and the School Energy Competition, then they might be better put into a new "general education" portfolio for which it may not make sense to establish shareholder performance metrics. Alternatively, if their principal purpose is to test and/or refine a new program concept to the point where it may make sense to launch full scale and include in the Resource Acquisition portfolio – as may be the case for the Run It Right, Comprehensive Energy Management and New Construction

---

Source's "DSM Insights" database and dashboard (which parties can access with an annual subscription). Results for several different years were found for five different utilities: Nicor Gas, North Shore Gas, Peoples Gas, National Grid (RI), and Minnesota Energy Resources Corporation. Results for those utilities were converted to 2015 Canadian dollars.

[78] Response to GEC.16, p. 5 of 10.

[79] JT1.36 Attachment 1

Commissioning programs – then it would seem more appropriate that they be put into a new "pilot program" portfolio for which it would not make sense to establish shareholder performance metrics.[80] I say that because when testing a concept one should not be driven by a performance metric that may not be important to figuring out how best to make the concept work. For example, it is probably less important to get larger numbers of participants in RIR, CEM and commercial new construction commissioning than to invest in deeper levels of exploration with a smaller number of customers regarding what works and what does not work well with a given program approach.

Beyond that high level concern, I have several concerns about the specifics of Enbridge's proposed metrics:

- If it is to be kept, the CEM target seems very low, especially in later years (growing to only 10 participants by 2020)
- The market share for commercial new construction projects starts off reasonably after the new code is introduced – 15 projects in 2017 out of roughly 170 annual projects,[81] or close to 10% - but hardly grows at all. In fact, three years later, in 2020, the target is only 21 projects. That is not a path to market transformation.
- The number of home ratings in 2016 (596) is lower than what was actually achieved in 2014 (662).[82] That clearly makes no sense. Moreover, it is only projected to roughly double by 2020. Again, that is not a path to market transformation.

2. Union

A. Resource Acquisition

Union's forecast resource acquisition spending per unit of savings over the 2016 to 2020 period is projected to be approximately 115% greater than what it experienced in 2014.

A significant portion of that increase is associated with its expansion of its home retrofit program (ramping up from 1000 participants in 2014 to 5000 per year by 2018) which produces savings at a higher cost than its historic C&I programs. However, that only explains about 35% of the difference in 2018. Another portion of the difference is the inclusion of the residential behavior program, which has a very high cost per unit of lifetime savings (on the order of six times the cost of the home retrofit program), at an annual budget of $3.3 million.[83] However, that only explains about another 20% of the difference.

[80] Note that I am not suggesting that the total allowable performance incentive should change, only that there are categories of spending that may not warrant performance metrics. That spending can get allocated to the other scorecard categories for the purpose of allocated shareholder incentive dollars.
[81] JT1.12.
[82] JT1.36 Attachment 1.
[83] As suggested in the Enbridge discussion above, I am not suggesting that such behavior programs should not be included in the utility's portfolio. Such programs can and do play useful roles in DSM portfolios, both by enabling larger portions of customers to participate and reap benefits of DSM, by providing some marketing support or leads to other programs and by supporting the general objective of educating consumers about their energy use. However, they are generally not very effective – per dollar spent – generating (lifetime) savings.

The remaining difference appears to be a function of a couple of additional factors. First, Union is forecasting that savings from custom C&I measures will decline by about 10% relative to 2014 while the costs of acquiring them will increase by 25% per lifetime m^3 saved. There does not appear to be a reasonable rationale for that change. Second, the cost per unit of savings from prescriptive measures is projected to increase by about 30% relative to 2014 while the amount of savings from such measures is growing. I have not delved deeply enough into the details of how Union's prescriptive savings estimates were developed or how they compare to 2014 to ascertain whether that is a reasonable forecast.

B. Low Income

Union's proposed low income spending per unit of savings is projected to increase substantially – by an average of 60% – relative to 2014. One contributing factor is the Company's proposal to provide incentives for furnace efficiency upgrades at the time that a new unit is being purchased. Those savings are extremely expensive and not cost-effective. However, the inclusion of that measure accounts for less than 20% of the increased cost. It is not immediately apparent what the other reasons are as the mix of single family and multi-family savings is similar to what it has been in the past; also, though the portion of savings from private multi-family buildings is project to increase over time, even by 2020 it still only represents about 10% of total low income savings.

C. Market Transformation

Union has proposed only one market transformation program targeted to the residential new construction market. Moreover, it has proposed the program be terminated at the end of 2016.

The biggest concern this proposal raises is with Union's interest in and commitment to supporting longer-term market transformation. In the context of a near doubling of its annual budget, it is hard to fathom why the Company would completely give up on market transformation activities.

D. Performance-Based

Union has proposed two performance-based programs: RunSmart and Strategic Energy Management. It proposes an evolving set of performance metrics for those two programs starting with numbers of new participants and gradually evolving so more and more of the scorecard becomes a function of savings from, rather than participants in, the programs. Consistent with my comments on some of Enbridge's proposed MTEM programs which are similar to these, I question whether these programs should be in a separate scorecard rather than perhaps starting off as pilots for which no metrics are assigned (but for which budgets are set aside) and then migrating to the Resource Acquisition scorecard. Again, if the purpose of these programs is ultimately to generate savings – and that is the only purpose I can conceive for them – then they ultimately should be part of the scorecard that measures savings achieved.

VIII. Governance of EM&V

In its 2014 Gas DSM Framework and Filing Guidelines, the Board has signaled that it intends to be more active in the governance of the evaluation, measurement and verification (EM&V) process. However, it did not provide a lot of detail regarding what that process will look like. In particular, it did not specifically address how the current Technical Evaluation Committee (TEC) or utility Audit Committees (ACs) will evolve or, indeed, if they will even continue.

I have served on the TEC since its inception. I have also served on every Enbridge AC, but one, since it was first formed in 2000. I have also served on some Union ACs in the past. I reach several conclusions from that experience that I hope will assist the Board in "fleshing out" the new direction it intends to take.

First, I think it is important to say that the work of the ACs and, more recently, the TEC have significantly improved the transparency of the utilities' savings claims, shareholder incentive claims and LRAM claims. In my view, it has also improved the accuracy of those claims and improved program designs going forward. Finally, from a process perspective, I think much has been learned about how to run these multi-stakeholder (I count the utilities as stakeholders here too) processes. Thus, I believe there would be great value from continuing the operations of both the TEC and the ACs, largely as currently designed, but with Board Staff also being regularly involved in the work of the Committees.

I think that there are two other ways in which the gas DSM EM&V process could and should be improved:

1. The utilities custom project savings verification (CPSV) process needs to be modified so that there is not even the possibility of the perception that the utilities control the process. Ontario has already come a long way in this regard. Just a few years ago, the utilities completely controlled the drafting of the scope of work for the CPSV firms and the review of their work; stakeholders were not even permitted to review the final CPSV reports. In contrast, in the most recent (2014) audit process, the scope of work for the CPSV firms was developed by the TEC with stakeholder input. Also stakeholder members of the ACs were able – for the first time – to participate in all calls between the Auditor, the utility and the CPSV firms, as well as to review and provide comments on both draft and final CPSV reports for the Auditor to consider. However, the utilities still controlled the issuance of the CPSV RFPs, review of the proposals and the selection of the winning bidders. It is important to note that a very large fraction of the utilities' savings are still projected to come from custom commercial and industrial projects. Thus, it will be important for the last vestiges of utility control of the CPSV process to be changed. Specifically, I would recommend that the Auditor be charged with hiring the CPSV firms.
2. While the goal of making decisions at the TEC by consensus should be retained, there needs to be a process for moving forward when consensus is not possible. That process needs to be one that can enable decision-making in a reasonably quick

period of time.

Both of these recommendations appear to be consistent with the proposal that Union put forward in its filing, provided that the non-consensus resolution process it suggests can truly be addressed quickly by the Board.[84] If it cannot be, there may need to be a different approach. Enbridge's recommendations on evaluation processes is much less detailed – more an articulation of high-level principles than specifics on process.[85] However, nothing in my recommendations appear to be inconsistent with the Enbridge principles.

[84] Exh A/T2/Appendix D.
[85] Exh. B/T3/S1.

IX. Consideration of DSM in Infrastructure Planning

1. Overview

In its December 2014 gas DSM framework and filing guidelines the OEB required three things of both Enbridge and Union with respect to consideration of the role DSM could play in potentially serving as a cost-effective alternative to future infrastructure projects:

1. Conduct a study of "the effects that DSM can have on deferring, postponing or reducing future capital investments."[86]
2. "Propose a preliminary transition plan that outlines how the gas utility plans to begin to include DSM as part of its future infrastructure planning efforts."[87]
3. "Provide evidence of how DSM was considered as an alternative at the preliminary stage of project development" for all leave to construct projects.[88]

Both a scope of work for the study (to be completed in time for the mid-term review) and the preliminary transition plan were to be included in the utilities' 2015-2020 DSM plan filings.

In general, Enbridge has been much more responsive to this guidance than Union. A discussion of each utility's approach is provided below.

2. Scope of Work for Study of the Role of DSM in Infrastructure Planning

Union did not provide what could reasonably called even a preliminary scope of work for its study of the use of DSM resources to defer or avoid infrastructure construction. A scope of work is effectively the "meat" of what one would put in an RFP to hire a contractor. It typically:

- Articulates the study objectives;
- fleshes out in detail the information expected to be collected and analyzed;
- provides a summary of information and/or resources that are available to the contractor, including utility staff that will be involved in the study;
- identifies specific tasks it expects the contractor to perform in collecting and analyzing the information; and
- specifies the form in which the results of the study will be presented.

In contrast, all Union has provided is a list of high level questions the study would attempt to answer. At best, that might be analogous to the articulation of study objectives. However, most of the other information one would expect in a scope of work has not been provided.

[86] Ontario Energy Board, "EB-2014-0134 Filing Guidelines to the Demand-Side Management Framework for Natural Gas Distributors (2015-2020)", December 22, 2014.
[87] Ontario Energy Board, "EB-2014-0134 Report of the Board: Demand Side Framework for Natural Gas Distributors (2015-2020)", December 22, 2014.
[88] Ontario Energy Board, "EB-2014-0134 Report of the Board: Demand Side Framework for Natural Gas Distributors (2015-2020)", December 22, 2014.

Moreover, even some of the questions that Union indicates the study will be designed to address are problematic as currently framed. For example, it makes no sense to generically ask the question "What is the required load reduction that would lead to deferral of infrastructure?" The answer to that question will necessarily be specific to each infrastructure project. The same is true of the question "Could DSM programs be designed and implemented to achieve the necessary impact?" Put simply, Union has either invested little effort in attempting to address this issue or it is being intentionally vague about its intentions. Either way, the Company may be sending a disconcerting signal that it is not likely to be serious about even-handedly considering DSM as a potential alternative to more expensive infrastructure investments.

In contrast, and to its credit, Enbridge has fully developed and presented a preliminary scope of work for its study. That said, I do have some concerns about that proposed work scope. Specifically, in the third part of the work scope – what Enbridge calls "Intersection #3: Targeted DSM and Reinforcement Projects" – the Company asks some of the same kinds of generic questions that critiqued Union for asking. Examples include:

- "Is it technical feasible?"
- "Is it possible?"
- "Is it cost-effective"

Unlike Union, and again to its credit, Enbridge has indicated in its scope of work that it intends to address these questions through analysis of specific case studies. That addresses the concern I expressed about Union's approach because the questions are not being asked generically. However, it raises an entirely different set of issues regarding how the case study examples will be selected. As I have noted in two different reports I have written on the electric utility experience with using geographically-targeted DSM to defer T&D investments,[89] DSM cannot address every type of infrastructure need. It only has potential value as an alternative to infrastructure projects that are being driven, at least in part, by load growth. Even then it will not always be applicable – either because the load reduction required is too great, or because it is needed too soon, because the economics of a particular application are not favorable, etc.

My experience with assessing the role that geographically-targeted DSM could play in cost-effectively deferring infrastructure investments – and I have studied every major example of such electric utility efforts over the past two decades, conducted trainings for system planners on how to integrate consideration of DSM into system planning, and am currently working on a pilot project with a Michigan utility – suggests that the key piece of new information most gas utilities would need to assess the potential role of efficiency in deferring infrastructure investments are hourly peak day load shapes (and/or an estimate of

[89] Neme, Chris and Rich Sedano, "U.S. Experience with Efficiency As a Transmission and Distribution System Resource", published by the Regulatory Assistance Project, February 2012 (see: www.raponline.org); and Neme, Chris and Jim Grevatt (Energy Futures Group), "Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments", published by Northeast Energy Efficiency Partnerships, January 9, 2013 (see: http://www.neep.org/initiatives/emv-forum/forum-products#Geotargeting).

the relationship between peak hour savings and annual savings) for each potential efficiency measure. That is a question that could and should be addressed generically and immediately.

Once that generic question is answered, it would be very appropriate to pursue case study assessments as Enbridge has suggested. However, great care must be taken in selecting the case studies. As noted in my reports on efficiency as a T&D resource make clear, the first step in that process is to develop a long-term forecast of potential infrastructure needs. That forecast should be for at least 10 years. Again, to its credit, Enbridge has stated that it will select its case studies from a list of potential infrastructure projects that it will develop (or already has developed). However, it is not clear that that it is planning to comprehensively assemble a 10 year forecast of such projects. (As noted above, Union has not even suggested it is thinking about such a forecast.)

The list of projects in a 10-year forecast should then be put through an initial high level screen to winnow the list down to candidates that would be worth a closer look. Several jurisdictions now require such a high level screening process for all electric infrastructure projects, typically using variants of the following criteria:

- **Is the project driven – at least in part – by load growth?** Only those that are should be considered.
- **How many years before the infrastructure is needed?** Typically, the infrastructure need must be at least three years into the future to be considered. More sophisticated approaches relate the minimum years before the need to the magnitude of the load reduction needed (the larger the reduction, the further out in time the need must be). That relationship is potentially one that an assessment of several gas case studies could inform.
- **What is the maximum load reduction required?** For electric system planning, the maximum typically assumed possible is on the order of 20-25% (relative to forecast future demand). That might be an appropriate starting point for gas as well, though this question is also one that the Enbridge and Union studies, particularly if they include several case studies, could better inform for gas.
- **What is the cost of the infrastructure project?** It does not make sense to invest in detailed assessments of alternatives to very inexpensive infrastructure projects. Thus, most jurisdictions now required consideration of DSM as a potential alternative if the infrastructure project costs at least $1 million.

A summary with more specifics of how different jurisdictions now routinely use such criteria is presented in a table in my most recent report on this topic which I have copied below.

Table 4: Criteria for Requiring Detailed Assessment of Non-Wires Solutions

	Must Be Load Related	Minimum Years Before Need	Maximum Load Reduction Required	Minimum T&D Project Cost	Source
Transmission					
Vermont	Yes	1 to 3 4 to 5 6 to 10	15% 20% 25%	$2.5 Million	Regulatory policy
Maine	Yes			>69 kV or >$20 Million	Legislative standard
Rhode Island	Yes	3	20%	$ 1 Million	Regulatory policy
Pacific Northwest (BPA)	Yes	5		$3 Million	Internal planning criteria
Distribution					
PG&E (California)	Yes	3	2 MW		Internal planning criteria
Rhode Island	Yes	3	20%	$ 1 Million	Regulatory policy
Vermont	Yes		25%	$0.3 Million	Regulatory policy

The Michigan utility with which I am currently working considered each of these criteria in selecting the pilot project that will be pursued.

Again, to its credit, Enbridge has clearly considered at least the second of these criteria as it has indicated that it will only consider those for which the lead time is at least 4 to 6 years. That is an eminently reasonable place to start. However, it hasn't indicated what other criteria it will use or consider.

Once candidate projects have been selected, more detailed assessments need to be conducted. For example, over the past several months the Michigan utility with which I am working has been assessing the mix of customers in the targeted region (residential, small business, larger customers), how the customers may differ from the average customers in the Company's broader service territory (e.g. in income levels, education, levels, etc.), the types of loads being served (e.g. through review of location specific responses to saturation surveys), historic participation in the utility's different efficiency programs, and other relevant factors. All that information is being used to develop a DSM program strategy for the area. That very same approach should be used for tailoring the assessment of the potential for targeted DSM for case studies for both Enbridge and Union.

3. Transition Plan for Integrating DSM into Infrastructure Planning

If anything, Union's approach to transition planning is worse than its approach to the development of the scope of work for its study. In fact, the Company has said that it did not develop a transition plan because such a plan is premature.

In contrast, Enbridge has put forward a transition plan. In a nutshell, its transition plan is to use real world case examples in the scope of work for the study described above. At a high level, that would be a reasonable approach if (1) the approach to identifying case studies is refined as I suggest above; and (2) the case studies are more than just paper studies. Only so

much can be learned from paper studies. Ultimately, pilot projects should be undertaken to test the "paper learnings" in real world applications. Indeed, I would note that the Michigan utility with which I am currently working plans to launch a pilot project in the field within roughly a year of when our analysis began.

4. Consideration of DSM in All Leave to Construct Projects

The Board was very clear in its order in the GTA case that both utilities must begin to explicitly consider DSM as an alternative to infrastructure investments. That view was reiterated in its December 2014 guidelines.

Unfortunately, it appears as if Union has been intentionally ignoring that requirement. Indeed, during the July 7, 2015 Technical Conference, its staff specifically said that it has initiated leave to construct projects since the GTA case was concluded and that it has not considered the role that DSM could potentially play in cost-effectively deferring those projects.[90]

I have not investigated whether the same is true of Enbridge.

[90] Technical Conference Transcript July 7, 2015, pages 103-104.

X. Recommendations

Based on the analysis provided above, I recommend that the Board do the following:

1. Given the information now available on the scale of the rate reducing impacts of T&D avoided costs, commodity price suppression, reduced purchases of relatively expensive gas and emission reduction cost avoidance, the Board should eliminate the budget caps included in its earlier guidelines and thereby enable greater savings without undue rate impacts for DSM non-participants. This would accord with Government policy, including recent greenhouse gas policy announcements, and lead to an improved economic outcome.

2. Require future utility filings to include analysis of the combined effects of DSM spending and the rate reducing effects discussed above.

3. Require future DSM Plan filings to include analyses of the size of eligible markets for all proposed measures and programs. This will facilitate evaluation of the proposals and facilitate subsequent evaluation of performance as well. This could be required as added information in the Technical Resource Manual (TRM) for each measure.

4. Given the timing of this proceeding, approve the utilities' budgets and targets for 2015 unless information put before the Board by other parties suggests significant problems in the way they were developed. However Union should report its 2015 results using the Board's Framework cost-effectiveness policy – that is including the 15% non-energy benefits adder in the TRC test and a 4% discount rate.

5. Given the timing of this proceeding and the fact that that the utilities are planning to significantly ramp up their DSM efforts, approve the utilities' proposed 2016 budgets and targets except as follows:

    a. Require that Union continue to deliver its Large Volume program for the T2/R100 customers.

        i. The program budget for 2015 can be carried forward with a similar approach to setting the target as in previous years. This budget would be in addition to the budget Union has proposed for other customer classes for 2016.
        ii. The available shareholder incentive will need to be reallocated among the scorecards as a result of the addition of the budget for Large Volume T2/R100 program.
        iii. Consider allowing the self-direct funds to be spent over a multi-year period. This provides customers greater flexibility to plan large projects and should enable larger savings.
        iv. Preclude O&M projects with a payback of less than 1.5 or 2 years to reduce free ridership.
        v. Consider adopting the innovation that if customers can demonstrate

through an independently hired energy auditor that they have completed all energy efficiency projects with a 10 year payback or less, they can 'opt out', potentially by 'rebating' them their incentive funds for a 3 year period.

b. Adjust the utilities' proposed 2016 performance metrics as follows:

i. Place a limit on the amount that any performance metric can contribute to the score computed for a scorecard. The limit should be equal to 150% of the weight of the metric.
ii. Consider increasing Enbridge's small volume customer CCM target if the Company cannot adequately explain why its small business direct install program is forecast to cost more than other gas utilities' programs.
iii. Increase Enbridge's low income single family target by 10%.
iv. Remove all metrics associated with Enbridge's Home Health Reports, School Energy Competition, Run it Right, Comprehensive Energy Management and New Construction Commissioning programs from the Company's Market Transformation scorecard. The weight of the other metrics can be increased proportionally to account for those removals.
v. Increase Enbridge's home ratings metric to 1000 homes.
vi. Consider whether to increase Union's Resource Acquisition CCM metric based on additional information provided in the hearing.
vii. Increase Union's 2015 low income performance metrics by 50% unless additional evidence supporting lower values is presented in the hearing.
viii. Eliminate Union's performance-based scorecard. The programs proposed for that scorecard can still be funded and run.

6. For 2017 the Board should establish an increased expected budget level for both utilities and require the LDCs to consult and file supplemental DSM plans during 2016, as was done a few years ago to accommodate additional low income spending. With the budget level established, the most contentious issue would be resolved and the utilities may well be able to present Plans that would enjoy a high level of support. I would recommend 2017 budgets be 30-40% higher than those in 2016 as a manageable ramp up.

7. For the mid-term review (to address plans for 2018 to 2020) the Board should make clear that growing budgets and targets in pursuit of cost-effective savings are expected and require 3 year Plans to be filed in early 2017 to allow for an adequate review period before the year begins. The Board should articulate that its default expectation is that the utilities proposed savings levels will be at least as high as the top several gas DSM jurisdictions in North America. Deviations from that expectation will need to be justified through demonstration that the savings levels are not cost-effective, cannot be achieved, and/or produce undue rate impacts (after consideration of the rate mitigating factors discussed above). The

Board may also want to consider whether the maximum shareholder incentive level should be increased if budgets, savings and levels of effort increase considerably in the 2018-2020 period.

8. Regarding EM&V and oversight, continue the operation of the TEC and Audit Committees with the involvement of Board Staff. The committees should function as in the past but with two refinements (in addition to regular involvement of Board Staff):

   a. turn over the hiring of CPSV evaluators of the custom projects to the Auditor rather than the utilities, and
   b. reform the TEC decision-making process so that decisions can be made and work can proceed if consensus is not possible.

9. Regarding the integration of DSM into infrastructure planning:

   a. Accept Enbridge's proposed study scope of work and transition plan with the following modifications:
      i. make the development of hourly peak day load shapes for each major efficiency measure the first task and deliverable of the study
      ii. case studies for the study should be selected through a structured process as I outline in my evidence
      iii. ensure that at least one case study is launched as a pilot project in the field before the end of 2016 to enhance its transition plan.
   b. Reject Union's efforts in this area and instruct it to work with Enbridge on its study.
   c. Require Union to adopt the same transition plan as Enbridge, including the launch of a pilot infrastructure deferral project within before the end of 2016.
   d. Instruct both utilities to work with interested stakeholders on their studies and the development of pilot projects.
   e. Establish penalties that utilities will face if they do not abide by the Board's previous order to consider DSM as an alternative to infrastructure investments in all future leave to construct projects.

CHRISTOPHER NEME, PRINCIPAL

EDUCATION

M.P.P., University of Michigan, 1986
B.A.., Political Science, University of Michigan, 1985

EXPERIENCE

2010-present: Principal, Energy Futures Group, Hinesburg, VT
1999-2010: Director of Planning & Evaluation, Vermont Energy Investment Corp., Burlington, VT
1993-1999: Senior Analyst, Vermont Energy Investment Corp., Burlington, VT
1992-1993: Energy Consultant, Lawrence Berkeley National Laboratory, Gaborone, Botswana
1986-1991: Senior Policy Analyst, Center for Clean Air Policy, Washington, DC

PROFESSIONAL SUMMARY

Chris Neme leads a variety of consulting projects for clients across the United States, Canada, and Europe. He specializes in analysis of markets for energy efficiency measures and the design and evaluation of programs and policies to promote them. Prior to co-founding Energy Futures Group, he served as Director of the Vermont Energy Investment Corporation's 30-person consulting division. During his 20+ years in the energy efficiency industry, Mr. Neme has conducted or critically reviewed analyses of efficiency potential in ten states; reviewed or developed efficiency programs in more than 25 states and provinces and in Europe; and defended expert witness testimony before regulatory commissions in ten different jurisdictions. Mr. Neme has led training courses on the elements of good efficiency program design and published/presented assessments of efficiency markets, programs and policies through a variety of publications, conferences, Consortium for Energy Efficiency Committees, ENERGY STAR working groups and other forums. He previously served as Co-Chair of NEEP's EM&V Research and Evaluation Committee.

SELECTED PROJECTS

- ***Northeast Energy Efficiency Partnerships.*** Managing Regional EM&V forum project estimating for emerging technologies. Also, leading project to assess national best practices and develop policy guidance on the use of efficiency to defer T&D investments. (2009 to present)
- ***Regulatory Assistance Project - U.S.*** Providing guidance on efficiency policy and program design. Lead author on strategic reports, including what it would take to achieve 30% electricity savings over ten years and lessons from U.S. experience using efficiency programs to defer T&D system investments. Also provide technical assistance to several state regulators, technical support to various Energy Foundation grantees across the U.S., and assistance in RAP's work with the U.S. EPA on efficiency's role in 111d carbon emission regulations. (2010 to present)
- ***Natural Resources Defense Council (Illinois & Michigan).*** Critically reviewed multi-year DSM plans filed by Illinois and Michigan utilities. Drafted and defended regulatory testimony on critiques. Represent NRDC in monthly stakeholder-utility meetings to review and provide feedback on efficiency potential studies, program designs, evaluation priorities, draft evaluation reports, cost-effectiveness screening, TRM savings assumptions, and other related topics. Also, assisting with strategy for maximizing the cost-effective use of efficiency to address EPA's proposed 111(d) regulations of carbon emissions from power plants. (2010 to present)

CHRISTOPHER NEME, PRINCIPAL

- ***Ontario Gas Utility Evaluation/Audit Committees:*** Elected by non-utility stakeholders to serve on provincial Technical Evaluation Committee both overseeing gas DSM evaluation planning managing individual evaluation studies. Also serve on Enbridge Gas's annual Audit Committee which oversees an annual savings verification process. (2000 to present)

- ***Green Energy Coalition (Ontario).*** Representing a coalition of environmental groups in various regulatory proceedings. Present recommendations on DSM policies (including integrated resource planning on pipeline expansions), critically review and negotiate with utilities on proposed DSM Plans, and defend expert witness testimony. (1993 to present)

- ***Regulatory Assistance Project - Europe.*** Providing on-going technical support on efficiency policy and program design to RAP and its partners in the United Kingdom, Germany, and other countries. Reviewed draft European Union policies on Energy Savings Obligations, EM&V protocols and other related issues. Drafted a policy brief on design considerations for efficiency feed-in-tariffs, a report on bidding of efficiency resources into capacity markets, and a roadmap for achieving deep retrofits in half of the residential building stock. (2009 to present)

- ***Ontario Power Authority.*** Managed jurisdictional scans of how efficiency programs leverage building efficiency labeling/disclosure requirements and how non-energy benefits are addressed in cost-effectiveness screening. Also supported staff workshop on the role efficiency can play in deferring T&D investments. Presented assessment of future efficiency policy and program trends for Advisory Council on Energy Efficiency. (2012-2015)

- **Vermont Public Interest Research Group.** Conducted comparative analysis of the economic and environmental impacts of fuel-switching from oil/propane heating to either natural gas or efficient, cold climate electric heat pumps. Filed regulatory testimony on findings. (2014-2015)

- **New Hampshire Electric Co-op**. Led assessment of the co-op's environmental and social responsibility programs' promotion of whole building efficiency retrofits, cold climate heat pumps and renewable energy systems. Presented recommendations to the co-op Board. (2014)

- ***National Association of Regulatory Utility Commissioners (NARUC).*** Assessed alternatives to basing state energy efficiency goals on first year savings to eliminate disincentives to invest in longer-lived (but often more expensive) measures and programs. Work was ultimately for the Michigan Public Service Commission and was used by Commission staff to establish lifetime savings metrics for utility programs it regulates. (2013)

- ***California Investor-Owned Utility***. Senior advisor on EFG project to compare the cost of saved energy across ~10 leading U.S. utility portfolios. The research sought to determine if there are discernable differences in the cost of saved energy related to utility spending in specific non-incentive categories, including administration, marketing, and EM&V. (2013)

- ***Green Mountain Power.*** Helped develop new program to introduce ultra-efficient cold-climate heat pumps to Vermont residential and small business markets. (2012-2013)

- ***DC Department of the Environment (Washington DC).*** Part of VEIC team administering the DC Sustainable Energy Utility (SEU). Primary responsibilities are characterizing the DC efficiency market and supporting the design of efficiency programs that the SEU will be implementing. (2011 to 2012)

CHRISTOPHER NEME, PRINCIPAL

- ***Ohio Sierra Club.*** Filed and defended expert witness testimony on the implications of not fully bidding all efficiency resources into the PJM capacity market. Also critically reviewing First Energy's and other utilities' multi-year DSM plans. (2012)
- ***Regulatory Assistance Project – Global.*** Assisted RAP in framing several global research reports. Co-authored the first report – an extensive "best practices guide" on government policies for achieving energy efficiency objectives, drawing on experience with a variety of policy mechanism employed around the world. (2011)
- ***Tennessee Valley Authority.*** Assisted CSG team providing input to TVA on the redesign of its residential efficiency program portfolio to meet aggressive new five-year savings goals. (2010)
- ***Efficiency Vermont.*** Oversaw residential program planning, input to the VT Department of Public Service on evaluation planning, input to NEEP's regional EM&V forum, and development of M&V plan and other aspects of bids of efficiency resources into New England's Forward Capacity Market (FCM) from March 2000 through Spring 2010.
- ***Ohio Public Utilities Commission.*** Senior Advisor to a project to develop a web-based Technical Reference Manual (TRM). The TRM includes deemed savings assumptions, deemed calculated savings algorithms and custom savings protocols. It is designed to serve as the basis for all electric and gas efficiency program savings claims in the state. (2009 to 2010)
- ***New Jersey Clean Energy Program.*** Oversaw support of Honeywell-led team delivering all statewide residential efficiency and renewable energy programs. Led work on program design, regulatory filings, savings algorithms, and evaluation planning. (2006 to 2010)
- ***New York State Energy Research and Development Authority (NYSERDA).*** Led several analyses of residential electric and gas efficiency potential (over 20 years) for New York State. Scenarios included continuation of existing initiatives, new budget constraints and a least-cost approach to meeting greenhouse gas emission reduction targets. (2001 to 2010)
- ***Oregon Energy Trust***. Part of a team that developed case studies of successful community-based efficiency or renewable energy efforts across North America, synthesized lessons learned from those examples, and developed recommendations for how the Trust might effectively advance its mission through community-based approaches to promoting efficiency. (2004-2005)
- ***New Jersey Utilities Collaborative.*** Oversaw all technical assistance on the design and implementation of nine statewide residential efficiency and renewable energy programs. Personally led work on two of the programs (Electric HVAC and Gas HVAC), including facilitation of monthly meetings with all seven electric and gas utilities in the state; negotiations with the utilities on budgets, goals, and program designs; and technical assistance on a variety of program issues, including development of marketing plans and evaluation plans. (1994 to 2003)
- ***Long Island Power Authority Clean Energy Plan.*** Led team that designed the four major residential programs (three efficiency, one PV) incorporated into the plan in 1999. Oversaw extensive technical support to the implementation of those programs. This involved assistance with the development of goals and budgets, development of savings algorithms, cost-effectiveness screening, and on-going program design refinements. (1998 to 2009)

CHRISTOPHER NEME, PRINCIPAL

SELECTED PUBLICATIONS

- "Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments", published by Northeast Energy Efficiency Partnerships, January 9, 2015 (with Jim Grevatt)
- "Unleashing Energy Efficiency: The Best Way to Comply with EPA's Clean Power Plan", Public Utilities Fortnightly, October 2014, pp. 30-38 (with Tim Woolf, Erin Malone and Robin LeBaron)
- "The Resource Value Framework: Reforming Energy Efficiency Cost-Effectiveness Screening", published by the National Efficiency Screening Project, August 2014 (with Tim Woolf et al.)
- "U.S. Experience with Participation of Energy Efficiency in Electric Capacity Markets", published by the Regulatory Assistance Project, August 2014 (with Richard Cowart)
- "Alternative Michigan Energy Savings Goals to Promote Longer-Term Savings and Address Small Utility Challenges", prepared for the Michigan Public Service Commission, September 2013 (with Optimal Energy)
- "An Energy Efficiency Feed-in-Tariff: Key Policy and Design Considerations", 2013 ECEEE Summer Study Proceedings, pp. 305-315 (with Richard Cowart)
- "U.S. Experience with Efficiency as a Transmission and Distribution System Resource", published by the Regulatory Assistance Project, February 2012 (with Rich Sedano)
- "Achieving Energy Efficiency: A Global Best Practices Guide on Government Policies", published by the Regulatory Assistance Project, February 2012 (with Nancy Wasserman)
- "Residential Efficiency Retrofits: A Roadmap for the Future", published by the Regulatory Assistance Project, May 2011 (with Meg Gottstein and Blair Hamilton)
- "Is it Time to Ditch the TRC?" Proceedings of ACEEE 2010 Summer Study on Energy Efficiency in Buildings, Volume 5 (with Marty Kushler).
- "Energy Efficiency as a Resource in the ISO New England Forward Capacity Market", in *Energy Efficiency*, published on line 06 June 2010 (with Cheryl Jenkins and Shawn Enterline).
- "Shareholder Incentives for Gas DSM: Experience with One Canadian Utility", Proceedings of ACEEE 2004 Summer Study Conference on Energy Efficiency in Buildings, Volume 5 (with Kai Millyard).

FORM A

Proceeding: EB-2015-0029
EB-2015-0049

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is Chris Neme (*name*). I live at Shelburne (*city*), in the state ~~(province/state)~~ of Vermont.

2. I have been engaged by or on behalf of Green Energy Coalition (*name of party/parties*) to provide evidence in relation to the above-noted proceeding before the Ontario Energy Board.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:
   (a) to provide opinion evidence that is fair, objective and non-partisan;
   (b) to provide opinion evidence that is related only to matters that are within my area of expertise; and
   (c) to provide such additional assistance as the Board may reasonably require, to determine a matter in issue.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date July 29, 2015

Signature