EB-2015-0029
EB-2015-0049

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act 1998,* S.O.1998, c.15, (Schedule B);

AND IN THE MATTER OF applications for approval of 2015-2020 demand side management plans by Union Gas Limited and Enbridge Gas Distribution Inc.

ENVIRONMENTAL DEFENCE'S DOCUMENT BOOK FOR CROSS-EXAMINATIONS OF GEC AND BOARD STAFF WITNESSES

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Note: The above documents have been marked up by counsel. Most are excerpts of the relevant document.

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[1] EB-2012-0037 at Exhibit D6.1.
[2] http://www.energy.gov/sites/prod/files/2015/06/f23/EXEC-2014-005846_6%20Report_signed_v2.pdf (referred to in Exhibit M.Staff.GEC.12).
[3] http://www.energy.gov/sites/prod/files/2015/06/f23/EXEC-2014-005846_5%20Study__0.pdf.
[4] http://www.iipnetwork.org/IEE_Effective_State_Programs.pdf2 (referred to in Exhibit M.Staff.GEC.12).
[5] Exhibit M.Staff.GEC.12, Attachment 1.
[6] EB-2015-0029/0049, Exhibit K4.3.

Exhibit L.GEC.1

Before the Ontario Energy Board

EB-2015-0029 and EB-2015-0049

Union and Enbridge 2015-2020 DSM Plans

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The Green Energy Coalition
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July 29, 2015
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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 a little more than 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 more than $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 3% to 5% below 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.

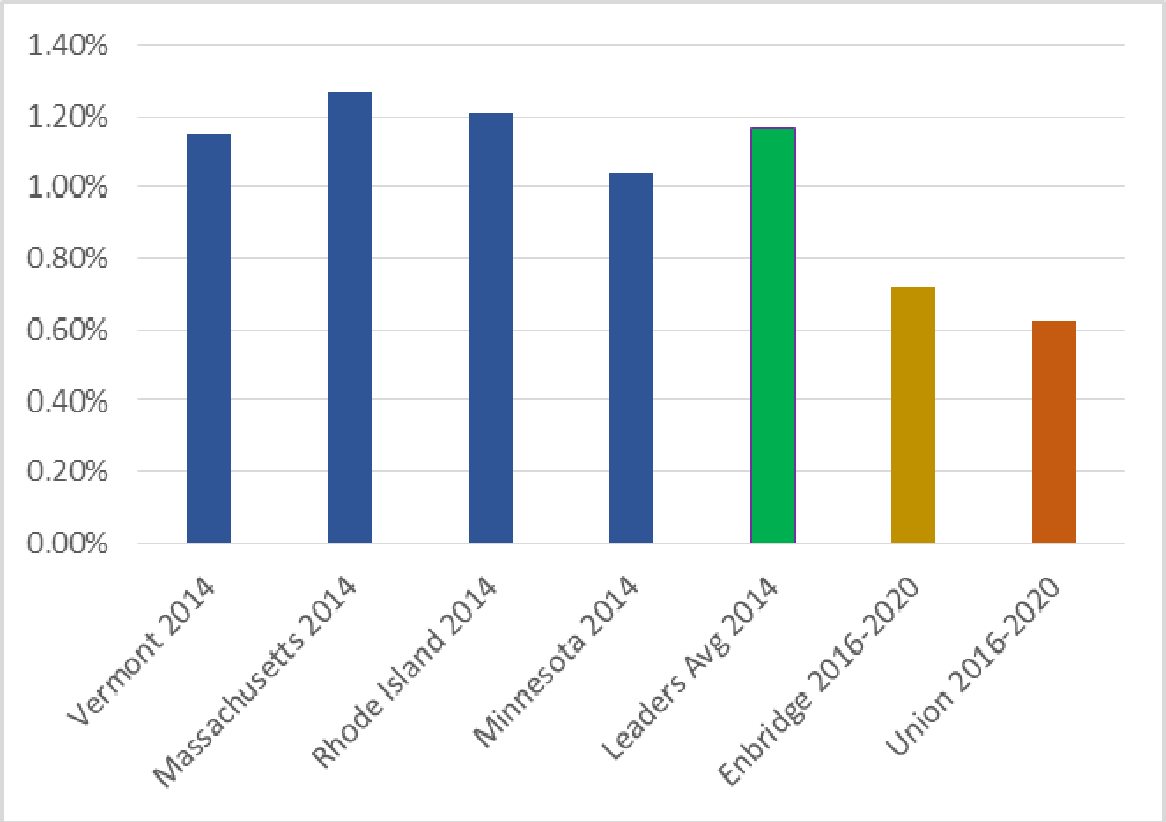
2. Savings Will Be Well Below Leading Jurisdictions

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, that level of savings is a little more than half of what leading jurisdictions have already achieved (i.e. in 2014)."[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]

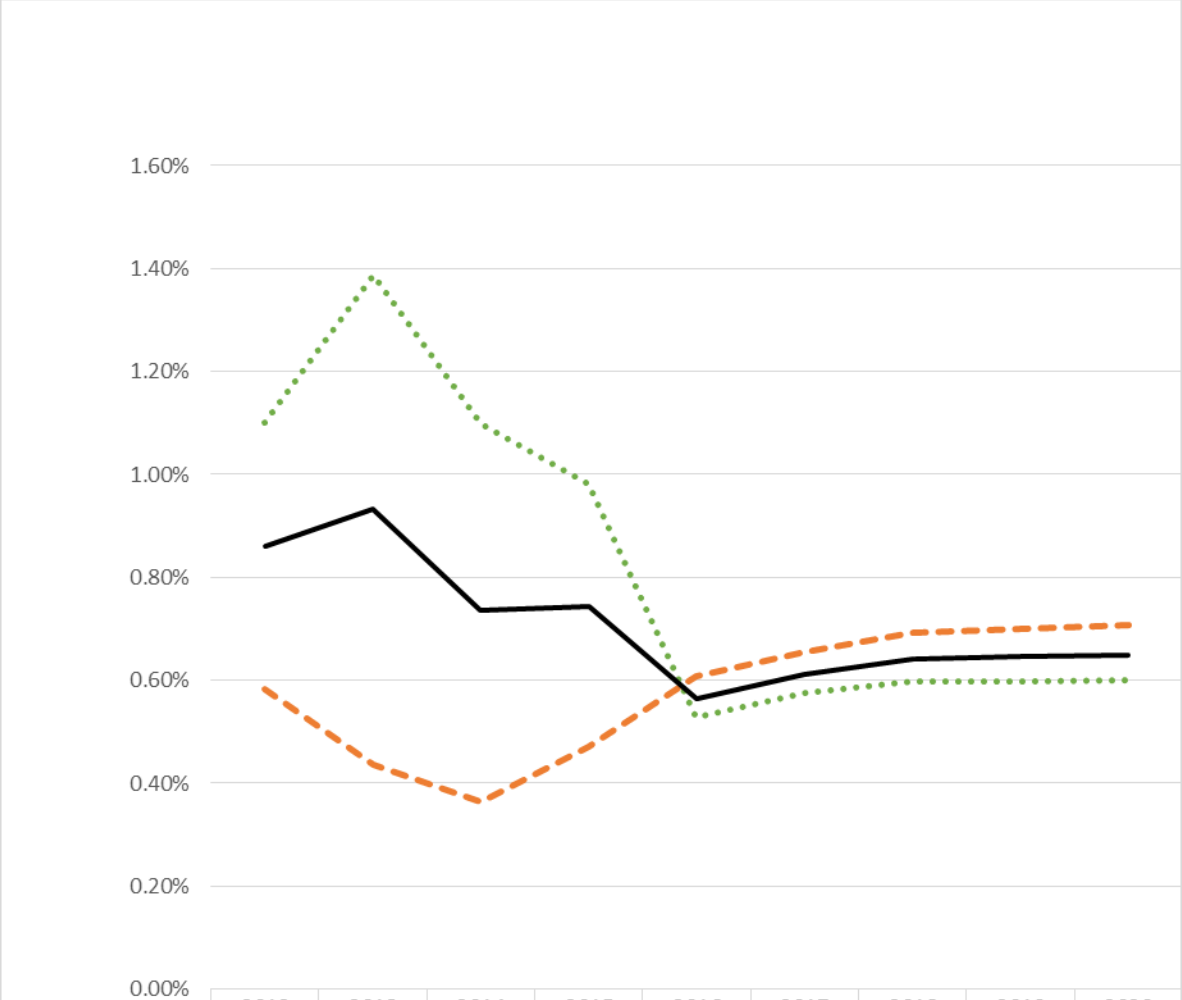


3. Total Ontario Gas Savings will Actually Decline under Utilities' Plans

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 each State's utilities are 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

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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

Benefit		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]	
		Enbridge	Union	Enbridge	Union	Enbridge	Union
1	Avoided carbon regulation costs[39]	$0.98	$0.98	$73.2	$73.9	101%	129%
2	Price suppression effects[40]	$0.08	$0.08	$6.2	$6.3	9%	11%
3	Reduce purchase of most expensive gas[41]	$0.10	$0.18	$7.2	$13.3	10%	23%
4	Avoided distribution system costs[42]	$0.38	$0.24	$28.1	$18.2	39%	32%
	Total	**$1.54**	**$1.49**	**$114.7**	**$111.7**	**158%**	**195%**

[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 is $72.3 million; Union's is $57.4 million (both in 2015 dollars).

[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] For Enbridge, 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). For Union, I used the average of the differences Mr. Chernick reports for 2015 and 2016 (Chernick p. 28): $0.015 for baseload and $0.017 for space heating measures. 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. 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 more than a $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.

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]

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[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.

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.

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

Ontario Energy Board

EB-2014-0134

Report of the Board

Demand Side Management Framework for Natural Gas Distributors (2015-2020)

December 22, 2014

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material advancements are made in the near future and maintained throughout the course of the 6-year framework and beyond. The gas utilities should allocate an appropriate portion of the shareholder incentive amount to these key priority areas to help drive activity. The shareholder incentive is discussed further in Section 5 below. The Board expects the gas utilities will develop and propose balanced scorecards that appropriately direct the utilities' efforts to achieve significant long-term natural gas savings as well as address other key priorities outlined in the DSM framework.

Proposed targets should be filed for approval as part of the gas utilities' applications for distribution rates to fund their DSM plans. There are a number of factors for the Board to consider in setting DSM targets. The Board expects that as part of the application process, the setting of targets will be an issue excluded from a settlement with parties. The Board therefore expects to hold a hearing with respect to approval of the multi-year DSM plans. This of course does not preclude the utilities from undertaking appropriate stakeholdering of their plans.

Each year, the Board will assess the gas utilities' overall performance based on their actual achievements, as conveyed through the annual final evaluation and audit process, in relation to the various annual targets approved by the Board. Shareholder incentives will be based on the achievement of the annual scorecard metrics and be rewarded to each gas utility annually.

4.0 DSM BUDGETS

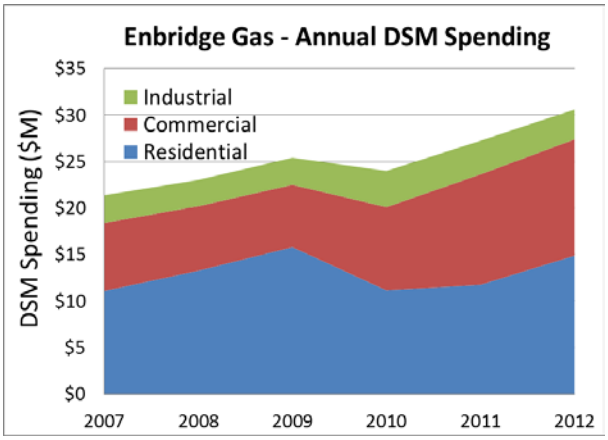
In order to fund the costs of administering and delivering DSM programs, including marketing efforts, financial incentives to participants, and educating consumers, long-term and annual DSM budgets must be developed that will enable the achievement of DSM targets over the duration of the DSM framework (i.e., 2015 to 2020).

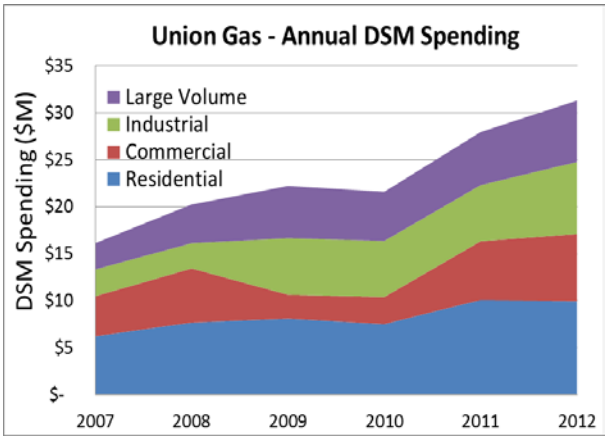
In the 2012 DSM Guidelines, the Board provided guidance to the gas utilities regarding the expected upper limit of the annual DSM budgets, which for 2011 was $28.1 million for Enbridge and $27.4 million for Union. Based on the Board's direction, the gas utilities developed their 2012 to 2014 DSM plans and respective annual targets based on an upper limit of the budget in 2014 being $32.8 million for Enbridge and $32.2 million for Union[13].

[13] The annual DSM budgets were subject to annual escalations for the previous year's Gross Domestic Product Implicit Price Index ("GDP-IPI") and could be increased if the gas utilities' low-income programs were expanded.

The gas utilities' DSM spending since 2002 is shown in the graphs below. It can be seen that both Enbridge and Union spent approximately the same amount of ratepayer funding on DSM in 2012. It can further be seen that spending levels on program types differ between the two utilities with Enbridge dedicating a larger portion of its ratepayer funding to residential and commercial customers while Union dedicated close to half of its budget to larger customers, those in the industrial and large volume rate classes.

Figure 3 (Enbridge DSM Expenditures) & **Figure 4** (Union DSM Expenditures[14])





As part of the Draft Report, the Board provided two options for comment related to how future budgets would be established. The first option proposed was similar to the direction provided as part of the 2012 DSM Guidelines, where the Board would establish a budget guideline for the gas utilities to follow. The second option proposed was to have the gas utilities propose annual budgets within their multi-year DSM plans commensurate with the activities required to achieve the long-term DSM targets.

The Board acknowledges that DSM targets and DSM budgets are closely related. In order to have a reasonable expectation that a particular target is attainable, a corresponding budget that has appropriately taken the targeted level of activity into account is necessary. It is important to consider the impacts both targets and budgets have on each other. In the event that the budget is not sufficient, the targeted goals may be inappropriate and overall results will be less than expected.

Following the application by the gas utilities for approval of their multi-year DSM plans, the Board will review and assess the appropriateness of the proposed budget amounts relative to the natural gas savings targets (both the annual and long-term goal). Additionally, the Board's consideration of appropriate budget and target levels will also

[14] Annual gas savings from large volume customers are for visual purposes only. Large volume customers for Union Gas Limited are defined as those from customers in the following classes: Rate T1, Rate T2 and Rate 100.

include the resulting impact that budgeted DSM expenditures have on distribution rates. Ultimately, distribution customers are responsible for financially supporting all DSM activities in Ontario. Although some of these customers will participate in the programs offered by the gas utilities and benefit from the natural gas savings, a large majority of customers will not participate for a number of reasons. Many elements of DSM programs that offer the greatest opportunity to realize long-term natural gas savings (and bill reductions) are related to the installation of energy efficient products, such as a furnace or insulation. The opportunity to install one of these more significant items will not be present for the majority of customers in the gas utilities' service territories. As a result of this, the many customers who do not participate in any DSM program end up cross-subsidizing, through natural gas distribution rates, energy efficiency upgrades for those customers who do participate. Because of this, the Board must be mindful of the overall impact additional costs have on all customers (both participants in DSM programs and non-participants).

The LTEP and Conservation Directive discuss the importance of the Board aligning natural gas DSM efforts with electricity CDM efforts and to implement the government's policy of putting conservation first in electricity distributor and natural gas distributor infrastructure planning processes at the regional and local levels. The goal of doing so is to avoid or defer infrastructure investments through targeted reductions in the demand for natural gas. However, it is important to note that one major difference between the electricity and natural gas sectors in Ontario is where the energy resources are sourced. A large portion of the electricity needed for the province is generated within Ontario. This differs from the natural gas needed by the province, which is sourced from outside of Ontario, other than that which is available in storage. Therefore, the ultimate goals of electricity CDM and natural gas DSM have differences. Electricity CDM can be related directly to a reduction in the need for future generation and the associated infrastructure.

In the Ontario electricity sector, almost all the financial risk with respect to new infrastructure (e.g., generation, transmission and distribution) is borne by Ontario ratepayers, either by way of regulation or long-term commitments by the OPA. Accordingly, avoiding infrastructure investments for electricity generation has a direct impact on the costs borne by consumers. By comparison, in the natural gas sector, deferral of natural gas infrastructure in Ontario through DSM relates only to pipes and related assets (including storage), since the supply of natural gas comes from outside of the province. Therefore, while all the financial risk with respect to transmission, distribution and some storage of natural gas are borne by Ontario ratepayers, this is not true with respect to the commodity, other than with relevant long-term transportation and supply contracts entered into by the distributor. This is an important factor for the

Board in considering the alignment of DSM and CDM efforts, especially with respect to the absolute costs that are appropriate for natural gas DSM efforts.

4.1 Stakeholder Comments

The gas utilities requested that the Board provide an acceptable budget range that reflects the Conservation Directive and the objectives of DSM. Further, they noted that this guidance should include the level of DSM budget that will result in reasonable rate impacts, but allow the gas utilities enough flexibility to meet their annual targets and long-term goals.

Stakeholders and the gas utilities generally agreed that the Board should allow the gas utilities to develop and propose annual budgets which were informed by their DSM target analysis to ensure that all savings opportunities were effectively being addressed. Many stakeholders, including the environmental representatives, did not feel that budget guidance from the Board was necessary and that budgets should be driven by the overall gas savings available to each gas utility. Some stakeholders, however, appreciated the benefit of the Board providing guidance for acceptable budget amounts in order to allow for a more efficient process in developing and analyzing the gas utilities' new multi-year DSM plans.

Stakeholders were in general agreement that it was not appropriate for the Board to establish DSM budgets as a percentage of gas utility distribution revenues. Neither did stakeholders believe it was appropriate to compare DSM budget amounts to other jurisdictions or Ontario's electricity conservation budget amounts as each utility and jurisdiction have distinct and unique opportunities and variables that must be considered.

Several stakeholders provided suggested budget parameters, but focused these suggestions on the long-term, or 6-year, budgets as opposed to annual budget guidance. These stakeholders noted that by providing more general guidance on overall budgets for the 6-year framework, the gas utilities will have the flexibility to adjust annual budgets according to its proposed suite of programs and avoid any detrimental issues associated with ramping up activities, such as doing so too fast and potentially inefficiently or doing so too slow and possibly missing opportunities. One stakeholder suggested that the Board established the overall 6-year framework budget guideline at a similar aggregate level to the gas utilities' 2014 budgets, increased for 15%, which the Board has found to be a reasonable level of additional spending in the past.

Overall, many stakeholders were of the view that annual DSM spending was likely to increase in order to achieve a greater level of natural gas savings, although there were some stakeholders who cautioned that increased spending must be supported by evidence that clearly displayed the incremental benefits the additional expenditures will produce.

4.2 Board Conclusions

The Board's objectives with respect to natural gas include the requirement to protect the interests of consumers with respect to prices, reliability and quality of gas service. The Board also has an objective to promote energy conservation and energy efficiency, but doing so having regard to the consumer's economic circumstances. In approving any budget amount, it is necessary for the Board to consider the rate impacts, or overall cost impacts, to customers, as all DSM costs are recovered through distribution rates. As noted earlier, since all customers share the total cost of DSM activities undertaken by the gas utilities, the Board must be mindful of the cost impacts to the non-participating customers. Many customers in all rate classes will likely not participate in a DSM program over the course of the new DSM framework. This is due to a number of reasons, including the inherent limits of DSM programs, primarily driven by the lack of opportunities a customer has to upgrade space or water heating systems. Although non-participating customers will enjoy some of the non-energy benefits that result from the program, including environmental benefits, the Board is centrally concerned with two factors that must be balanced: ensuring the gas utilities have sufficient funding available to pursue all cost-effective natural gas savings in their franchise areas and that the costs to undertake such efforts are reasonable for those customers who will not participate in a program.

Therefore, the Board has determined that for DSM activities between 2015 and 2020, the gas utilities' annual DSM budgets should be guided by the simple principle that DSM costs (inclusive of both DSM budget amounts and shareholder incentive amounts[15]) for a typical residential customer of each gas utility should be no greater than approximately $2.00/month. The current bill impact for a typical residential customer is just under $1.00/month. The budget guidance for the new multi-year DSM plans is in the order of double the cost impacts to residential customers from the 2012 to 2014 DSM period. Based on a $2.00/month cost impact to a typical residential customer and considering the general historic program mix and the relative size of each utility, the Board has estimated total annual DSM amounts of $85M for Enbridge and $70M for

[15] Shareholder Incentives are further discussed in Section 5 below.

Union (these amounts are inclusive of the maximum annual shareholder incentive[16]). The Board is therefore establishing this as the maximum budget guideline for the new framework. NRG is encouraged to prepare and file a DSM plan with Board. Given that this is a new activity for NRG, the Board concludes that it should start initially with a DSM budget lower than a budget based on NRG's relative size to EGD and Union, and a bill impact for residential customers more in line with EGD and Union's from the previous framework.[17] This can be reviewed at the time of the mid-term review.

To reach the annual budget levels of $75M for EGD and $60M for Union (exclusive of maximum annual shareholder incentive), utilities will need to propose cost-effective DSM plans with results in gas savings, benefits to customers, program participation and implementation of key priorities (outlined in Section 6.2 below) commensurate with the proposed spending. The Board expects that the multi-year DSM plan applications will propose a plan to phase in increases to the annual budget amounts. While the program mix going forward has not been prescribed, the Board is of the view that a bill impact of $2.00/month for a typical residential customer, combined with the total budget amounts discussed above, provides a reasonable guideline for the gas utilities to prepare their DSM plans. The Board notes that this is a guideline, and the utilities can propose alternative budgets for approval by the Board, appropriately supported by evidence.

The budget amounts outlined above assume a general program mix where 40% of ratepayer funding for DSM activities is dedicated to the residential class. The gas utilities should ensure that overall cost increases to all other rate classes are generally proportional with the guidance outlined relative to residential customers, and that any proposed increases are reasonable and supported by significant benefits, including both natural gas savings and prospective bill reductions for customers. The gas utilities should include a forecast of the number of participants (customers, not measures installed) for each proposed program in each year. For each program proposed by the gas utilities, they should also include anticipated overall cost impacts (budget and shareholder incentive) for a typical customer in each rate class, and projected monthly and annual bill reductions for a typical participant and the overall costs borne by a typical non-participating customer.

[16] This is made up of maximum annual budgets of $74.5M for EGD and $59.5M for Union with maximum annual incentives equal to $10.45M for EGD and Union.

[17] The Board does not have historic DSM information for NRG. A budget based on NRG's relative size to both EGD and Union would be $0.35M, and therefore the budget for NRG would be expected to be lower than this. NRG will be expected to fully support any application for rate funding to support DSM activities similar to that which is expected of both EGD and Union.

The final annual DSM budgets will be dependent on potential cost-effective natural gas savings, program mix, market opportunities and the cost to acquire additional savings acknowledging that some efforts are more costly for a variety of reasons (e.g., maturity level of program, cost of energy efficiency technologies with long-lives, low-income programs, etc.). DSM budgets will be driven by the gas utilities' ability to increase activity and address the key priorities discussed below, including delivering tailored service to those customers who have already increased their efficiency levels but can continue to realize savings, increasing operational efficiency improvements, and incorporating behavioural changes into program offerings.

The Board expects the gas utilities to develop innovative DSM programs over the course of the new DSM framework. DSM budgets should be used to continue to transition programs from those which offer and focus on short-term benefits to primarily pursuing long-term natural gas savings. The gas utilities should leverage their internal expertise to provide value-added support and technical guidance to customers. The Board is of the view that the areas noted above have the ability to provide long-term benefits and tangible bill reductions for participating customers. The Board expects the gas utilities' DSM budgets to enable the delivery of results in the key priorities outlined in Section 6.

As noted above, rate and cost impacts for all customers across all classes must be reasonable and a central point of consideration by the gas utilities as they develop their multi-year DSM plans. The Board expects that the gas utilities will provide clear evidence that shows how the proposed DSM expenditures will achieve significant natural gas savings and help customers realize tangible bill reductions.

The Board will approve final annual DSM budgets as part of the hearing on the multi-year DSM plan applications filed by the gas utilities. It is expected that, similar to targets, budgets will not be open to a formal settlement amongst the parties so that the Board has the opportunity to consider all aspects regarding budgets through the hearing. Ultimately, the Board will be responsible for determining the manner and method of approving all elements of the gas utilities' multi-year DSM plan applications through the hearing process.

5.0 SHAREHOLDER INCENTIVE

Natural gas utilities are not licensed by the Board. They operate under franchise agreements with the municipalities they serve. Therefore, there is no licence condition mandating that the gas utilities undertake DSM activities. These activities therefore remain a voluntary business function. This differs in comparison to the electricity sector.

REVIEW OF DEMAND SIDE MANAGEMENT (DSM) FRAMEWORK FOR NATURAL GAS DISTRIBUTORS

SUPPLEMENTAL REPORT

Prepared for:

The Ontario Energy Board

September 15, 2014

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The views expressed in this report are those of Concentric Energy Advisors and do not necessarily represent the views of, and should not be attributed to, the Ontario Energy Board, any individual Board member, or OEB staff.

I. PURPOSE AND METHODOLOGY

The Ontario Energy Board ("OEB") retained Concentric Energy Advisors, Inc. ("Concentric") to update sections of our 2010 report titled *Review of Demand Side Management ("DSM") Framework for Natural Gas Distributors*. In particular, the OEB is seeking updated information regarding certain aspects of gas DSM programs in Canada and the United States, including the following:

1) Market size relative to natural gas consumption and number of customers by sector;
2) DSM budgets by sector;
3) Bill impacts of DSM budgets by sector;
4) DSM budgets as a percentage of distribution revenues by sector, excluding gas costs;
5) DSM budgets as a percentage of gross operational revenues by sector;
6) DSM metrics and targets;
7) Shareholder incentives;
8) Stakeholder engagement; and
9) Legislative and regulatory context – mandatory or voluntary participation and governing body responsible for establishing targets.

Concentric's previous report was presented to the OEB in March 2010, and was based on program data for 2007 and 2008. This supplemental report is based on program data for 2012 and 2013, including DSM budgets, actual DSM expenditures, DSM targets, and DSM budgets as a percentage of revenues. While the primary focus of Concentric's research is on providing updated information for the above categories, the supplemental report also offers historical context and trends by comparing the current state of gas DSM programs to the situation that was observed in the previous report.

Concentric's previous report was based on information for five Canadian jurisdictions and twelve U.S. jurisdictions. The Canadian jurisdictions were selected because they were known to have gas distributors that were actively engaged in DSM activities, while the U.S. jurisdictions were selected on the basis of having the highest per capita[1] spending on gas DSM programs. Per capita spending served as a proxy for being the most actively engaged in implementing gas DSM programs.

[1] "Per capita" is defined as the average per person.

In this supplemental report, Concentric has provided information for the same five Canadian jurisdictions. In the U.S., the twelve jurisdictions in the updated report were selected on the basis of having the highest "Utility Program" score from the American Council for an Energy-Efficient Economy ("ACEEE"). The score is based on ACEEE's assessment of each jurisdiction on the following factors: 1) 2012 electricity program budget; 2) 2012 gas program budget; 3) 2011 electricity program savings; 4) 2011 gas program savings; 5) adoption of an Energy Efficiency Resource Standard; and 6) performance incentives and fixed cost recovery.

Our revised screening criterion in the U.S. resulted in dropping three jurisdictions (i.e., Colorado, New Jersey, Wisconsin) that were part of the 2010 report and adding three new jurisdictions (i.e., Michigan, Rhode Island, Vermont). Concentric determined that it was reasonable to exclude Arizona (ranked 10th by ACEEE) because it has almost no gas DSM programs and to include Maine (ranked 15th) because it is more actively engaged in gas DSM programs after funding was restored in 2013. Table 1 lists the Canadian and U.S. jurisdictions that are included in the supplemental report.

Table 1: Jurisdictions in Concentric's Updated Study

Canadian Provinces	U.S. States
Alberta	California
British Columbia	Connecticut
Manitoba	Iowa
Nova Scotia	Maine
Ontario	Massachusetts
Quebec	Michigan
	Minnesota
	New York
	Oregon
	Rhode Island
	Vermont
	Washington

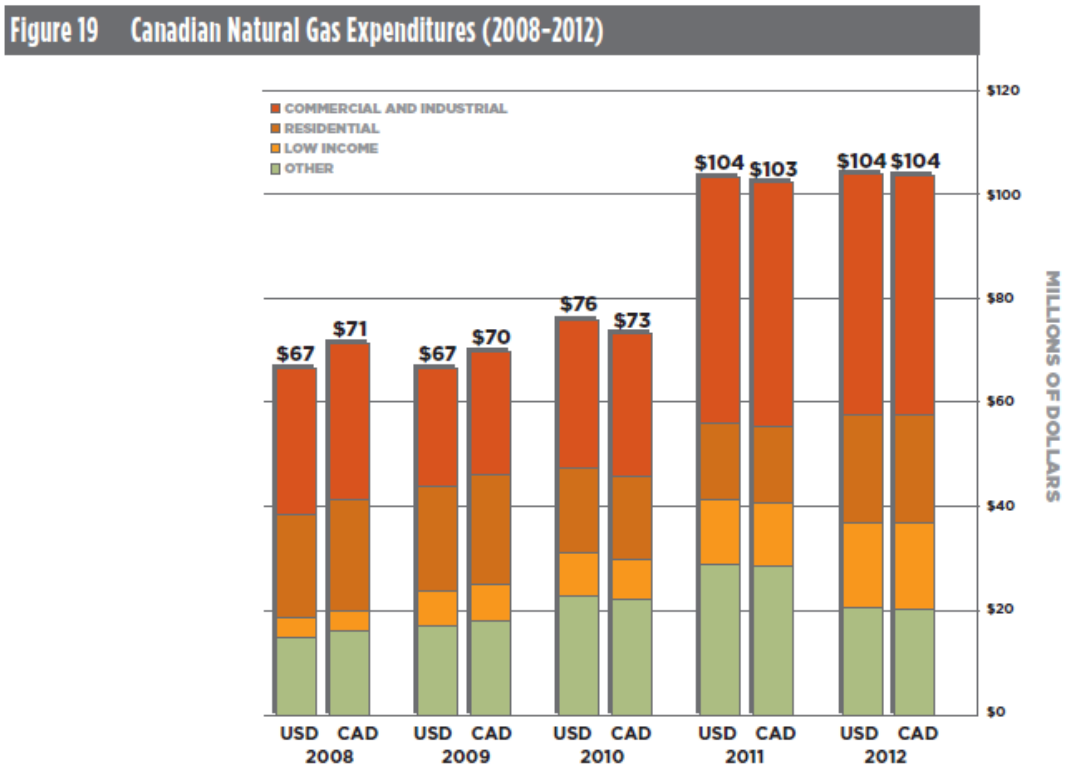
Concentric updated the jurisdictional information for gas DSM programs based on both primary and secondary research. We relied on reports published by the ACEEE, the Consortium for Energy Efficiency ("CEE"), and both the American Gas Association ("AGA") and the Canadian Gas Association ("CGA"). In addition, Concentric gathered financial, operating and customer data from SNL Financial and from various reports filed by individual utilities with their respective utility

regulatory agencies in Canada and the U.S. The results of Concentric's research are summarized in the following series of tables and charts in Section II.

II. SUMMARY OF UPDATED RESEARCH

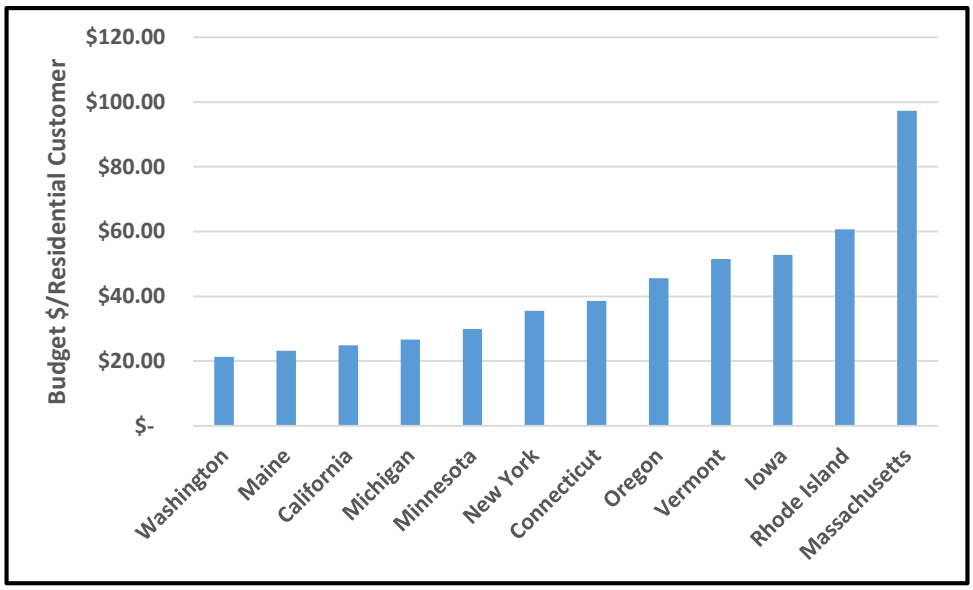
Before discussing our updated research for the nine specific elements of interest to the OEB regarding gas DSM programs, Concentric thought it would be useful to provide a comparison of how spending on gas DSM programs has changed in Canada and the U.S. in recent years. As shown on Chart 1, spending on gas DSM programs in Canada has increased by more than 46% from $71 million in 2008 to $104 million in 2012, with the largest increase in spending having taken place in 2011 and 2012. Similarly, as shown on Chart 2, spending on gas DSM programs in the U.S. has almost doubled from $565 million in 2008 to $1,125 million in 2012.

Chart 1: Canadian Natural Gas DSM Expenditures – 2008-2012[2]



[2] Consortium for Energy Efficiency, 2013 State of the Efficiency Program Industry, March 24, 2014, at 36.

Chart 4: 2012 Gas DSM Budget Dollars per Residential Customer[12]



4) DSM budgets as a percentage of revenues

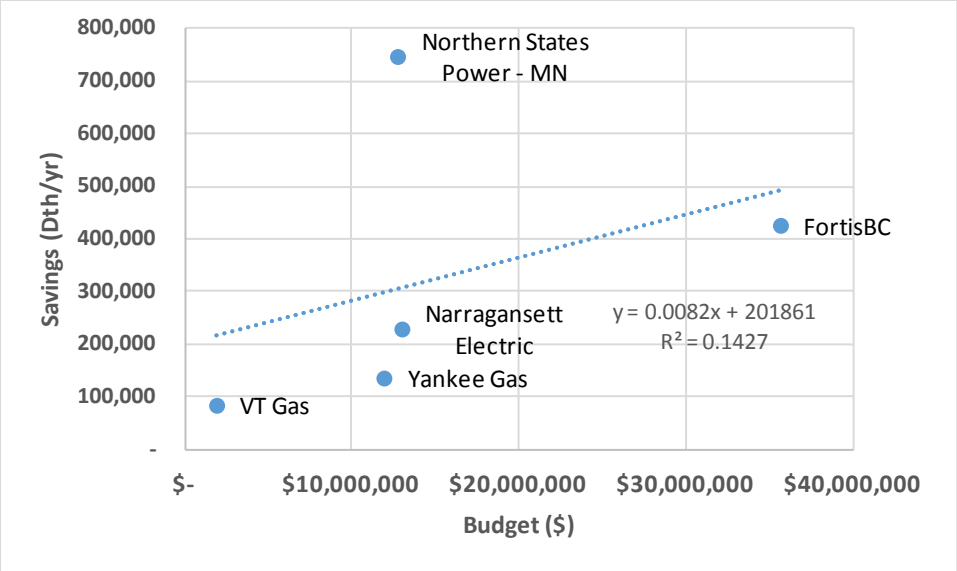
Concentric calculated gas DSM budgets as a percentage of both gross operating revenues and gas distribution revenues for a sample of companies that provide service in the U.S. and Canadian jurisdictions in our study. As shown in Table 10, the DSM budget for gas distributors in the twelve U.S. jurisdictions represented approximately 3.54% of gross operating revenues[13] and 7.52% of gas distribution revenues.[14] By comparison, Concentric's previous report indicated that actual expenditures on gas DSM programs (which are normally less than approved DSM budgets) in the U.S. were equal to approximately 1.14% of gross operating revenue and 3.90% of gas distribution revenues. Table 11 shows that the DSM budget for gas distributors in the Canadian jurisdictions in our study represented approximately 2.77% of gross operating revenues and 5.67% of gas distribution revenues (excluding the cost of gas). By comparison, our previous report indicated that actual expenditures on gas DSM programs in Canada were equal to approximately 0.70% of gross operating revenue and 2.01% of gas distribution revenue.

[12] Based on DSM budget data provided by ACEEE.
[13] Gross Operating Revenue represents total revenues from gas operations, including transportation revenues and the cost of gas supply.
[14] Gas distribution revenue represents Gross Operating Revenue less gas supply costs.

Connecticut, Yankee Gas had a savings target of 0.60% in 2012, a DSM budget equal to 3.22% of gas distribution revenue, and was eligible to earn a shareholder incentive of 5% of the approved DSM budget for achieving 100% of the target.

Chart 5 examines the correlation between savings and DSM budgets for U.S. and Canadian jurisdictions for which data are available. As shown on Chart 5, the correlation between savings and DSM budgets is low (approximately 38%) based on this limited data sample. However, four of the five data points suggest a much higher correlation between savings and DSM budgets (approximately 95%). One outlier (Northern States Power – Minnesota) significantly skews this relationship.

Chart 5: Savings and DSM Budgets



In conclusion, based on Concentric's jurisdictional review, the following recommendations are consistent with our research and would balance competing interests:

1) Annual savings targets of 0.75% to 0.85% of retail sales, increasing gradually from current levels over the term of the DSM plan;
2) DSM budgets equal to approximately 6% to 7% of gas distribution revenue; and
3) Shareholder incentive of approximately 5% of DSM budget for achieving 100% of savings targets, 10% for achieving 150% of savings targets, and 3% for achieving 75% of savings targets.

Filed: 2015-06-23
EB-2015-0029
Exhibit B.T3.Union.ED.4
Page 1 of 2

UNION GAS LIMITED

Answer to Interrogatory from
Environmental Defence ("ED")

Reference: Exhibit A, Tab 3, Appendix A, p. 64

This page describes the key features of Union's Large Volume (T2 and Rate 100) DSM program in 2013 and 2014.

Please provide Union's best estimates of the TRC Net Benefits and lifetime cubic metre savings that would be created if this program were to continue to operate in 2016 with a budget of: a) $4 million; b) $8 million; and c) $16 million.

Please assume that the key qualitative features of this Large Volume (T2 and Rate 100) DSM program in 2016 are the same as they were in 2013 and 2014, but with any adjustments as would be necessary to maximize the net TRC benefits.

Please provide a similar sensitivity analysis for 2017, 2018, 2019 and 2020.

Response:

Union's historical results for the Large Volume Direct Access program are outlined in Table 1. Please note that the 2014 figures are pre-audit and pre-verification.

Table 1

Year	Direct Access (Rate T2/Rate 100) Program Spend[1]	Cumulative Natural Gas Savings (m^3)	Net TRC
2013 Actual	$ 3,209,153	1,664,166,592	$ 221,142,333
2014 Pre-Audit	$ 3,255,408	1,010,819,454	$ 90,749,345

Union could potentially achieve similar annual results if the Direct Access Large Volume program were to be continued in 2016, with a total annual budget of approximately $4 million.

Availability of an $8 million budget could potentially result in approximately twice the results achieved with the 2013/2014 program, indicated above. However, Union expects that since the

[1] Union has allocated promotion, administration and evaluation costs by the percentage of customer incentive as allocated to Rate T2/ Rate 100

overall cost effectiveness of savings opportunities available to customers will decrease as the program size increases, the savings will diminish with budget allocated.

Union is unable to realistically estimate achievable savings considering a total annual budget of $16 million. Extrapolating lifetime savings results based on such a significant increase in budget is unrealistic.

Union notes that the customer rate impacts for its previous program with a budget of $4 million were of significant concern to Large Volume customers. Scenarios related to $8 and $16 million would greatly exacerbate these concerns.

ONTARIO ENERGY BOARD

FILE NO.:	**EB-2015-0029** **EB-2015-0049**	**Union Gas Limited** **Enbridge Gas Distribution Inc.**

VOLUME: **4**

DATE: **August 24, 2015**

BEFORE:	**Christine Long**	**Presiding Member**
	Allison Duff	**Member**
	Susan Frank	**Member**

about that.

MS. LYNCH: Yes, it does account for the free rider rate in these results.

MS. DUFF: Thank you. Thank you, Mr. Elson.

MR. ELSON: Just to clarify further, you have already accounted for a 54 percent free rider rate in these assumptions; is that correct?

MS. LYNCH: Yes, we have.

MR. ELSON: Thank you. According to your response to Environmental Defence Interrogatory No. 4, if the annual budget of the large volume direct access program were raised to $8 million, it's net TRC benefits would rise to approximately $312 million, which is 156 times two. Is that correct, subject to check?

MR. GOULDEN: Yes.

MR. ELSON: Thank you. I'd like to discuss the possibility of rate-basing this spending -- but actually before I do that, I'll ask one question. I think I know what the answer is.

If Environmental Defence were to ask the Energy Board to direct Union to expand its large volume access program with a budget of $8 million, I understand that you would object simply because that's not your proposal; is that correct?

MR. DENT: Yes, we would. As you say, it isn't our proposal. And I think something that we need to take into consideration here, and something that Union has done, is that we have looked at the customer impact and we have

3. Re exhibit I.T3.EGDI.ED.17:

> This interrogatory reads as follows: “Section 5.1.3 and Appendix E contain a benchmarking analysis. Please reproduce the tables and figures contained therein including only those jurisdictions where the utilities in question are required to implement all cost-effective DSM.”
>
> The response reproduced the tables appearing in Section 5.1.3 of the Navigant report but not those in Appendix E. Please also reproduce the tables and figures in Appendix E including only those jurisdictions where the utilities in question are required to implement all cost-effective DSM.

Enbridge provides the following response:

Please see on the following pages the revised versions of Figures E-1, E-2, E-3, E-4, E-5 and Table E-3. Please note that Enbridge has not investigated in detail the characteristics of the below noted utilities or their DSM portfolios. As such significant differences may exist in terms of the types of programs, technologies, input assumptions, adjustment factors, or other details between Enbridge’s DSM activities and those of the utilities displayed below.

Witnesses: K. Mark
S. Moffat
B. Ott

Figure E-1. 2012 Retail Cost of Natural Gas [1,2,3,4,5,6,7]

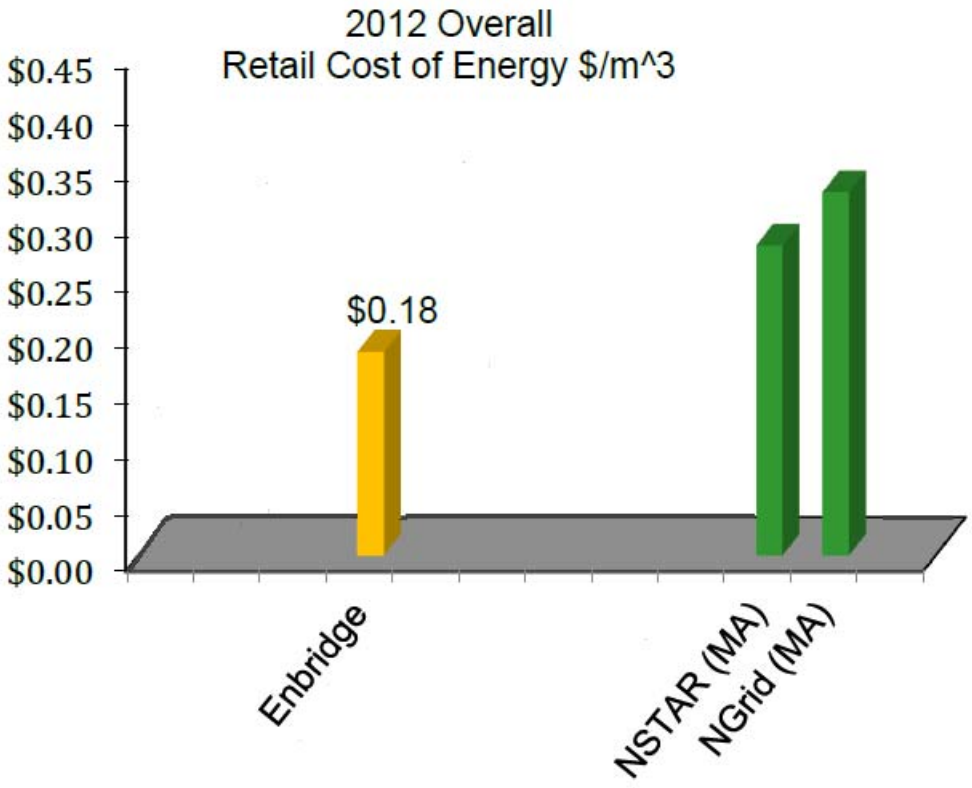


Figure E-2. 2012 DSM Spending as a Percentage of Revenue [1,2,3,4,5,6,7]

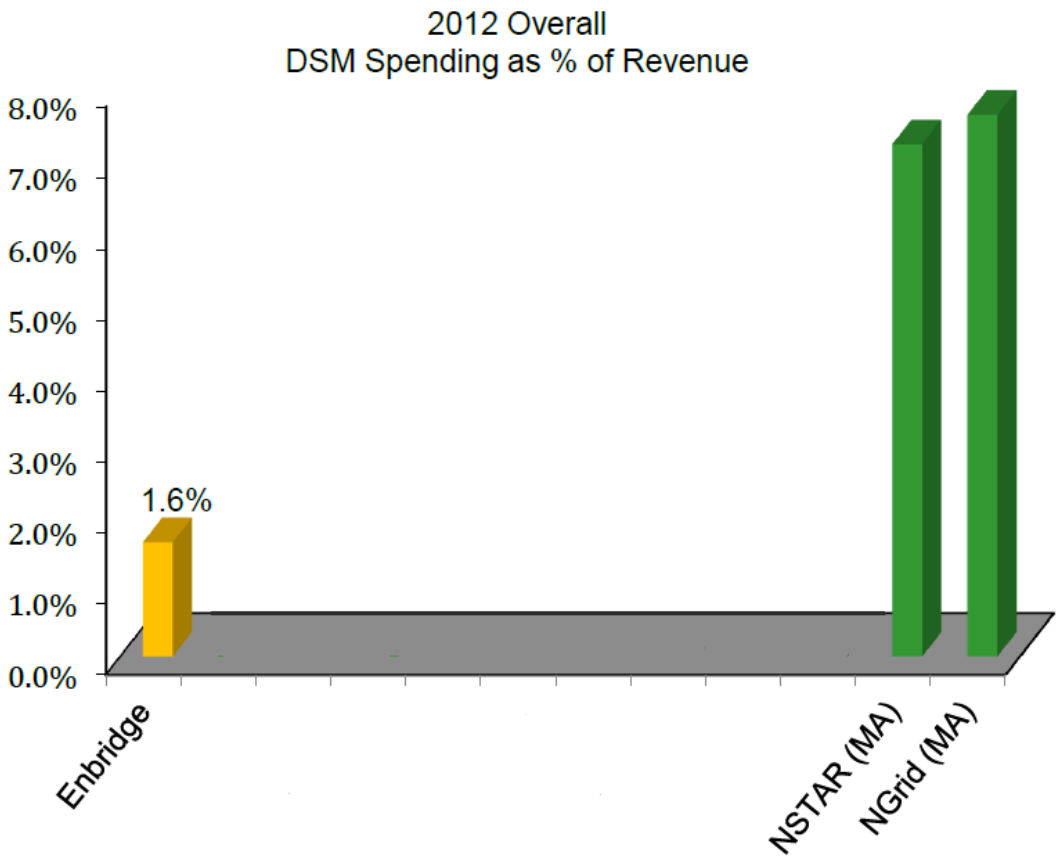


Figure E-3. 2012 Gross Energy Savings as a Percentage of Gas Sales [1,2,3,4,5,6,7]

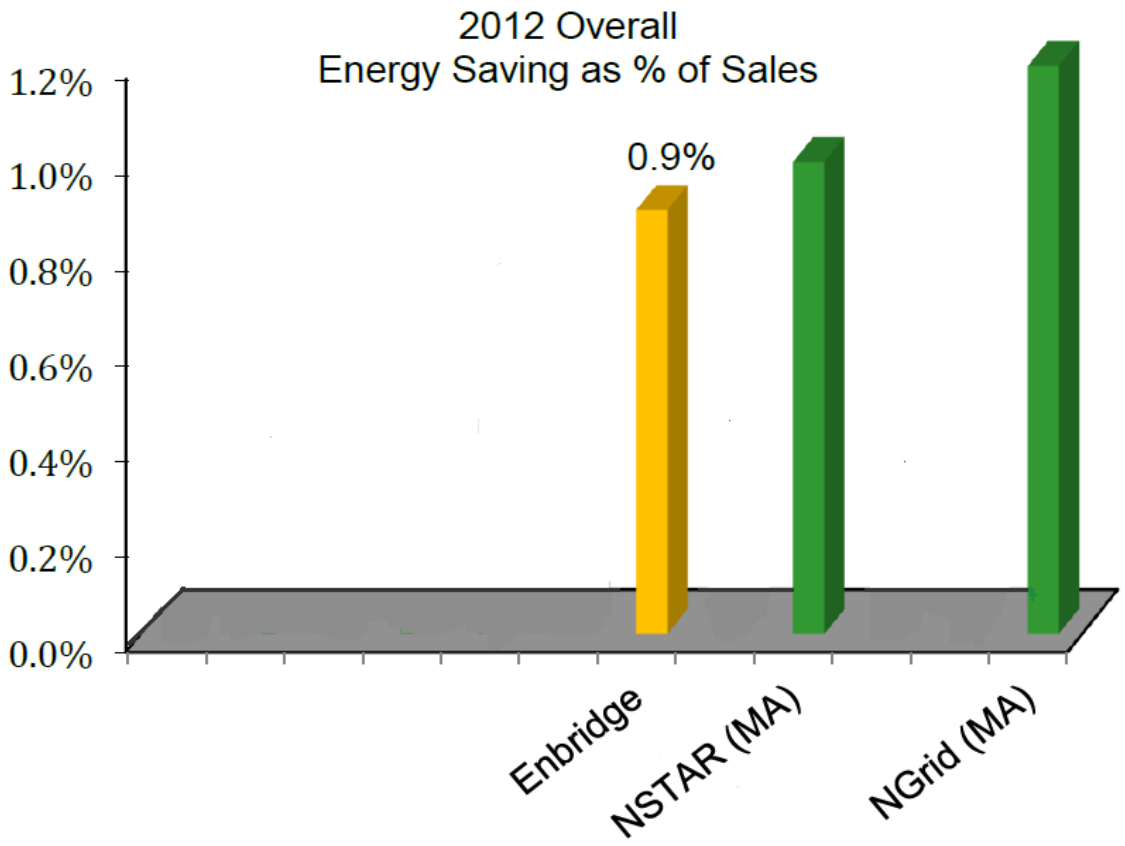
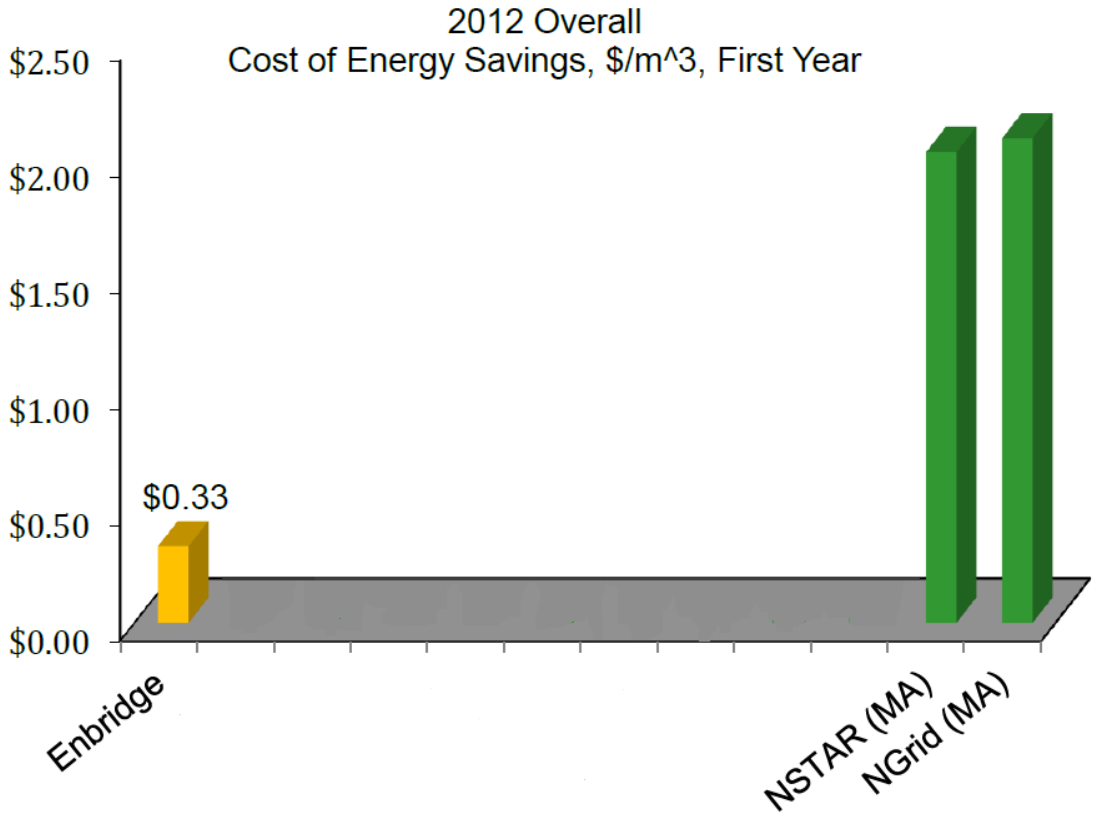
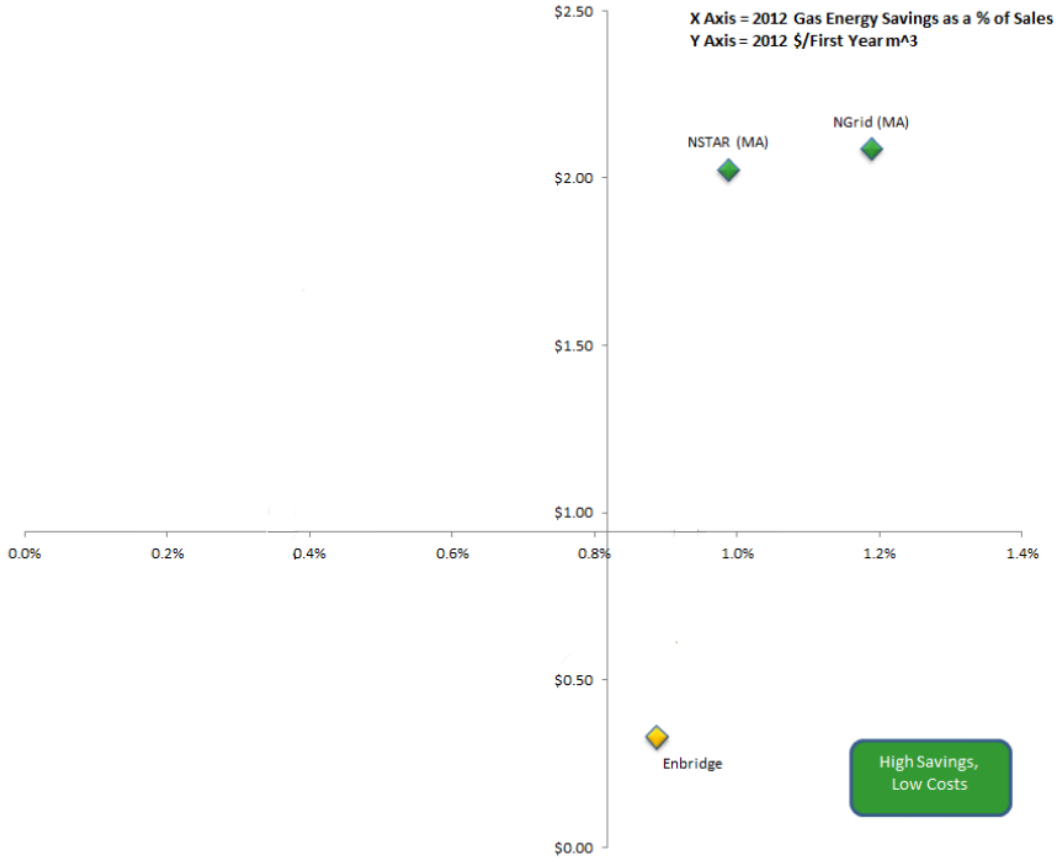


Figure E-4. 2012 Cost of Natural Gas Savings [1,2,3,4,5,6,7]



Filed: 2015-07-17
EB-2015-0049
Exhibit JT1.34
Page 9 of 10

Figure E-5. 2012 Natural Gas Savings and First Year Costs ($/m^3) Over All Sectors [1,2,3,4,5,6,7]



Witnesses: K. Mark
S. Moffat
B. Ott

Table E-3 Detailed Benchmark Data [1,2,3,4,5,6,7]
2012- DSM Results by State

		2012 Incremental DSM Results		2012 Retail				Normalized DSM Results		
Customer Sector	Utility	m3	Costs $M	Customers	Annual m3	Revenue $M	Cost of Energy $/m3	Spending as a % of Revenue	Energy Savings as a % of Sales	Cost of Savings $/m3
Residential										
Canada	Enbridge	14,086,586	$16.6	1,929,313	3,868,127,000	$1,239	$0.32	1.3%	0.4%	$1.18
Massachusetts	NGrid	27,009,771	$71.1	808,556	1,942,084,180	$779	$0.40	9.1%	1.4%	$2.63
Massachusetts	NSTAR	4,867,191	$19.5	245,507	505,168,314	$212	$0.42	9.2%	1.0%	$4.01
C&I										
Canada	Enbridge	78,445,878.0	$14.0	160,167.0	6,567,894,000	$666	$0.10	2.1%	1.2%	$0.18
Massachusetts	NGrid	14,108,121.2	$14.6	82,795.0	1,517,942,300	$346	$0.23	4.2%	0.9%	$1.04
Massachusetts	NSTAR	6,966,670.1	$4.4	27,295.0	692,874,911	$120	$0.17	3.7%	1.0%	$0.64
Overall										
Canada	Enbridge	92,532,464.0	$30.6	2,089,480.0	10,436,021,000	$1,905	$0.18	1.6%	0.9%	$0.33
Massachusetts	NGrid	41,117,892.4	$85.8	891,361.0	3,460,026,479	1,124.6	$0.33	7.6%	1.0%	$2.03
Massachusetts	NSTAR	11,833,861.2	$24.0	272,802.0	1,198,043,225	332.2	$0.28	7.2%	1.0%	$0.66

[1] (0.2% annual savings in 2011, ramping up to 1.5% in 2019) (ACEEE (2014) *State and Local Policy Database: Illinois*, http://database.aceee.org/state/illinois#sthash.bGWyz5jh.dpuf)
[2] http://database.aceee.org/state/iowa#sthash.8lQbPs2e.dpuf
[3] http://database.aceee.org/state/michigan#sthash.TZP0sYSN.dpuf
[4] Vermont law requires program administrators to set *electricity* energy utility budgets at a level that would realize "all reasonably available, cost-effective energy efficiency. A separate proceeding for setting gas energy efficiency budgets is expected in the future, but is not currently in place.
[5] http://database.aceee.org/state/massachusetts#sthash.ulRAAgsM.dpuf
[6] The Green Communities Act requires that electric and gas utilities procure all cost-effective energy efficiency before more expense supply resources http://database.aceee.org/state/massachusetts#sthash.ulRAAgsM.dpuf).
[7] http://database.aceee.org/state/minnesota#sthash.Lr12YnGK.dpuf

Witnesses: K. Mark
S. Moffat
B. Ott

GEC Response to Environmental Defence Interrogatory #4

Question:

Reference: Exhibit L.GEC.1, pp. 30-31 Topic 3: Budgets

(a) Mr. Neme's report notes that in 2013 and 2014 Union calculated the TRC benefits of its large industrial DSM programs based on a free rider rate of 54%. Does that mean that only 46% of the actual TRC benefits associated with these programs were counted in the cost-effectiveness screening undertaken for Union's DSM plans for those years? Does that also mean that, according to the Union's board-approved plans for those years, *all* of the TRC benefits reported by Union in relation to those programs would not have occurred without the utility's programs?

(b) Please file a copy of the studies regarding free ridership referred to on page 31.

(c) Mr. Neme's report states that "There is also no empirical evidence, from Ontario or any other jurisdiction, to support the hypothesis … that large customers would pursue all cost-effective efficiency investments on their own." Do the ACEEE and Navigant Consulting reports outlined on page 31 constitute solid empirical evidence showing that large customers likely will *not* pursue all cost-effective efficiency investments on their own?

(d) In Mr. Neme's professional opinion, are Union's large customers are sufficiently sophisticated and motivated to implement all cost-effective DSM measures on their own? Why or why not?

Response:

a) It means that only 46% of the benefits associated with the efficiency measures installed were counted in Union's cost-effectiveness screening of its program. It is also true that Union only claimed 46% of the savings from the measures installed through the program. Put another way, if 54% is an accurate estimate of free ridership, all of the savings that Union claimed would not have occurred without its program.

b) For the Navigant study for the TEC see M.GEC.APPrO.1. The ACEEE study was previously filed in EB-2012-0037 at Exhibit D6.1 The Utah study is attached.

c) Yes. And in my testimony I just referenced a few studies that suggest there is significant untapped efficiency potential among industrial customers. I provided other references in my testimony in the Union 2013-2014 DSM plan case (EB-2012-0337).

Witness: Chris Neme

d) I have no doubt that Union's large customers are quite sophisticated; nor do I doubt that they are motivated to acquire cheap savings. However, experience across North America suggests that they almost certainly are not capturing all efficiency that is more cost-effective than supply alternatives. That said, as suggested in my testimony, if the Board was concerned about the rare customer that may be addressing all cost-effective opportunities, it could deal with that concern by allowing such customers to "opt-out" of a program if an independent audit confirms such claims.

Exhibit C1

Before the Ontario Energy Board

EB-2012-0337

Issues Pertaining to Union Gas' 2013-2014 Demand Side Management Plan for Large Volume Customers

Prepared by:

Chris Neme
Energy Futures Group

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

December 14, 2012

Filed: 2012 December 14
EB-2012-0337
Exhibit C1

INTRODUCTION

In late August 2012, Union Gas filed its proposed Demand Side Management (DSM) Plan for Large Volume Customers for the years 2013 and 2014. This report critiques Union's proposed plan and recommends modifications that the Board instruct Union to make or adopt. The report focuses on three related issues:

1. the reasonableness of the Company's proposal to continue to offer DSM services to large volume customers;
2. the reasonableness of the Company's proposed "self direct" program design; and
3. the reasonableness of the company's proposed performance metrics and shareholder incentive proposal for the Plan.

Mr. Neme, the author of this report, has 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), as well as before similar regulatory bodies in Quebec, Connecticut, Illinois, Maine, Maryland, Michigan, New Jersey, Ohio and Vermont. He also played a lead role in negotiating the settlement agreement between Enbridge Gas and stakeholder groups on Enbridge's 2012-2014 DSM Plan and the settlement agreement between Union Gas and stakeholder groups on Union's 2012-2014 DSM Plan.[1] A copy of Mr. Neme's curriculum vitae is provided as Appendix A to this document.

[1] That agreement covered all budget and key performance aspects of Union's DSM programs for all customers other than large volume customers for 2012, 2013 and 2014. With respect to large volume customers, it addressed only 2012. The latter two years – 2013 and 2014 – were left to be addressed in a subsequent proceeding. This is that subsequent proceeding.

I. Continuing DSM Service for Large Volume Customers

1. Summary of Union's Proposal

Union is proposing to continue to offer a DSM program to what were previously called "large industrial customers" and what the Company is now calling "large volume customers". Both terms refer to customers currently served under Rate T1 or Rate 100.

The Company notes that it has proposed in a different proceeding (EB-2011-0210) that T1 customers be split into two groups: a new Rate T1 mid-market service and a new Rate T2 large market service. The Company's DSM plan for large volume customers covers all three possible future rate classes. However, the design of the service is different for the new T1 customers than it is for the new T2 and Rate 100 customers.

Union's proposed DSM program offering to the new T1 customers would have similar characteristics to what is offered to other commercial and industrial rate classes. Specifically, there would be a "pooled" budget that the Company could use to provide financial incentives, technical assistance and other services to customers. However, Union is proposing that the budget for new T1 customers be treated much more restrictively than the budget for other commercial and industrial rate classes is treated – with respect to both (1) potential budget shifts from or to other rate customer classes and (2) the application of additional DSMVA funds.[2]

The Company's proposed DSM program offer to new T2 and Rate 100 customers would be fundamentally different than its offerings to any other customers. In particular, it would essentially give each customer "direct access" to the portion of the program's financial incentive budget which they fund in their rates. Customers would be required to submit an Energy Efficiency Plan to Union for approval by April 1st. Once the plan is approved, a customer would have until August 1st to spend or earmark that year's direct access funds for efficiency projects that it would commit to complete by December 31st. Any program budget that wasn't spent or committed by August 1st would go into a "pool" which Union would use to support additional efficiency projects that Rate T2/Rate 100

[2] For example, only $0.5 million of additional funding (about 30%) can be shifted to the new T1 customers and that can come only from the new T2/Rate 100 offering. The Company can also access a 15% DSMVA and apply it to the new T1 customers, but the additional DSMVA funds would be limited to just 15% of the new T1 budget. Thus, under its current proposal, the Company can increase spending on T1 customers by a maximum of 45% - but even then only if it shifted resources from a relatively small T2/Rate 100 budget and accessed a class specific DSMVA. In contrast, the Company can shift up to 100% additional funds to other rate classes – including other commercial and industrial classes – covered by its Resource Acquisition programs. Moreover, that 100% does not need to include the DSMVA and could come from a much larger and more diverse budget pool (making it easier to shift if desired). On the other, if desired, it could potentially come entirely from the 15% DSMVA because the 15% is applied to the entire resource acquisition budget (rather than from the much narrower, class specific DSMVA proposed for T1).

customers wish to pursue (and which presumably they have not already committed to fund using their direct access funds).

This approach is what is commonly referred to in the efficiency industry as a "self direct" program. That means that customers are provided access to DSM funds raised through rates and are given discretion over how to use them as long as they meet certain criteria (the need to have savings evaluated, the need to demonstrate savings are cost-effective, and/or others). Union's program has similarities to a "self-direct" program in the northwestern U.S. (Puget Sound Energy) that has been touted by experts in the efficiency community as an innovative and appealing self direct model.[3]

Union has proposed that the same $0.5 million budget shifting limitation that would apply to Rate T1 (referenced above) would also apply to Rate T2 and Rate 100 customers. Unlike for the new Rate T1, Union has proposed that there would be no ability to access or spend additional DSMVA funds for the new Rate T2 and Rate 100 customers.

2. Union's Rationale for Its Proposed Program

Some stakeholders have proposed that large volume customers be offered an "opt out" of DSM. Under such a provision, individual customers would have the option of both not receiving DSM services and not paying DSM fees (or a significant portion of them). Union makes the following arguments for proposing a "self direct" program instead of an "opt out":

- **Feedback from large volume customers suggests a majority prefer continued DSM**. The Company held a variety of meetings with customers in the affected rate classes. The Company has summarized the results of those discussions as follows: "The majority of customers value Union's technical resources, would like increased flexibility to access incentives and want to avoid large one-time deferral charges….Some customers would like to not participate in the program and avoid associated costs."[4]
- **Significant untapped efficiency potential remains**. One of the common arguments for an "opt out" provision is that large businesses are sufficiently sophisticated that they will identify and pursue cost-effective efficiency on their own. However, the Company has noted that both recent Ontario studies and its own DSM experience suggest that significant cost-effective efficiency potential remains within the industrial sector.[5]

[3] Anna Chittum, "Follow the Leaders: Improving Large Customer Self-Direct Programs", Report Number IE112, published by the American Council for an Energy Efficiency Economy, October 2011.
[4] Exh B5.3, p. 2.
[5] Exh B5.6.

- **The approach proposed is consistent with that of other leading jurisdictions**. Union states that it has found no Canadian jurisdiction that offers either a "self direct" or "opt out" option to large customers. It further states that among the top 20 leading U.S. jurisdictions only Vermont offers any form of opt out, but 10 others offer self direct programs.
- **It is important to treat all customers in a rate class consistently**. Union argues that allowing individual customers to opt out of paying DSM costs would result in "intra-class subsidy" and that is "inconsistent with the principles of class rate-making."

I cannot speak to the accuracy of Union's characterization of the feedback it received from its large volume customers. I also cannot speak to the reasonableness of Union's argument with respect to the principles of class rate-making. However, the other two arguments are both accurate and compelling.

The conclusion that significant untapped efficiency potential remains is indeed supported not only by recent efficiency potential studies, but also by the Company's own DSM experience. In 2011 alone, nearly two-thirds of customers (weighted by annual gas consumption) in the new T1 and T2 rate classes participated in its program; the comparable number for Rate 100 was 83%.[6] Those are remarkably high numbers for just one year. Moreover, Union has estimated that those customers' 2011 efficiency projects produced lifetime savings of over 1.4 billion m^3 of gas – even after adjusting for substantial free rider effects.[7] Such high levels of participation in efficiency programs offered to large industrial customers is consistent with my own direct experience supporting the delivery of Efficiency Vermont's programs. As the following citations make clear, Union's experience is also consistent with numerous other assessments of and expert conclusions regarding energy efficiency potential across North America:

> *"Numerous analytic studies have found that abundant, low cost efficiency opportunities exist in all parts for the industrial sector. These savings projections have been corroborated by actual evaluated program results in regions that have implemented robust programs and also at individual companies."*[8]

> *"It is frequently argued that the opportunities to improve efficiency in industry have been exhausted, and that the free market dictates that efficiency improvements will be made when they are cost-effective…(but) industrial market data…indicate that there still is significant potential for improving energy*

[6] Exh. B2.5 Note that the unweighted percentages are also high – roughly 60% for T1/T2 and over 70% for Rate 100

[7] Exh B5.6

[8] Shipley, Anna and R. Neal Elliott, "Ripe for the Picking: Have We Exhausted the Low-Hanging Fruit in the Industrial Sector?", published by the American Council for an Energy Efficient Economy, Report Number IE061, April 2006, p. iii.

efficiency… Does low-hanging fruit still exist in the industrial sector? We believe that the answer is yes."[9]

"Recently, an unprecedented volume of public and utility ratepayer funds have been poured into energy incentive and assistance programs for the manufacturing sector (Chittum and Nowak 2012). While assistance programs frequently reveal improvement opportunities of all kinds and magnitudes, many facilities tend to favor solutions that involve low- and no-cost improvements to existing assets. Meanwhile, a sluggish economic recovery combined with uncertain future tax and regulatory consequences have discouraged many companies from making strategic capital investment in energy-intensive systems. In sum, great potential remains for industrial energy improvement."[10]

"Not all energy efficiency is equally cost-effective or equally beneficial. The industrial sector in particular offers some of the most cost-effective efficiency savings available to any given utility (see Goldberg et al. 2009, Energy Trust of Oregon 2011, Kushler et al. 2004)…Therefore maximizing industrial energy efficiency is a priority for utility resource planning and resource acquisition, and for maximizing ratepayer benefits."[11]

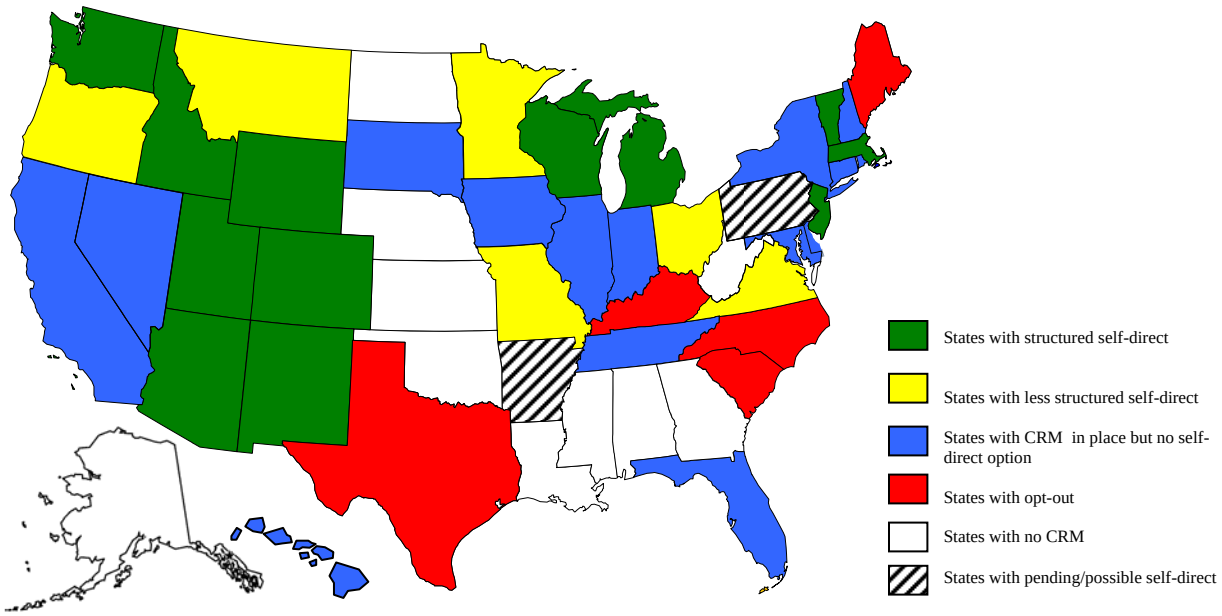
Further, it is worth noting that several jurisdictions – Utah, Wyoming and Oregon – permit customers to opt out of all or part of their DSM charges if they can demonstrate that they have addressed all cost-effective efficiency opportunities. As stated in a recent ACEEE report, "no company has taken advantage of these exemptions in any of these states, because there is always some cost-effective projects that could be identified during an energy audit."[12]

The Company is also correct in stating that it's preference for a "self direct" approach rather than offering an "opt out" is consistent the approach taken in leading North American jurisdictions. As Figure 1 shows, only a handful of states have DSM opt out provisions. None of those states – Texas, Kentucky, South Carolina, North Carolina and Maine – were ranked by ACEEE in its most recent State Energy Efficiency Scorecard

[9] Ibid, p. viii.
[10] Russell, Christopher and Rachel Young, "Understanding Industrial Investment Decision-Making", published by the American Council for an Energy Efficient Economy, Report Number IE124, October 2012, p. 2.
[11] Anna Chittum, "Follow the Leaders: Improving Large Customer Self-Direct Programs", Report Number IE112, published by the American Council for an Energy Efficiency Economy, October 2011, p. 5.
[12] Ibid., p. 17. Corroborated by a recent analysis presented to the Ohio Public Utilities Commission by Merrian Borgeson, Lawrence Berkeley National Laboratories, November 15, 2012. (http://emp.lbl.gov/sites/all/files/LBNL_Self-Direct_Program_Presentation_PUCO_111412_PUBLIC.pdf?utm_source=BenchmarkEmail&utm_campaign=Self%20Direct%20PPT%20Email&utm_medium=email) – see slide 20.

(2011)[13] as among the top 16 states in terms of utility funded efficiency programs; only Maine (17th) was among the top 28 states. Only a half dozen other jurisdictions had what ACEEE calls "less structured self-direct programs", and most of those were also relatively low ranked states.

Figure 1: Opt-Out and Self-Direct Program Options in the United States[14]



It is worth noting that Union's identification of Vermont as being the one leading jurisdiction that has an "opt out" for large volume customers could be misleading. It really depends on how one defines "opt out". While Vermont does allow one participating customer (IBM) to avoid paying the statewide DSM surcharge, there is a substantial quid pro quo. Specifically, that customer must demonstrate in exchange that it is making substantial efficiency investments on its own. Indeed, it must document spending a minimum of $3 million over three years on cost-effective efficiency,[15] report its savings to the state regulators, be subjected to external review of its savings claims (to ensure cost-effectiveness) and meet several other criteria. Thus, Vermont's "opt out" option is, in many ways, more akin to a "self direct" option (which may be why ACEEE

[13] Sciortino, Michael et al., "The 2011 State Energy Efficiency Scorecard", published by the American Council for an Energy Efficient Economy, Report Number E115, October 2011, pp. 6-7.
[14] Anna Chittum, "Follow the Leaders: Improving Large Customer Self-Direct Programs", Report Number IE112, published by the American Council for an Energy Efficiency Economy, October 2011, p. 5.

[15] That is almost as much as it would have paid into the statewide efficiency fund had it not "opted out".

identifies it as a state with a structured self-direct program) and may be very different than what some Ontario stakeholders are seeking.

Finally, it is also worth noting that roughly half of the leading states – including both New York and California – had neither an opt out or a self direct program. In other words, they relied exclusively on the kind of traditional DSM programs that Union has offered to its large volume customers in the past.

3. Other Arguments for Continued DSM and Against "Opt Outs"

There are several other reasons to support the continued offer of DSM services to large volume customers and reject calls for "opt out" provisions.

A. System Benefits of Efficiency

Energy efficiency investments do not just benefit those customers who participate in the programs. They have the potential to provide system benefits that help all gas rate-payers as well. For example, market clearing prices for gas can drop as demand drops. Thus, to the extent that demand drops below where it otherwise would be due to energy efficiency investments, all gas ratepayers could benefit. For example, a study in New York State several years ago concluded that savings from running substantially less aggressive gas efficiency programs than Ontario's current programs[16] would still produce average annual reductions in the price of gas of 0.2% over the 2007 to 2016 time period. The price reductions for industrial customers were estimated to be even a little better than that.[17] To my knowledge no comparable study has been conducted for Ontario. The gas market has also changed substantially in the past several years. Thus, the numerical results of the New York study should not be used to estimate price effects today in Ontario. However, they support the conceptual notion that there can be benefits that accrue to all gas consumers as a result of DSM efforts.

There may also be long term transportation and/or storage investment costs that can be avoided or deferred due to efficiency investments. However, that is a potentially complex issue that I have not analyzed. I am also unaware of any other recent efforts by others to analyze it.

[16] The price effects were estimated for a scenario in which five years of programs generated average incremental annual savings of about 4000 MDth, the equivalent of about 114 million m3. In contrast, in 2011 the combined incremental annual savings of Union Gas and Enbridge Gas were more than twice that amount despite serving a province whose population and gross domestic product are substantially less than New York's.

[17] Optimal Energy et al., "Natural Gas Energy Efficiency Resource Development Potential in New York", Final Report, Prepared for the New York State Energy Research and Development Authority (NYSERDA), October 31, 2006.

FOLLOW THE LEADERS:
IMPROVING LARGE CUSTOMER SELF-DIRECT PROGRAMS

Anna Chittum

October 2011

Report Number IE112

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CONTENTS

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EXECUTIVE SUMMARY

Energy efficiency offers tremendous system-wide benefits at a portion of the cost of new generation resources. Energy efficiency is highly cost-effective, consistently available at one-tenth to one-third the cost of new renewable or fossil-fuel generation. The benefits of energy efficiency to any given public utility system include lower energy prices, reduced grid congestion, reduced energy-related emissions and increased system reliability. Industrial energy efficiency is some of the most cost-effective energy efficiency available, and investments in industrial energy efficiency benefit users in all sectors of the economy.

Like other utility system resources, energy efficiency is enjoyed by all users and paid for by all users. To fund energy efficiency, states typically implement some cost-recovery mechanism (CRM) on a customer's bill. These moneys are pooled together and are then used to fund cost-effective energy efficiency across multiple sectors. In the industrial sector, CRM fees are used to fund technical assistance, energy management, and incentive programs that encourage energy efficiency investments.

In response to requests by their industrial and large commercial sectors, some states allow those sectors to either "opt out" of paying the CRM fee or "self-direct" all or a portion of the fee into internal energy efficiency investments. Firms that choose to opt out or self-direct their CRM fees are often assumed or required to make energy efficiency investments on their own. These unique programs — opt-out and self-direct programs — are the focus of this report.

This report is based on first-person conversations conducted with over 50 individuals closely acquainted with today's opt-out and self-direct programs. Interviewees included administrators of today's self-direct programs, state regulators, energy efficiency advocates, industrial energy users and officials from other state agencies affiliated with a self-direct or opt-out program's administration. The report discusses the self-direct programs in place today and the policy goals we ought to have embedded within our self-direct programs. It discusses the unique opportunities presented by self-direct programs and the leading self-direct programs in place today. The report also discusses the challenges presented by opt-out programs and poorly structured self-direct programs, and concludes with recommendations of how ideal self-direct programs might be structured.

In some particular cases, well-structured self-direct programs are being used as highly useful tools to industrial customers and other large energy users. Self-direct programs can offer certain tools and a level of flexibility that helps overcome long-standing barriers to greater energy efficiency in the industrial sector. When coupled with strong oversight and extensive measurement and verification of claimed savings, these programs can serve an entire public utility system very well.

Unfortunately, most self-direct programs lack at least one of the critical components of these highly successful (but few) self-direct programs. Forty-one states in the US have some sort of a CRM mechanism in place. Of those, 23 have some sort of opt-out or self-direct provision in place. Only a small number of the self-direct programs are structured to maximize cost-effective energy efficiency and ensure that retained CRM fees are used in a manner that benefits all users of a given public utility system.

This report finds that the structures of opt-out and self-direct provisions vary widely. Opt-out provisions allow customers to simply opt out entirely from a CRM program, and do not measure or verify that a customer has made any energy efficiency investments in exchange for their exemption from paying a CRM fee. Self-direct programs usually assume that customers are making their own energy efficiency investments, but do not usually measure and verify those savings in the manner that would have been done had the customer been making those investments within a CRM-funded energy efficiency program.

In contrast to some of the standout programs identified in this report, the majority of opt-out and self-direct programs are either poorly structured, subject to minimal oversight, or not subject to stringent measurement and verification protocols. This report finds that these programs cannot claim with certainty that they are achieving energy efficiency investments equal to that which would have been achieved had the customers remained within existing CRM-funded energy efficiency programming, or that the industrial customer is being well-served by the program.

The choice by state policymakers to implement an opt-out or self-direct program when developing long-term energy efficiency goals and CRM programs is a popular one. Unfortunately the long-term impact of these programs is not very well known, and program structures in place today generally do not ensure that the CRM funds retained by opt-out or self-direct customers are being well-spent.

Allowing large customers to opt out of CRM programs or self-direct their funds without substantial oversight by regulators or adherence to cost-effectiveness tests, as is found in programs around the country, is unfair to other classes of customers. There are some very good examples of self-direct programs that offer large customers the tools they need to make substantial energy efficiency investments and the peace of mind for regulators that public funds are being spent in a manner that benefits the public good.

This report's appendices include summaries of all known self-direct programs in place today, as well as some suggested model language for effective self-direct programs and a detailed chart of CRM and opt-out/self-direct programs as they exist in each U.S. state.

- The amount of energy saved by each individual measure, and
- The overall amount of energy saved.

These are important data points that can help utilities and policymakers better craft and administer energy efficiency programs in the future. If a self-directing customer is not acting in good faith, its behavior can have system-wide impacts. Failing to acquire the most cost-effective energy efficiency can put upward pressure on energy prices and generally increase the overall cost of efficiency programming.

Xcel Energy's self-direct program, administered in its Colorado and New Mexico service territories, maintains strong relationships and communication with its self-direct customers. It engages in substantial communication with its self-direct customers at the beginning of their self-direct application, identifying necessary data points early on in project development. Xcel requires pre-installation energy monitoring and regularly reviews and evaluates self-direct program performance. Xcel tasks its highest level engineers to review self-direct project engineering analyses and energy monitoring plans. The result is that Xcel is equally as confident in the self-direct program's claimed savings as in those claimed in the more traditional CRM-funded incentive programs. Such confidence in savings is rare among self-direct programs (Romero 2011).

The above examples illustrate that self-direct programs can be well constructed and successful in encouraging cost-effective energy efficiency. Some self-direct program managers are confident that their programs are producing savings of similar quality to those achieved through more traditional programs, though data is not usually collected to yield true "apples to apples" comparisons among self-direct programs and more traditional CRM-funded energy efficiency programs. It is clear that in some cases the flexibility and unique tools offered by self-direct programs enable greater efficiency than would have been achieved with more traditional programming. In a few select states, self-direct programs have developed into highly effective tools in a state's suite of energy efficiency programming.

THE SELF-DIRECT CHALLENGE

As noted in the previous section, examples of successful self-direct programs exist. Unfortunately, developing and administering a self-direct program can be a challenge. Most self-direct programs and all opt-out programs feature a number of characteristics that are troubling to those interested in maximizing cost-effective efficiency across all sectors. The successful self-direct programs noted in the previous section are the exceptions to this rule. For self-direct programs to establish themselves as essential components of a state's energy efficiency efforts, the following challenges will need to be addressed:

- Unfounded assumptions on which the programs are predicated,
- Lack of data and evaluation within programs, and
- Unfair treatment of self-direct customers and other classes of customers.

Unfounded Assumptions

Self-direct programs are predicated on some assumptions about industrial energy efficiency that are largely unfounded, or at least not substantiated by available data. The assumptions are that industrial companies are better at acquiring energy efficiency than CRM programs and will always acquire all cost-effective energy efficiency on their own, absent any efficiency programs. These assumptions, repeatedly promoted by some industrial sector stakeholders during energy policy discussions, have provided the policy basis for opt-out and self-direct programming in almost every state with such an option, despite their shaky foundations. Instead of establishing self-direct programs because they are effective energy efficiency programs in their own right, self-direct programs have tended to be developed as a response to these assumptions, put forth by some vocal members of the industrial sector.

Industrial Customers Do Efficiency Better

The first assumption on which opt-out and self-direct programs are based is that industrial companies are better at capturing cost-effective energy efficiency than CRM-funded programs. This assumption also includes the inherent belief that CRM-funded programs are not capable of serving the industrial sector well. In many states, evidence suggests otherwise. ACEEE has studied industrial energy efficiency programs for years, and has, over the years, consistently identified industrial energy efficiency programs that are tremendously effective at capturing energy efficiency from their customers (see Chittum et al. 2009, York et al. 2008). Though it is clear that some CRM-funded programs are not as effective as others, examples of CRM-funded programs serving their industrial sectors well are easily found.

In fact, self-direct programs themselves tend to refute this assertion. In Wisconsin, where industrial energy efficiency programs have historically been quite strong, no single customer has chosen to take advantage of the self-direct program. Wisconsin's policy-makers and administrators of the CRM-funded programming attribute the lack of interest in the self-direct option to industrial companies' perceptions that Wisconsin's Focus on Energy programs serve them well and provide benefits equal to or greater than their individual CRM fees (Schepp 2011, Schutt 2011). In Oregon, companies have increasingly stopped using the self-direct program and instead chose to pay into the CRM-funded programming offered through the Energy Trust of Oregon. Customers have noted that they made the switch to take advantage of the Energy Trust's incentives and technical assistance. This has been especially true as the Energy Trust has developed more industrial-focused offerings (Crossman 2011, Stipe 2011).

Industrial Companies Will Maximize Cost-Effective Efficiency

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. This claim is typically followed by the assertion that the CRM fee is a "penalty" (Chittum and Elliott 2009, Schwartz 2011, Crossman 2011, Lazar 2010). 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 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).

Lack of Data and Evaluation

Measuring and evaluating the true costs and benefits of energy efficiency programs and projects is critical to maximizing efficiency's public benefits. Conducting data collection and analysis ensures money is not wasted that could otherwise be used to acquire efficiency. Customers of all classes paying a CRM fee to support system-wide energy efficiency want to know that their dollars are not being wasted. Similarly, when customer rates increase because a new power plant is built, customers want to know that the power plant is running as effectively as possible. Performance data must be collected to know this.

Opt-out programs collect little to no data, and self-direct programs often do a poor job of collecting and analyzing data. This is due largely to the structure of self-direct programs, which generally allow for few if any dedicated staff and few additional resources. Most but not all self-direct programs retain a percentage of a customer's CRM fee to cover program administrative costs, though the amount retained can be quite small and insufficient to pay for all desired program administrative activities. These collections range from about 5% to 20% of a customer's CRM fee. Self-direct programs are also often challenged by competitive concerns of participating customers who may not wish to share

GREEN ENERGY COALITION INTERROGATORY #12

INTERROGATORY

Reference: Section 5.8.2, p. 83

Question:
Regarding large volume customers:

a. Is Synapse aware of any evidence from Ontario or any other jurisdiction to suggest that large volume customers will acquire all cost-effective savings on their own, without utility DSM program support? If so, please document the basis for the conclusion.
b. If not, is Synapse aware of any evidence from Ontario or any other jurisdiction to suggest that large volume customers typically do not acquire all cost-effective savings on their own, without utility DSM support? If so, please document the basis for that conclusion.
c. Is Synapse aware of any evidence from any jurisdiction to suggest that well-designed self-direct programs for large customers typically have very low NTG ratios (and/or high free ridership)? If so, please provide examples and references.

RESPONSE

a. Synapse is not aware of any evidence to suggest that large volume customers will acquire all cost-effective savings on their own.

b. Synapse is aware that large volume customers (often, from the industrial sector) typically do not acquire all cost-effective savings on their own. See, e.g.:
    - U.S. Department of Energy. 2015. Barriers to Industrial Energy Efficiency: Report to Congress.
    - State & Local Energy Efficiency Action Network. 2014. Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector.
    - Chittum, Anna. 2011. Follow the Leaders: Improving Large Customer Self-Direct Programs. ACEEE report No. IE112.
    - Synapse Energy Economics. Commercial & Industrial Customer Perspectives on Massachusetts Energy Efficiency Programs. Prepared for the Massachusetts Energy Efficiency Advisory Council. April 3, 2012. Please refer to Exhibit M.Staff.GEC.12, Attachment 1.

c. The term "well-designed" was not defined in this interrogatory. For the purpose of answering this question, we assume that "well-designed" means maximizing public benefit as specified in

Witnesses: T. Woolf
K. Takahashi
E. Malone
J. Kallay
A. Napoleon

Chittum 2011 (Chittum, Anna. 2011. Follow the Leaders: Improving Large Customer Self-Direct Programs. ACEEE report No. IE112.) That is, a well-designed program focuses on energy savings and has adequate oversight, measurement and verification of savings (using the same M&V standards for other industrial programs), and follow up.

Synapse is not aware of any evidence from any jurisdiction to suggest that well-designed self-direct programs for large customers typically have very low net-to-gross ratios or high free ridership.

Witnesses: T. Woolf
K. Takahashi
E. Malone
J. Kallay
A. Napoleon

U.S. DEPARTMENT OF ENERGY

Barriers to Industrial Energy Efficiency

Report to Congress
June 2015

United States Department of Energy
Washington, DC 20585

Message from the Assistant Secretary

The industrial sector has shown steady progress in improving energy efficiency over the past few decades and energy efficiency improvements are expected to continue. Studies suggest, however, that there is potential to accelerate the rate of adopting energy efficient technologies and practices that could reduce energy consumption in the industrial sector by an additional 15 to 32 percent by 2025. There are barriers that impede the adoption of energy efficient technologies and practices in the industrial sector. This report examines these barriers and identifies successful examples and opportunities to overcome these barriers.

I extend my appreciation to the many stakeholders across industry, non-profit organizations, and the public sector for their support, feedback and strategic interest in industrial energy efficiency. Contributions from these stakeholders helped identify the most serious barriers and helped develop recommendations that can have a large impact on improving energy efficiency in the industrial sector.

This report is being provided to the following Members of Congress:

- **The Honorable John A. Boehner**
  Speaker, House of Representatives

- **The Honorable Joseph R. Biden**
  President of the Senate

- **The Honorable Fred Upton**
  Chairman, House Committee on Energy and Commerce

- **The Honorable Frank Pallone**
  Ranking Member, House Committee on Energy and Commerce

- **The Honorable Lisa Murkowski**
  Chair, Senate Committee on Energy and Natural Resources

- **The Honorable Maria Cantwell**
  Ranking Member, Senate Committee on Energy and Natural Resources

If you have any questions or need additional information, please contact me or Mr. Brad Crowell, Assistant Secretary for Congressional and Intergovernmental Affairs, at (202) 586-5450.

Sincerely,

Executive Summary

The industrial sector accounts for the largest share of energy consumption in the United States, and energy efficiency improvements in this sector can significantly reduce the nation's demand for energy. In 2012, the industrial sector accounted for 32 percent of all energy consumption, and by 2025 this share is expected to exceed 36 percent. In 2012, manufacturers accounted for 74 percent of industrial energy consumption, which represents 24 percent of all energy consumed in the United States.

The industrial sector has shown steady progress in improving energy efficiency over the past few decades, and energy efficiency improvements are expected to continue. Studies suggest, however, that there is potential to accelerate the rate of adopting energy efficient technologies and practices that could reduce energy consumption in the industrial sector by an additional 15 to 32 percent by 2025. This reduction in industrial sector energy consumption is equivalent to a reduction in national energy consumption of 6 to 12 percent by 2025.

There are barriers, however, that impede the adoption of energy efficient technologies and practices in the industrial sector. This report examines these barriers and identifies successful examples and opportunities to overcome these barriers. The report was prepared in response to Section 7 of the American Energy Manufacturing Technical Corrections Act (Act), which directs the Secretary of Energy to conduct a study,[1] in coordination with the industrial sector and other stakeholders, of barriers to the deployment of industrial energy efficiency.

Three groups of energy efficiency technologies and measures were examined:

- Industrial end-use energy efficiency
- Industrial demand response
- Industrial combined heat and power

The conclusions of this collaborative effort, summarized below, demonstrate the important role that industrial energy efficiency has in the U.S. and highlight its potential to continue to assist American industrial sectors with being strong, clean and efficient for decades to come. A total of 42 barriers were identified that affect the deployment of industrial energy efficiency across all three groups, and many examples and opportunities were identified to address these barriers. There may be additional barriers and opportunities not captured in this document, and this list should not be viewed as fully exhaustive.

[1] The study is contained in Appendix A.

This report results from a collaboration of the DOE with nearly 50 experts from industry, combined heat and power operators, environmental stewardship organizations, associations of state governmental agencies, and federal governmental agencies.

BARRIERS TO INDUSTRIAL ENERGY EFFICIENCY

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I. Legislative Language

This report was prepared in response to Section 7 of the American Energy Manufacturing Technical Corrections Act (Public Law 112-210). Section 7 of the Act is titled, "Reducing Barriers to the Deployment of Industrial Energy Efficiency," wherein it is stated:

(a) Definitions – In this section:

1) *Industrial Energy Efficiency – The term "industrial energy efficiency" means the energy efficiency derived from commercial technologies and measures to improve energy efficiency or to generate or transmit electric power and heat, including electric motor efficiency improvements, demand response, direct or indirect combined heat and power, and waste heat recovery.*

2) *Industrial Sector – The term "industrial sector" means any subsector of the manufacturing sector (as defined in North American Industry Classification System codes 31-33 (as in effect on the date of enactment of this Act)) establishments of which have, or could have, thermal host facilities with electricity requirements met in whole, or in part, by onsite electricity generation, including direct and indirect combined heat and power or waste recovery.*

(b) Report on the Deployment of Industrial Energy Efficiency

1) *In General – Not later than 2 years after the date of enactment of this Act, the Secretary shall submit to the Committee on Energy and Commerce of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report describing:*

   (A) the results of the study conducted under paragraph (2); and

   (B) recommendations and guidance developed under paragraph (3).

2) *Study —The Secretary, in coordination with the industrial sector and other stakeholders, shall conduct a study of the following:*

   (A) The legal, regulatory, and economic barriers to the deployment of industrial energy efficiency in all electricity markets (including organized wholesale electricity markets, and regulated electricity markets), including, as applicable, the following:

      (i) Transmission and distribution interconnection requirements.

      (ii) Standby, back-up, and maintenance fees (including demand ratchets).

      (iii) Exit fees.

      (iv) Life of contract demand ratchets.

      (v) Net metering.

(vi) Calculation of avoided cost rates.

(vii) Power purchase agreements.

(viii) Energy market structures.

(ix) Capacity market structures.

(x) Other barriers as may be identified by the Secretary, in coordination with the industrial sector and other stakeholders.

(B) Examples of—

(i) Successful State and Federal policies that resulted in greater use of industrial energy efficiency;

(ii) successful private initiatives that resulted in greater use of industrial energy efficiency; and

(iii) cost-effective policies used by foreign countries to foster industrial energy efficiency.

(C) The estimated economic benefits to the national economy of providing the industrial sector with Federal energy efficiency matching grants of $5,000,000,000 for 5- and 10-year periods, including benefits relating to—

(i) estimated energy and emission reductions;

(ii) direct and indirect jobs saved or created;

(iii) direct and indirect capital investment;

(iv) the gross domestic product; and

(v) trade balance impacts.

(D) The estimated energy savings available from increased use of recycled material in energy-intensive manufacturing processes.

3) Recommendations and Guidance —The Secretary, in coordination with the industrial sector and other stakeholders, shall develop policy recommendations regarding the deployment of industrial energy efficiency, including proposed regulatory guidance to States and relevant Federal agencies to address barriers to deployment.

II. Background

Section 7 of the American Energy Manufacturing Technical Corrections Act directs the U.S. Department of Energy (DOE) to undertake a study "in coordination with the industrial sector and other stakeholders" on barriers to industrial energy efficiency. DOE is directed to "develop policy recommendations regarding the deployment of industrial energy efficiency, including proposed regulatory guidance to States and relevant Federal agencies to address barriers to deployment."

In the Act, the industrial sector is defined to be manufacturing subsectors as described in North American Industry Classification System (NAICS) codes 31–33.[2] The manufacturing sector (NAICS 31–33) is broadly defined to include business establishments that use mechanical, physical, or chemical processes to create new products. Business establishments in the manufacturing sector are frequently called plants, factories, or mills, and cover a wide size of operations, ranging from small bakeries to integrated steel mills. The key distinction between manufacturing business establishments (NAICS 31–33) and businesses in other NAICS sectors is that manufacturers transform raw materials into new products.

The manufacturing sector is an important segment of the U.S. economy and is responsible for driving a significant amount of economic activity. Metrics that highlight the importance of manufacturing in the United States include (2013 data unless noted otherwise):

- Contributed $2.08 trillion, or about 12.5 percent, to U.S. gross domestic product.
- Supported more than 17.4 million jobs.
- Created high paying jobs—in 2012, compensation for manufacturing jobs was more than 25 percent higher than the average compensation for all U.S. jobs.

Data from the Energy Information Administration (EIA) shows that the industrial sector accounts for the largest share of energy consumption in the United States. In 2012, the United States consumed approximately 95 quads of energy, with the industrial sector accounting for 30.6 quads, or 32 percent of the total. Of this 32 percent, manufacturers accounted for 74 percent, equal to 22.6 quads of energy or 24 percent of all energy consumed in the United States.

EIA forecasts that total energy consumption will grow to about 102 quads in 2025, with nearly all of the growth coming from the industrial sector. From 2012 to 2025, energy consumption in

[2] EIA's definition of the industrial sector includes agriculture, mining, construction and manufacturing. The Act defines the industrial sector more narrowly to only include manufacturing.

the industrial sector is forecast to increase from 30.6 quads to 37.4 quads – a 22 percent increase. In 2025, energy use in the industrial sector is expected to exceed 36 percent of total energy consumption in the United States.

Given the scale of energy use in the industrial sector, energy efficiency improvements in this sector can significantly reduce the nation's demand for energy. While the industrial sector has shown steady progress in improving energy efficiency over the past few decades, studies suggest that industrial energy efficiency could be accelerated, reducing industrial energy consumption by an additional 15 to 32 percent by 2025 compared to EIA forecasts. This level of energy reduction in the industrial sector translates to a reduction in national energy consumption of 6 to 12 percent by 2025.

There are barriers, however, that impede the adoption of energy efficient technologies and practices in the industrial sector, and these barriers limit opportunities to capture additional energy savings. DOE recognizes that barriers to deployment of industrial energy efficiency involve complex, often controversial, issues. The intent of this report is not to prioritize or make value judgments of the barriers. Rather, the objective is to identify and discuss barriers that impede deployment of energy efficiency in the industrial sector and identify successful examples and opportunities to overcome these barriers.

For this report, industrial energy efficiency is divided into three groups:

- Industrial end-use energy efficiency
- Industrial demand response
- Industrial combined heat and power (CHP)

For each group, barriers are discussed and successful examples are identified to overcome many of these barriers. This study also discusses economic benefits of an energy efficiency grant program and energy savings from increased recycling. These latter two topics are both specified in the legislative language.

This report results from a collaboration of the DOE with nearly 50 experts from industry, combined heat and power operators, environmental stewardship organizations, associations of state governmental agencies, and federal governmental agencies. Contributions from these stakeholders significantly improved the depth and breadth of the report and study.

III. Barriers to Industrial End-Use Energy Efficiency

Industrial end-use energy efficiency includes a broad range of energy-efficient technologies and management practices that can be implemented in the manufacturing sector to reduce energy consumption. Examples that illustrate the diversity of technologies and practices include advanced electric motors and drives, high efficiency boilers, waste heat recovery, energy-efficient lamps and lighting controls, modernization or replacement of process equipment, improved process performance through the use of sensors and controls, and implementation of systematic energy management systems.

Barriers that impede implementing industrial end-use efficiency are summarized in the following categories:

- Economic and financial
- Regulatory
- Informational

Economic and Financial Barriers

- *Internal competition for capital.* Manufacturers often have limited capital available for end-use efficiency projects and frequently require very short payback periods (one to three years).
- *Corporate tax structures.* U.S. tax policies, such as depreciation periods, the treatment of energy bills, and other provisions can be a deterrent.
- *Program planning cycles.* There can be a mismatch between industrial planning cycles and utility and state energy efficiency program cycles, which can hinder industrial sites from moving forward with an energy efficiency project.
- *Split incentives.* Companies often split costs and benefits for energy efficiency projects between business units, which complicates decision-making.
- *Failure to recognize non-energy benefits of efficiency.* Not considering non-energy or co-benefits of an end-use energy efficiency project weakens the business case.
- *Energy price trends.* Volatile energy prices can create uncertainty in investment returns, leading to delayed decisions on energy efficiency projects.

Regulatory Barriers

- *Utility business model.* The structure of utility cost recovery and lost revenue mechanisms can reduce a utility's interest in promoting industrial energy efficiency projects.

- *Industrial participation in ratepayer-funded energy efficiency programs.* Opt-out programs or loosely defined self-direct programs allow industrial customers to not participate in traditional energy efficiency programs.
- *Failure to recognize all energy and non-energy benefits of efficiency*. There can be unrecognized energy benefits and non-energy societal benefits associated with improving energy efficiency. If these benefits are omitted, there can be under-procurement of industrial energy efficiency resources.
- *Energy resource planning.* Not requiring cost-effective energy efficiency to be considered as part of the integrated resource planning process can slow the evolution or expansion of industrial energy efficiency programs.
- *Environmental permitting.* Uncertainty, complexity, and costs associated with permitting processes such as New Source Review can deter facilities from moving forward with energy efficiency projects.

Informational Barriers

- *Adoption of systematic energy management system.* Some manufacturing plants lack information on the benefits of modern energy management systems. These plants fail to capture the value of cost-effective energy savings that can be achieved by these systems.
- *Awareness of incentives and risk.* Lack of knowledge of available Federal, state and utility incentives for end-use efficiency measures can lead to missed opportunities.
- *Metering and energy consumption data.* Lack of disaggregated energy consumption data, such as process unit and equipment-level energy consumption data, and tools to evaluate such data, can prevent identification and evaluation of opportunities.
- *In-house technical expertise.* Lack of in-house technical expertise or the resources to hire outside staff for the development and operation of end-use efficiency projects can hinder deployment.

The barriers listed above are focused on industrial end-use energy efficiency. It is important to note that there is some overlap between barriers as they are applicable to multiple energy efficiency groups. For example, internal competition for capital is discussed as a barrier for both end-use energy efficiency and combined heat and power (see **Table 4** for a list of overlapping barriers). In this report, most barriers are discussed under a single energy efficiency group. The categorization of a particular barrier to a single energy efficiency group is based on factors that include where stakeholders frequently associated the barrier, and how the barrier is frequently discussed in reference material.

IV. Barriers to Industrial Demand Response

Demand response is defined as:[3]

> *Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.*

The definition of demand response includes changes that might involve a reduction in electricity demand, a shift in demand, or even an increase in the demand for electricity. In the past, traditional demand response programs were focused on reducing electricity use during peak time periods (e.g., a hot summer afternoon). In recent years, technology advancements and new electricity market structures have allowed a greater level of communication and interaction between electricity consumers and utilities, and the definition of demand response has evolved from a focus on reductions in electricity demand to now include changes in electricity demand.

Barriers to increased industrial demand response are summarized below.

Economic and Financial Barriers

- *Limited number of customers on time-based rates.* Participation in demand response programs can be limited if customers are not on time-based rates.
- *Lack of sufficient financial incentives.* Some demand response programs may not provide a sufficient financial incentive to encourage participation.
- *Failure to fully account for demand response benefits.* Valuing the benefits of demand response, and determining how to attribute the benefits, can be complex.

Regulatory Barriers

- *Utility cost recovery structure.* The traditional regulatory model can discourage demand response if utility revenue is linked to financial returns derived from building new infrastructure.
- *Program requirements and aggregation.* Some potential participants in demand response programs are deterred due to numerous program requirements and terms that vary significantly, or aggregation rules that limit smaller industrial facilities.

[3] Definition of demand response from FERC, Web link.

- *Lack of standardized measurement and verification.* Absence of standard measurement and verification procedures can negatively impact demand response contract settlement, operational planning, and long-term resource planning.
- *Electricity market structures that limit demand response.* Some electricity markets focus on supply side resources, and demand response may not be allowed to participate in certain markets, or there may be other barriers to participation.
- *Inclusion in state energy efficiency resource standards (EERS).* Not including demand response in EERS programs may limit growth.

Informational Barriers

- *Knowledge and resource availability.* Lack of knowledge of federal, state, and utility incentives for demand response programs and lack of an understanding of programs can result in low participation. In addition, insufficient in-house technical expertise can also hinder participation.
- *Lack of widespread adoption of interoperability and open standards.* Many different devices and systems need to communicate in a robust demand response program. Demand response programs are hindered if technologies from different vendors do not interoperate seamlessly. Several types of interoperability standards have been established such as SEP 2.0, OpenADR, and Green Button, and they are being adopted in the market. However, more widespread use of open standards is necessary to align communication across devices.
- *Administrative burden.* The amount of time and effort required to participate in a demand response program can be a deterrent, especially for smaller industrial companies.

V. Barriers to Industrial Combined Heat and Power

Combined heat and power, also known as cogeneration, is the simultaneous production of electric and thermal energy from a single fuel source. Instead of purchasing power from the grid and then producing thermal energy onsite in a furnace or boiler, a CHP system produces both forms of energy—electricity and useful thermal energy (e.g., hot water or steam).

CHP systems are described as either topping or bottoming cycles. In a conventional topping-cycle system, a fuel (e.g., natural gas) is combusted in a prime mover, such as a gas turbine or reciprocating engine. The prime mover produces mechanical energy in the form of a rotating shaft, and this mechanical energy drives a generator that produces electricity. The thermal energy that is not used to generate electricity (e.g., exhaust heat) is captured from the prime mover and used for an end-use need such as process heating, hot water heating, or space conditioning. In a bottoming cycle, also referred to as waste heat to power (WHP), fuel is combusted to provide thermal input to a furnace or other industrial process and some of the heat rejected from the process is then used for power production.

Within the context of this report, the topic of waste heat recovery is limited to WHP. Most industrial WHP applications are bottoming cycle systems as described in the previous paragraph. Industrial WHP can also include systems in which heat is recovered from the exhaust of an engine or turbine generator and used to generate additional electricity through an organic Rankine cycle or similar technology. This type of system is less common in industrial applications and is not a CHP system, because there is no thermal energy delivered to an end-use. That said, the barriers to implementing non-CHP WHP are similar to those that apply to CHP, such as interconnection and utility rate structures. Therefore, both types of WHP are addressed in conjunction with the discussion of CHP, and both types of WHP are addressed by policy recommendations included in this study.

Barriers to CHP are summarized below.

Economic and Financial Barriers

- *Internal competition for capital.* Payback expectations and capital budget constraints influence CHP investment decisions.
- *Natural gas outlook.* The availability and long-term price forecast for natural gas impacts investments in CHP.

- *Accounting practices.* Emphasis on minimizing upfront capital costs, and the "split-incentive" between capital improvement and operation and maintenance (O&M) budgets.
- *Financial risk.* Industrial facilities may have a hard time finding low-cost financing due to financial risks.
- *Access to favorable tax structures.* Lack of financing instruments such as Master Limited Partnerships or Real Estate Investment Trusts.
- *Sales of excess power.* The inability to sell excess power or access to reasonable sales agreements for excess power.

Regulatory Barriers

- *Utility business model.* The structure of utility cost recovery and lost revenue mechanisms can reduce a utility's interest in promoting industrial CHP projects.
- *Environmental permitting and regulatory issues.* Output-based regulations (lb/MWh versus lb/MMBTu) and New Source Review permitting requirements.
- *Inconsistent interconnection requirements.* Lack of standardized interconnection requirements can impede CHP.
- *Lack of recognition of environmental benefits.* Lack of financial value for the potential emissions benefits of CHP.
- *Failure to recognize the full value of CHP in regulatory evaluations.* Utility procurement and resource plans may omit some value streams provided by CHP.
- *Standby rates.* Structure of standby rates that are not designed to closely preserve the nexus between charges and cost of service.
- *Exclusion from clean energy standards.* CHP's eligibility under CEPS programs.
- *Capacity and ancillary services markets.* Electricity markets and programs may limit CHP's ability to participate.

Informational Barriers

- *Awareness of available incentives.* Insufficient knowledge of federal, state and utility incentives and eligibility requirements for CHP projects.
- *Technical knowledge and resource availability.* Lack of in-house technical expertise or the resources to hire outside staff for the design, development, and operation of a CHP system.

VI. Economic Benefits of Energy Efficiency Grants

The Act requests the development of estimated economic benefits from Federal energy efficiency matching grants:

> *[… shall conduct a study of …the] estimated economic benefits to the national economy of providing the industrial sector with Federal energy efficiency matching grants of $5,000,000,000 for 5- and 10-year periods, including benefits relating to—*
>
> *i. Estimated energy and emission reductions;*
> *ii. Direct and indirect jobs saved or created;*
> *iii. Direct and indirect capital investment;*
> *iv. The gross domestic product; and*
> *v. Trade balance impacts.*

The economic benefits analysis was completed based on the following key assumptions:

- $5 billion of Federal matching grants allocated equally over 10 years (i.e., $500 million per year).
- Participant cost share is 80 percent for a base case. With this assumption, the total funding pool is $25 billion or $2.5 billion per year.
- 50 percent of funds are allocated for combined heat and power projects, and 50 percent of funds are allocated for energy efficiency and demand response projects.

All funds for this hypothetical grant program are used for deployment of commercially available technologies. In practice, a grant program could be set-up to allocate funds for related activities that complement commercially available technologies and stimulate industrial energy efficiency. For example, a modest percentage of funding could be allocated for marketing and outreach, and also for research and development, while preserving the majority of grant funds for deployment.

The results of the analysis indicate that a $5 billion Federal matching grant program implemented over a 10-year period ($500 million of Federal funding invested each year) will reduce annual energy consumption by 119 to 300 TBtu in Year 5, and 237 to 600 TBtu in Year 10. This reduced energy consumption is expected to save participating manufacturers $3.3 to $3.6 billion per year in Year 5, and $6.7 to $7.1 billion per year in Year 10 (single year savings are $670 to $710 million per year). Annual CO_2 emissions are expected to be reduced by 24 to 38 million metric tons in Year 5, and 48 to 75 million metric tons in Year 10. The grant program is expected to support approximately 9,700 to 11,200 jobs per year, which equates to 3.9 to 4.5

jobs per million dollars of investment. The GDP impact is expected to be in the range of $374 to $452 million per year.

The results shown above correspond to a base case scenario with 80 percent participant cost share. An alternative scenario was evaluated based on 50 percent participant cost share and is described in the study. In general, the economic impacts for the 50 percent cost sharing scenario are not as great as the 80 percent cost sharing scenario because of reduced capital leverage from the Federal funds.

The economic analysis did not consider impacts that might be derived from increased awareness that would be generated as a result of a $5 billion Federal grant program. Based on observations from the American Recovery and Investment Act and other energy efficiency incentive programs, there is frequently a "spillover" effect that creates activity by market participants that do not receive incentive payments. In the case of the hypothetical $5 billion grant program, some manufacturing plants would likely move ahead with industrial energy efficiency projects even though they do not receive grant funds. These plants could decide to move ahead with an energy efficiency project that they would not otherwise consider because of increased awareness and education resulting from the grant program. Due to modeling limitations, this spillover effect was not captured in the analysis completed for this study.

Barriers to Industrial Energy Efficiency

A Study Pursuant to Section 7 of the
American Energy Manufacturing Technical Corrections Act

June 2015

generally defined to be technologies that provide an internal rate of return (IRR) of 10 percent or higher.[31]

3.2 Barriers

Manufacturers in the industrial sector have shown progress in using energy more efficiently. However, barriers impede greater adoption of energy efficiency in the industrial sector. Barriers are discussed in three categories: (1) economic and financial, (2) regulatory, and (3) informational.

3.2.1 Economic and Financial Barriers

Significant economic and financial barriers to industrial end-use energy efficiency include:

- *Internal competition for capital.* Manufacturers often have limited capital available for end-use efficiency projects and frequently require very short payback periods (one to three years).
- *Corporate tax structures.* U.S. tax policies, such as depreciation periods, the treatment of energy bills, and other provisions can be a deterrent.
- *Program planning cycles.* There can be a mismatch between industrial planning cycles and utility and state energy efficiency program cycles, which can hinder industrial sites from moving forward with an energy efficiency project.
- *Split incentives.* Companies often split costs and benefits for energy efficiency projects between business units, which complicates decision-making.
- *Failure to recognize non-energy benefits of efficiency.* Not considering non-energy or co-benefits of an end-use energy efficiency project weakens the business case.
- *Energy price trends.* Volatile energy prices can create uncertainty in investment returns, leading to delayed decisions on energy efficiency projects.

Internal Competition for Capital

Manufacturers have limited capital for investments in new equipment, process upgrades, and plant improvements, and energy efficiency projects need to compete for this capital.[32] In a 2010 survey, respondents from a number of industry sectors (e.g., health care, manufacturing, finance, consulting, retail, and government) in the United States and Canada cited capital availability as their top barrier to investing in energy efficiency.[33] This survey indicated that decision-makers in the industrial sector typically expect capital investments to have short payback periods of 1 to 3 years.[34] In interviews, 44 percent of energy managers indicated that they need a payback of less than 3 years for energy efficiency projects, and other evidence suggests that under difficult economic conditions companies may look for a payback period of

18 months or less.[35] Short payback periods were also identified in a 2013 report by the Alliance to Save Energy.[36] In this report, payback and return on investment expectations were evaluated for three different types of investors. If the capital was being provided by an internal capital equipment budget, the payback period was in the range of 1–3 years (see **Table 8**) as opposed to longer payback periods for other types of investors (up to 30 years for funding from government sources).

Even when end-use energy efficiency projects do meet corporate investment thresholds, manufacturers may still not go ahead with such projects if they do not have a direct connection with the company's core business. For example, the ability to increase production is often viewed more favorably than being able to produce a product/good with less energy, even if the economic impacts are equal for both alternatives.

Some companies have taken proactive steps to encourage evaluation of energy efficiency projects. One example is Walmart (see sidebar), which works with suppliers to identify attractive projects. Another example is Cummins (see sidebar below), which has an internal capital fund devoted to energy efficiency improvements.

Another barrier associated with capital constraints is that financing an energy efficiency project can also impact a manufacturer's credit rating

Walmart Supplier Energy Efficiency Program (SEEP)

Walmart established the SEEP program to help encourage end-use efficiency investments in their supply chain. The SEEP program is structured as follows:

1. Walmart has an ongoing dialogue with manufacturers to discuss energy efficiency improvements. Upgrades are generally focused on building technologies (e.g., lighting, HVAC, water heating, and energy management systems or controls).
2. If a particular manufacturer shows interest in an energy efficiency upgrade, Walmart and the manufacturer will discuss the expected financial performance for the upgrade (e.g., payback or IRR).
3. If the outcome of Step 2 is positive, an energy audit will be performed. Walmart pays for the energy audit if the manufacturer invests in energy efficiency equipment based on the results of the audit. If the supplier takes no action, the supplier pays for the audit.
4. If the manufacturer decides to make an investment in energy efficiency, Walmart helps the manufacturer obtain competitive bids for the projects.

An example of a successful SEEP project is at VonDrehle Corporation, a U.S. paper manufacturer located in Hickory, NC. Walmart paid for an energy audit at a VonDrehle site. Following the audit, Walmart helped VonDrehle obtain bids for lighting upgrades that were subsequently implemented on 50 percent of the lights at the VonDrehle facility. VonDrehle paid for the lighting upgrades, which save an estimated $37,000 a year, resulting in a payback of less than 4 years.

Source: Institute for Industrial Productivity. Web link.

because the carrying cost of the project is included on the company's balance sheet. With this barrier in mind, some utilities have started offering alternative financing structures:

- In Wisconsin, Alliant Energy's Shared Savings Program operates as a type of on-bill financing program to encourage customers to take on major energy efficiency investments such as CHP that they may not have pursued due to capital constraints. Alliant now earns a rate of return on its Shared Savings portfolio equivalent to what it receives from its investments in more traditional assets.[37]
- Minnesota Power provides industrial users in northeastern Minnesota with on-bill financing for energy efficiency projects.[38]

Table 8. Investment Expectations

Class of Investor	Payback (years)	Return-on-Investment (annual %)
Government Agency	7-30	3-10
Outside Investor	3-7	10-25
Internal Capital Equipment Budget	1-3	25-100

Source: Adapted from ASE, 2013

Cummins' Internal Capital Fund to Support Energy Efficiency

Cummins, Inc., designs, manufactures, distributes, and services engines and related technologies, including fuel systems, emissions solutions, and power-generation systems. The company is a partner in DOE's Better Buildings Better Plants program, and committed to reducing energy intensity by 25 percent in 2016 compared to 2005. Cummins has already reduced the energy intensity of its facilities by almost 34 percent from 2005 to 2012 by targeting high-return opportunities. The company has an internal capital fund devoted to these high-return efficiency projects and has allocated $20.7 million in capital over 2013–2015 to install submeters, expand control systems, and upgrade or replace inefficient equipment. Additionally, Cummins was recognized by EPA with a Climate Leadership Award in 2012 due in part to this internal capital fund that helped create dedicated, annual funding for energy efficiency improvements.

Source: Cummins. Web link.

Corporate Tax Structure

The U.S. Internal Revenue Service (IRS) tax structure may discourage investments in end-use efficiency. Most business expenses, including energy costs, qualify as a tax deduction. Most types of property, including machinery and equipment investments, can be depreciated over time. The depreciation periods allowed by the IRS vary depending on several factors, including the type of asset and the expected life of the asset. In the IRS tax code, depreciation periods

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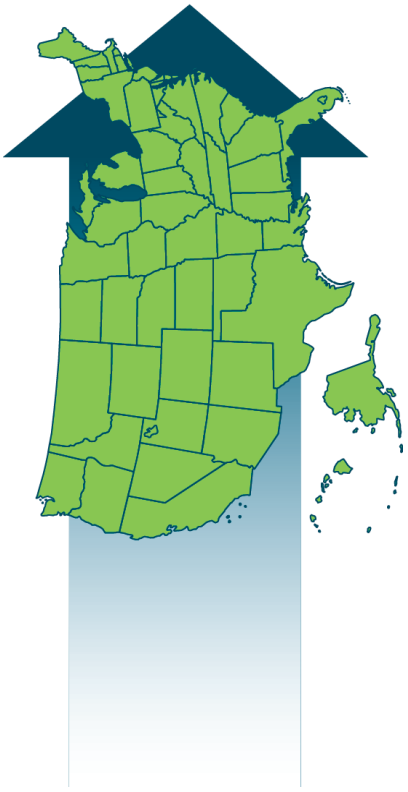

Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector

Industrial Energy Efficiency and Combined Heat and Power Working Group

March 2014

The State and Local Energy Efficiency Action Network is a state and local effort facilitated by the federal government that helps states, utilities, and other local stakeholders take energy efficiency to scale and achieve all cost-effective energy efficiency by 2020.

Learn more at www.seeaction.energy.gov

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Acronyms

BPA	Bonneville Power Administration
Btu	British thermal units
CEE	Consortium for Energy Efficiency
CEPS	clean energy portfolio standard(s)
CFA	Consolidated Funding Application
CHP	combined heat and power
C&I	commercial and industrial
DOE	U.S. Department of Energy
DSM	demand-side management
EERS	energy efficiency resource standard(s)
EPA	U.S. Environmental Protection Agency
EPI	energy performance indicator
EnMS	energy management system
ETO	Energy Trust of Oregon
EWEB	Eugene [Oregon] Water and Electric Board
FTE	full-time equivalent employee
GWh	gigawatt-hour
IEE	Industrial energy efficiency
IOF-WV	Industries of the Future West Virginia
IPE	NYSERDA's Industrial Process Efficiency program
IPMVP	International Performance Measurement and Verification Protocol
IRP	integrated resource planning
HVAC	heating, ventilating, and air conditioning
HPEM	High Performance Energy Management (BPA program)
kW	kilowatt
kWh	kilowatt hour
M&V	measurement and verification
MMBtu	million British thermal units
MW	megawatt
MW_{avg}	average megawatts
MWh	megawatt-hour
NAICS	North American Industry Classification System
NEEA	Northwest Energy Efficiency Alliance
NEB	non-energy benefit
NWFPA	Northwest Food Processors' Association
NYSERDA	New York State Energy Research and Development Authority
O&M	operations and maintenance
PAC	program administrator cost test
PDC	program delivery contractor
RMP	Rocky Mountain Power
SEM	strategic energy management
SEO	state energy office
SEP	U.S. Department of Energy Superior Energy Performance program
SME	small- and medium-sized enterprise
SWEEP	Southwest Energy Efficiency Project
Therm	100,000 Btu
TRC	total resource cost
UMP	Uniform Methods Project
WFE	Wisconsin Focus on Energy

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Executive Summary

Industry[1] is a key energy-using sector in the United States and accounted for about one-third of the nation's total primary energy consumption in 2012. In addition, the potential cost-effective energy savings in U.S industry is large—amounting to approximately 6,420 trillion British thermal units of primary energy (including combined heat and power), according to a comprehensive 2009 analysis by McKinsey & Company. In the United States, efforts to capture more of the potential energy savings in industry at the state level have grown in recent years as energy efficiency programs that capture cost-effective savings continue to be created and expand.

This report provides state regulators, utilities, and other program administrators an overview of the spectrum of U.S. industrial energy efficiency (IEE) programs[2] delivered by a variety of entities including utilities and program administrators. The report also assesses some of the key features of programs that have helped lead to success in generating increased energy savings and identifies new emerging directions in programs that might benefit from additional research and cross-discussion to promote adoption.

Why Do States Undertake Industrial Energy Efficiency Programs?

Many states have instituted energy efficiency programs funded by the public or ratepayers to achieve a variety of benefits. A core, compelling reason for this is because energy efficiency represents a least-cost option for supplying energy services compared to other prevailing options, providing both consumers and society with cost savings. Additional benefits can include environmental gains (including carbon or water use reduction), improved security against energy supply disruption or rapid price increases, and enhanced economic competitiveness. Most state governments have determined that it is necessary to include programs that cover all customers as part of their overall energy efficiency efforts, with industrial customers often a critical component. Experience has shown that the industrial sector historically saves more energy per program dollar than other customer classes: at the national level, IEE programs had an average cost of saved energy of $0.030 per kilowatt hour (kWh) in 2012—nearly one cent lower than the aggregate average energy efficiency program cost of $0.038/kWh.[3] Many of the well-established ratepayer-funded IEE programs in North America, such as those of Bonneville Power Authority, BC Hydro, Energy Trust of Oregon, or Wisconsin's Focus on Energy, continue to realize reliable energy savings from industry at or below the average costs they face for their programs overall. To realize these low-cost energy savings, however, requires a concerted effort developed specifically for the industrial sector and long-term, focused efforts addressing specific industrial needs and circumstances.

States have found that a larger amount of energy savings potential in industry can be gained from energy efficiency programs than can likely be achieved if industrial energy users pursue energy efficiency individually, with limited program assistance. Industrial companies are often aware of energy savings projects in their facilities and many companies have a solid record of developing these projects to save money; however, energy efficiency often cannot compete with other capital demands, even with similar or better paybacks. Moreover, industrial staff members often report that it is difficult to effectively navigate corporate project decision-making systems to get management endorsement for even quick payback energy efficiency projects. In addition, small- or medium-sized energy savings projects often do not compete well with other projects in garnering management attention and

[1] As defined by the Energy Information Administration (EIA), industry consists of the following types of activity: manufacturing (NAICS codes 31-33); agriculture, forestry, fishing, and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). This report principally focuses on the manufacturing subsector.

[2] The best practices information presented in this report is based on a review of publically available literature on state energy efficiency programs and materials and presentations from related workshops and discussions with industrial energy efficiency experts and program administrators, including: the ACEEE Summer Study on Industry (July 2013, Niagara Falls), the ACEEE Resource Acquisition Conference (September 2013, Nashville), the Industrial Energy Efficiency and CHP Regional Dialogue Meetings (held in 2011, 2012 and 2013), the Midwestern Governor's Association Industrial Energy Productivity Meeting (November 2013, Chicago).

[3] Source: Aden et al. 2013 based on EIA 2012 demand-side management, energy efficiency, and load management programs data for more than 1,000 utilities. Note: To ensure consistency and comparability, these values only include the 182 organizations that reported residential, commercial, and industrial savings and expenditure data; transport sector energy efficiency program data are not included except as a component of the aggregate average.

enthusiasm. Finally, limitations on staff resources and knowhow can further hinder implementation of cost-effective energy efficiency measures.[4]

In states where ratepayer-funded energy efficiency programs are in place, industrial programs can make a significant difference, not only by fostering higher implementation of quick payback projects, but also by providing financial incentives that improve the economics of what would have been longer-term payback projects (3–6 years) that are well outside the typical interest scope of industrial managers. Program incentives to help industrial customers capture the potential for large, additional energy savings can strengthen the alignment of company incentives with the broader interests of energy users statewide in developing low-cost resources for energy service supply. In addition, other intensive but highly cost-effective initiatives of key medium-term interest can be fostered through multi-year programming, such as development of new strategic energy management (SEM) systems in industrial companies.

Even relatively simple programs providing technical assistance, fostering peer exchange, and disseminating practical information can make a difference by supporting facility or company energy management staff in their work and drawing company management attention to energy cost saving possibilities. Increasing awareness of the non-energy benefits (NEBs) that often accompany energy saving projects can help tip the scale in favor of project implementation.

The Wide Spectrum of Ongoing and Useful State Programs

There is wide variation in the types of IEE programs pursued by states, utilities, and energy efficiency program administrators. The dynamics of local economies, existing regulatory frameworks, political interest, and characteristics of local industrial sectors help define what different states feel are the most appropriate approaches for IEE programs. Within this wide spectrum of successful—if diverse—experience, all states can certainly launch new programs, or adapt existing programs, providing cost-saving benefits to industry and the state at large. Moreover, because of the diversity of programs and experience, each state can learn from others about new ideas and lessons learned in program design and implementation.

This report defines a state IEE program in broad terms as a program that provides information, services, and/or financial support to interested industrial facilities within the state for energy efficiency activities. Broadly speaking, there are two main types of IEE programs in the United States:

- Ratepayer-funded energy efficiency programs which are funded through electric and gas customer rates
- Non-ratepayer-funded programs, which are funded by other means (e.g., federal resources, state operating budgets) and are often run by out-of-state energy offices and universities.

This report principally focuses on ratepayer-funded programs, although non-ratepayer-funded programs are also touched upon. Many states also mix a variety of different offerings and funding streams. The National Association of State Energy Officials (NASEO) reports that at least 35 state energy offices operate some type of IEE program separate from, or in support of, ratepayer-funded programs. Forty-one states have ratepayer-funded energy efficiency programs, and just over one-half of states operate ratepayer-funded programs with clean energy portfolio standards/energy efficiency resource standards or utility energy efficiency targets. Some states have chosen to include a self-direct or opt-out option to industrial programs. Self-direct programs are defined in this report as programs that allow qualifying industrial customers to "self-direct" fees that would normally be charged for a ratepayer-funded program directly into energy efficiency investments in their own facilities instead of into a broader aggregated pool of funds collected through a public benefits charge for energy efficiency programs. Not to be confused with "opting out," where the industrial company does not have to participate in the program, self-directed industrial customers are still obligated to spend money and deliver energy savings, either on a project-by-project basis, or over a certain amount of time.

[4] These IEE program challenges were identified through SEE Action Industrial Energy Efficiency and Combined Heat and Power Regional Dialogue Meetings held across the country in 2011, 2012, and 2013 (www1.eere.energy.gov/seeaction/ieechp_dialogues.html).

APPROACH	DESCRIPTION	PROGRAM EXAMPLES
KNOWLEDGE SHARING	• Low-cost or no-cost technical assistance • Workshops and other outreach • Peer exchange opportunities between industrial clusters or groups of companies • Success story dissemination	• West Virginia Industries of the Future • Southwest Energy Efficiency Project
PRESCRIPTIVE INCENTIVES	• Explicit incentives or rebates for certain specific eligible technologies (e.g., lighting, motors, drives, compressed air, process heating equipment)	• Rocky Mountain Power • Efficiency Vermont
CUSTOM INCENTIVES	• Specific energy efficiency projects tailored to individual customers or specific industrial facilities • May be a mix of technologies • Incentives or rebates often based on entire electricity or natural gas savings	• Xcel Energy • NYSERDA
MARKET TRANSFORMATION	• Streamlined path for introduction of new energy efficiency products to the market • Address structural barriers to energy efficiency (e.g., outdated building codes or lack of vendors offering an emerging technology)	• Northwest Energy Efficiency Alliance
ENERGY MANAGEMENT	• Operational, organizational, and behavioral changes through strategic energy management • Continuous energy improvement (e.g., embedded energy manager to provide leadership and organizational continuity for implementing change)	• Wisconsin Focus on Energy • Energy Trust of Oregon
SELF-DIRECT	• Customer fees directed into energy efficiency investments in their own facilities instead of a broader aggregated pool of funds • Eligibility for customer participation often based on threshold amount of energy use or energy use capacity • Verified energy savings	• Puget Sound Energy • Michigan Self-Direct Energy Optimization

Source: Categorization adapted from Bradbury et al. (2013)

Figure ES-1. Spectrum of IEE state program approaches with program examples

Financial incentives and technical assistance are often provided to energy users to implement sufficient energy efficiency measures to meet specific statewide energy savings goals or pursue all cost-effective energy efficiency opportunities. The main types of offerings, shown in Figure ES-1, are the following:

- **Technical Assistance and Knowledge-Sharing Programs.** These programs typically offer no-cost or low-cost expertise and advice to industrial companies on new technologies and practices, share analytical tools, disseminate success stories and case studies, and offer networking opportunities.
- **Prescriptive Programs.** Standardized prescriptive program offerings provide explicit incentives for adoption of specified higher-efficiency technologies in applications that are common among a variety of commercial and industrial energy users.
- **Custom Programs.** These program offerings provide financial and technical support, usually for customized, often process-specific, project implementation designed to meet the explicit needs of specific industrial customers. They can unlock substantial energy savings beyond what is possible when targeting only individual pieces of equipment and are usually quite cost-effective.

- **Market Transformation Programs.** These programs aim to streamline the path from market introduction of new energy efficiency products or practices to their promotion and consumer acceptance. Adoption of the new products can be supported through increasingly stringent energy efficiency codes and standards, technical assistance, and/or financial incentives.
- **Strategic Energy Management and Energy Manager Support Programs.** Rather than focusing on technology and equipment, these programs seek to promote operational, organizational, and behavioral changes resulting in energy efficiency gains on a continuing basis. SEM involves the operation of internal cross-organization management systems for companies that need to identify and implement many energy efficiency measures year after year.

Experience from Designing and Delivering Programs

A central finding of this report is that achieving success in IEE programs requires significant upfront investment and steady commitment over a number of years. In practice, the experience of strong IEE programs shows that the dedicated effort required is worth it in terms of generating robust and low-cost energy savings. This is especially true in the industrial sector where energy improvement decisions may be linked to operational or capital cycles.

The industrial sector is heterogeneous; different plants have different needs, all of which takes time and skill to grasp. Industrial plant staff members are generally more sophisticated concerning energy matters compared to residential and many commercial energy users. However, internal decision-making processes in industrial companies concerning energy efficiency investments or energy use behavioral change can be complex. Plant operational cycles must be understood and typically define project scheduling. Often, non-energy benefits, including increased productivity, may provide a key tipping point benefit in favor of pursuing a given line of projects, but such benefits may not be immediately obvious. As detailed further in Chapter 4, the barriers and challenges of the industrial sector must be addressed if IEE programs are to create real value for their customers.

To overcome existing barriers and provide high value to industrial customers, programs require quality market assessments, steady and close interaction with customers, a critical mass of knowledgeable staff and strategically engaged consultants, and operational stability. This requires upfront investment and a multi-year focus.

There are 10 IEE program features highlighted by analysts and practitioners that consistently add value to industrial customers and contribute to program success. These program features are:

1. **Clearly demonstrating the value proposition of IEE projects to companies.** There are many direct and indirect benefits from IEE projects. A key point in making the value proposition case to industrial company managers is to lay out in simple and concise terms the operating cost savings and other benefits—including profits—that are being left on the table by not addressing cost-effective energy efficiency improvement opportunities.
2. **Developing long-term relationships with industrial customers that include continual joint efforts to identify IEE projects.** Maintaining relationships with key industrial customers is important in pure technical assistance programs as well as energy efficiency resource acquisition programs. It takes time and a steady relationship for program personnel to understand company circumstances and needs, and for company personnel to understand what a program can offer them. Projects tend to be identified over time, as circumstances change and opportunities arise.

   Maintaining quality long-term relationships is people-dependent. Most programs have found that it is necessary to have a consistent and savvy contact person for industrial customers to interact with, such as an account manager. Satisfaction of industrial customers with program delivery and results often hinges on the level of trust established in relationships with program staff or experts.

   Due to the importance of long-term relationships, substantial program investments in staffing or contracted expert capacity are necessary over a number of years to generate the best results. Contracting for program delivery capacity based on only short-term goals, with frequent changes in contractors, is not likely to succeed. Time and effort is needed to set up effective institutional systems.

3. **Ensuring program administrators have industrial sector credibility and offer quality technical expertise.** Effective IEE programs also develop credibility with the industrial customer by employing staff and/or contracted experts that understand the customer's industrial segment and have the technical expertise to provide quality technical advice and support on energy efficiency options and implementation issues specific to that industry and customer. Addressing industrial companies' core needs requires understanding a plant's production processes, operating issues, and the market context that it operates within. Effective IEE programs will adopt the language, engagement strategies, and metrics that are meaningful to the corporate managers who drive capital investment decisions. Understanding customer needs and their investment decision-making processes allows IEE program administrators to generate trust with their industrial customers, boosting IEE implementation rates while making better use of limited resources.
4. **Offering a combination of prescriptive and custom options to best support diverse customer needs.** A combination of both prescriptive offerings for common cross-cutting technologies and customized project offerings for more unique projects can best meet diverse customer needs and provide flexible choices to industries.
5. **Accommodating scheduling concerns.** Program flexibility to meet industry project scheduling requirements is important to meet industrial customer needs. Typically, scheduling of capital project implementation must consider both operational schedules that dictate when production lines may be taken out of operation and capital investment cycles and decision-making processes. Programs with multi-year operational planning can best accommodate company scheduling requirements and the ebb and flow of company project implementation progress.
6. **Streamlining and expediting application processes.** Industrial customers may perceive the application and implementation procedures for IEE programs to be administratively complex and burdensome. Achieving the right balance between meeting key program administration needs for information and keeping program procedures simple and efficient may often require a continual process of evaluation and improvement.
7. **Conducting continual and targeted program outreach.** Even where industrial programs are well established, various industrial customers may remain unaware of the industrial program offerings that may be most applicable or useful for them due to staff turnover and internal demands. Steady and continual outreach and dissemination of information, such as examples of successful past projects, is important to encourage participation. Effective long-term relationships with industrial customers create better information flow and can assist in program outreach efforts.
8. **Leveraging partnerships.** Successful IEE programs often partner with federal, state, and regional agencies and organizations to leverage their expertise, access to customers, and program implementation support capacities. Partnerships can help programs by providing technical expertise, program design and implementation guidance, and expanding program outreach and implementation channels.
9. **Setting medium- to long-term goals as an investment signal for industrial customers.** Most state IEE programs have found that establishing and reporting on energy savings goals in three-year cycles is effective. Medium- and longer-term goals and coordinated funding cycles set a framework for long-term programming and can signal increased certainty to the market and program administrators.
10. **Undertaking proper project measurement and verification and completing program evaluations.** Effective measurement and verification (M&V) of project energy savings is critical to program administrators and regulators to assess the actual results of program activities and measure the contribution of projects and aggregate programs for achieving their goals. Manufacturers also can obtain clear views of the results of investment. Planning for M&V during the program design phase as well as periodic evaluation and adjustment in M&V approaches is important. If NEBs can be included in project assessments, they can further improve understanding of these often important benefits in conveying the value proposition for future energy efficiency projects. Finally, it is useful for programs to undertake periodic process and/or operational strategy evaluations of their full range of activities to assess where program efficiency and results can be further improved.

Self-Direct Programs

This report's review of self-directed IEE programs found a wide range in program structures. Some programs leave obligations of self-directed industries only vaguely defined, include little reporting, and little or no monitoring of energy-saving actions. Such programs ultimately may be little different in terms of results from provisions allowing industry to opt out of energy efficiency programs entirely. At the other end of the spectrum, some programs require verified self-directed customer investment and energy savings to be achieved in order for payment into the programs to be waived. Clarity in self-directed customer obligations and M&V of results are necessary if the policy goal is to ensure that self-directed industrial customers contribute to overall efforts to ensure least-cost electricity or gas service at a level on par with the contributions of other customers.

Emerging Industrial Program Directions

Most states with active IEE programs continue to devote much effort to expanding and improving their programs. There are four key areas of particular interest for further program evolution.

- **Expanding and strengthening strategic energy management programs in industry.** Efforts to support implementation of SEM systems in industry (and also commercial and institutional) are gaining momentum in state programs and internationally. Successful implementation of SEM in many industries could have a dramatic impact on capturing more unrealized energy efficiency potential. The benefits of supporting internal company platforms for continual identification and implementation of energy savings measures include more comprehensive identification and prioritization of energy savings investments (including across organizations), high-impact and low-cost behavioral changes, and operational and maintenance improvements, all contributing to the company bottom line. For example, use of greater submetering as part of an SEM initiative may allow previously unclear issues and solutions to come to light, or enable a new energy intensity program to be put in place.

  SEM implementation can be effectively supported through technical assistance and recognition programs or through energy efficiency resource acquisition programs. One key common challenge is how to easily convey options for introducing SEM into different corporate environments and the value proposition of these management systems. Experience has shown that company senior management support for SEM initiatives is necessary for success and strategies are needed to garner such support.

- **Providing energy efficiency incentives for whole-facility performance.** Program expansion to assess energy savings from SEM implementation could provide directions for taking energy efficiency programs that encompass process- or plant-wide opportunities (e.g., providing incentives and assessing savings credits for whole industrial facility performance) as opposed to performance of individual investments or measures. Efforts are underway to determine baselines and performance metrics that can provide sufficiently robust measurements of facility savings so that regulators and the public are confident that funds have produced real and new energy efficiency savings.

- **Valuing and expanding quantification and recognition of project NEBs.** Although there is wide variation between projects, several studies have shown that NEBs from IEE projects, such as broader productivity or quality gains, can be as high as or even higher than the energy cost saving benefits achieved by the projects. Awareness of the importance of quantifying or otherwise highlighting key and large co-benefits is growing. Even so, quantification of these benefits tends to occur mainly after project commissioning as part of project evaluation efforts. Some co-benefits, such as water savings, are relatively easy to quantify, while others, such as safety improvements, are more complex to assess. If programs employed systematic ways to assess some of the NEBs for key projects earlier in the project cycle, the clarity added to both the resulting total returns and shorter project payback could tip the scale on a variety of projects from "wait and see" to implementation.

- **Continuing efforts to expand industrial natural gas efficiency programs.** Although natural gas efficiency programs have been implemented in various states for years, effective coverage of the industrial sector is much less common than for electricity efficiency programs, even though industry accounts for about 26%

of total end-use natural gas consumption in the United States. A key challenge is that most large industrial customers purchase their gas through third-party suppliers, rather than their distribution companies. Another challenge is the recent decrease in natural gas prices (even though many gas saving projects are still cost-effective at current prices). Nevertheless, a number of states and Canadian provinces continue to serve as promising examples in delivery of industrial natural gas efficiency programs, which other states may profit from reviewing. In addition, innovative concepts are under consideration to increase the effectiveness and the reach of gas efficiency programs. One such concept proposes to pool gas and electric efficiency funds to allow participating manufacturers to implement larger and more holistic programs with the flexibility to deliver both electricity and gas savings.

The Importance of Cross Exchange

As this report will show, the experience gained by various states in developing and implementing IEE programs is both diverse and rich. Often, however, valuable details of different programs—and the successes, failures, and lessons learned—are not well known or are poorly understood out-of-state, even though other state practitioners could benefit from these experiences. In addition, early ideas on new programs or improvements to existing ones are common among various practitioners. Opportunities for peer exchange on design and operational specifics could further programs' progress. Finally, there are benefits from greater mutual understanding that can be gained from increased cross-state exchange among different types of stakeholders in the IEE program practice, including regulatory agencies, program administrators, and involved industrial energy users in different states, as well as associated experts.

Various formal and informal networking mechanisms exist for further information exchange. In addition, the State and Local Energy Efficiency Action Network (SEE Action) can play a role in organizational and implementation specific activities on program design and implementation topics of greatest interest. Regional IEE organizations also are well-placed to help foster the increased cross-exchange needed to further ramp up the promising results in IEE programs in the states.

Conclusion

Many opportunities remain to incorporate cost-effective, energy-efficient technologies, processes, and practices into U.S. manufacturing. IEE remains a large untapped potential for states and utilities looking to improve energy efficiency, reduce emissions, and promote economic development. Successful IEE programs vary substantially in operational mode, scope, and financial capacity, but also exhibit common threads and challenges.

Gaining industry support for IEE programs is key; one of the best means to gain increased industry support is by demonstrating the high value of efficiency programs to industrial customers. Experience highlighted in this report will show that IEE programs can effectively deliver value to industries in terms of lower costs, reduced environmental impact, and improved competitiveness, and can help alleviate common resistance by industry to pay into ratepayer programs.

The development and operation of a highly valued IEE program requires a close understanding of the special needs of industrial customers, flexibility in program offerings, and sustained engagement. In practical terms, this means helping industry achieve concrete energy cost reduction benefits, improved competitive position, and additional NEBs such as enhanced productivity and product quality well above the costs of paying into the program. Flexibility in addressing project scheduling and investment cycles, provision of high-quality technical expertise, and comprehensive offerings that include both prescriptive and custom incentives are features of successful programs.

In addition to responding to the needs of industrial customers, IEE programs that leverage strategic partnerships, have robust M&V and evaluation methodologies, and seek to introduce more holistic program approaches, such as SEM and pooled gas and electric programs, will ultimately help program administrators operate more effective programs and deliver significant additional energy savings. As this report will show, states' experience in developing and implementing IEE programs is both diverse and rich. There are benefits from greater mutual

understanding that can be gained from increased cross-state exchange among regulatory agencies, program administrators, industrial energy users, and associated experts.

Table ES-1 summarizes the key issues and considerations for regulators and program administrators in designing and implementing effective energy efficiency programs for industry, as well as programs that address that issue. They do not cover all decisions or issues that regulators and program administrators may need to consider because there will undoubtedly be jurisdiction- and case-specific topics that are not anticipated here. However, these considerations provide a starting point for addressing many of the issues that typically arise.

Table ES-1. Summary of Key Issues and Considerations for Regulators and Program Administrators

Topic	Issue	Considerations for Regulators and Program Administrators	Program Examples
The value of energy efficiency projects	Energy efficiency projects may compete with core business investments and decision-making is often split across business units.	• Clearly demonstrate the value proposition of energy efficiency projects to companies • Relay the operating cost savings and other benefits—including profits—lost if energy efficiency improvement opportunities are not addressed.	• Bonneville Power Administration • New York State Energy Research and Development Authority • West Virginia Industries of the Future
Relationships with industrial customers	It takes a long-term relationship for programs to understand industrial operation and needs, and for industrial companies to understand what a program can offer them.	• Long-term relationships with industrial companies enable joint identification of energy efficiency opportunities • Stability in program support and personnel over a number of years is critical.	• Energy Trust of Oregon
Industrial sector credibility and technical expertise	Addressing industrial companies' core needs requires understanding a plant's production processes, operating issues, and the market context the plant operates within.	Effective IEE programs develop credibility with industrial companies by employing staff/contractor experts that understand the industrial segment and have the technical expertise to provide quality technical advice and support issues specific to that industry and customer.	• Efficiency Vermont • Wisconsin Focus on Energy • Xcel Energy (Colorado and Minnesota)
Diverse industrial customer needs	Manufacturers use energy differently than the commercial sector, typically having significant process-related consumption. Focusing on simple common technology fixes alone will miss many of the opportunities.	A combination of both prescriptive offerings for common crosscutting technology and customized project offerings for larger, more unique projects can best meet diverse customer needs and provide flexible choices to industries.	• Rocky Mountain Power • CenterPoint Energy • Xcel Energy
Project scheduling	Scheduling of energy efficiency investments can be heavily dependent on a plant's operational and capital cycle, as proposed equipment changes must be guided through rigorous, competitive, and time-consuming approval processes.	Programs with multi-year operational planning can best accommodate company scheduling requirements, as scheduling of capital project implementation must consider both operational schedules that dictate when production lines may be taken out of operation as well as capital investment cycles and decision-making processes.	• NYSERDA

Topic	Issue	Considerations for Regulators and Program Administrators	Program Examples
Application processes	Industrial customers may perceive the application and implementation procedures for IEE programs to be administratively complex and burdensome.	Achieving the right balance between meeting key program administration needs for information and keeping program procedures simple and efficient may often require a continual process of evaluation and improvement.	• BPA • NYSERDA
Program outreach	Various industrial customers may be unaware of the industrial program offerings that may be most applicable or useful for them due to staff turnover and internal demands.	Steady and continual outreach and dissemination of information, such as examples of successful past projects, is important to encourage participation.	• AlabamaSAVES • NYSERDA
Leveraging partnerships	A range of federal, national, regional, and state initiatives and resources are relevant to state IEE programs, including those provided by the U.S. Department of Energy, the U.S. Environmental Protection Agency ENERGY STAR® program, state energy offices, and the Manufacturing Extension Partnership.	Successful IEE programs often partner with federal, state, and regional agencies and organizations to leverage their expertise, access to customers, and program implementation support capacities.	• AlabamaSAVES • Northwest Energy Efficiency Alliance, Northwest Food Processors Association and BPA
Medium- and long-term goals	Industrial companies and program administrators seek market certainty and reduced risk in ramping up the implementation of cost-effective energy efficiency measures.	Regulators and program administrators can set energy savings goals or targets for the medium- to long-term, coordinated with funding cycles (e.g., in three-year cycles).	• Michigan Self-Direct Energy Optimization Program • Southwest Energy Efficiency Project
Measurement, verification, and evaluation	Effective M&V is critical for program administrators to assess results and measure progress, and is also useful for industrial companies to verify results of their investments.	• Guidelines for M&V need to be clearly defined and periodically reviewed and adjusted • Periodic impact and process evaluations help identify where IEE program efficiency and results can be further improved • Non-energy benefits (NEBs) can be a key element of both project M&V and program evaluation.	• DOE's Uniform Methods Project • International Performance Measurement and Verification Protocol • ETO process evaluations • NYSERDA, Mass-achusetts, and BPA valuation of NEBs
Self-direct programs	There is a wide range in structures of self-direct programs: from those that are only vaguely defined, and include little M&V of energy saving actions, to those that require verified self-directed customer investment and energy savings to be achieved in order for payment into the programs to be waived.	Clarity in self-directed customer obligations and M&V of results are necessary if the policy goal is to ensure that self-directed industrial customers contribute to overall efforts to ensure least-cost electricity or gas service at a level on par with the contributions of other customers.	• Michigan Self-Direct Energy Optimization Program • Puget Sound Energy • Xcel Energy

Emerging Industrial Program Directions			
Topic	**Issue**	**Considerations for Regulators and Program Administrators**	**Program Examples**
Expanding and strengthening strategic energy management programs	Efforts to support implementation of SEM in industry are gaining momentum in state programs.	The challenge of crediting SEM (how to quantify and credit energy savings specifically achieved through SEM), as well as other SEM-related topics, is worthy of further research and cross-exchange.	• AEP Ohio • BPA • BC Hydro • ETO • WFE • Xcel Energy
Program approaches for whole-facility performance	Significant challenges exist in determining baselines and performance metrics that can provide sufficiently robust measurements of facility savings while maintaining practical and easy-to-implement methodologies.	Work on crediting energy savings from SEM could facilitate the provision of incentives and assessing savings credits for whole industrial facility performance, as opposed to performance of individual investments or measures.	• European experience
Capturing non-energy benefits at the project level	Although there is wide variation between projects, several studies have shown that NEBs from IEE projects, such as broader productivity or quality gains, can be as high as or even higher than the energy cost saving benefits achieved by the projects.	If programs employed systematic ways to assess NEBs earlier in the project cycle, the resulting total returns and shorter payback could tip the scale on a variety of projects from "wait and see" to implementation.	• Energy Trust of Oregon
Expanding natural gas programs	• There is less coverage of the industrial sector in natural gas efficiency programs than in electricity efficiency programs. • Most large industrial customers purchase their gas through third-party suppliers rather than their distribution companies. • Most single-fuel utilities administer energy efficiency programs on their own. However, energy efficiency opportunities typically lead to savings in both gas and electric energy use.	• Gas and electric efficiency measures—when delivered together as part of the same project or a combined program—can result in larger, more effective programs that capture more of the technically and economically viable energy efficiency potential. • Innovative concepts are under consideration to increase the effectiveness and the reach of natural gas efficiency programs.	• Efficiency Vermont • ETO • NYSERDA • PG&E • WFE

energy use patterns vary substantially. In the chemical industry, for example, it is typical for individual plants to continually adjust their product outputs as market conditions change and new opportunities arise. Such changes often require adjustments in process flows and the equipment and energy use patterns of different parts of a facility.

The industrial sector includes a broad spectrum of company size and technical sophistication ranging from very large companies with internal engineering staff to small and medium enterprises (SMEs) with limited technical capabilities.

The heterogeneity of the manufacturing sector can make it difficult for IEE programs to meet the specific needs of individual companies. To some extent, fairly simple programs designed to assist companies to save energy in common technology applications can be designed to be relevant to a wide range of manufacturing plants, providing some value. However, focus on simple common technology fixes alone will tend to put programs on only the periphery of manufacturing energy use and savings concerns. Manufacturers use energy differently than the commercial sector, typically having significant process-related consumption in addition to heating, ventilating, and air conditioning (HVAC) and lighting loads. Although it varies depending on manufacturing subsector, HVAC and lighting typically make up around 20% of total energy consumption (Kolwey 2012).

Although manufacturing as a sector is usually heterogeneous, industries may cluster in certain service areas for a variety of reasons. This creates opportunities for program administrators to concentrate energy efficiency process expertise in such places. Wisconsin's cluster approach is discussed in Section 4.7.

Energy Efficiency is Often Not Integrated into a Company's Decision-Making Process

Because energy can be a significant percentage of total manufacturing costs, lowering energy costs through increased efficiency can improve a company's bottom line and overall competitiveness. However, the decision-making processes of industrial companies involve a variety of participants, concerns, and procedures. There is a range of reasons why internal decision-making processes may not result in implementation of highly cost-effective energy efficiency opportunities, including:

- Energy efficiency projects may compete with core business investments that dominate attention, as well as investments for safety, environmental, and other regulatory requirements
- Decision-making is often split across business units
- The skills required to identify and pursue energy efficiency opportunities are not always present.

Projects focusing on operating cost savings may not compete well internally with projects focusing on expansion or new market development, despite very attractive financial returns. The profit benefits of investments leading to operating cost reductions may be difficult to clearly identify or communicate. Sometimes, other major investments may be seen as more core to the business, attracting higher priority. At other times, access to financing for operating cost saving projects also may be a barrier. Projects may be difficult to finance with outside loan capital if they are relatively small, due to lukewarm interest among financiers and high transaction costs.

Large companies often split responsibility for plant operations, energy bills, and investment decisions across different organizational units. A plant manager may be interested in energy efficiency, but does not see the actual energy bills or get credit for reducing them. A procurement manager may be motivated to minimize first costs instead of life-cycle costs, even if efficient choices save operating costs at the plant level. These "principal-agent" or "split-incentive" barriers can keep cost-effective improvements from happening.

In addition, in some cases manufacturers concerned about controlling energy costs may focus on efforts to gain more favorable energy pricing and contractual arrangements with energy suppliers and not necessarily on improving the efficiency of energy use in operations.

Finally, the skills required to identify and implement IEE opportunities are not always present in existing staff or staff are tasked with addressing other priorities. Companies often lack in-house staff capacity and specialized

expertise in energy management and technology skill sets. This prevents cost-effective measures from being identified, and also prevents known options from being advanced to the implementation stage.

Operational Cycles Influence When Energy Efficiency Investments Can Be Made

Energy efficiency investments are heavily dependent on the industrial customer's operational cycle, which can span four to seven years on average (Chittum 2009). Maintaining stable production is critical in industry. Project implementation can require temporary downtime for equipment installation and testing, impacting plant operations and production. Flexible scheduling to best match production requirements—for example, delaying implementation to times when many projects can be done at once or to planned shutdowns—will minimize plant interruptions and reduce management concerns.

In addition, IEE projects can often be significantly larger than projects in other sectors, requiring completion of comprehensive project approval processes and careful consideration by various personnel across a number of corporate divisions. Time horizons for project approval may be long. Moreover, implementation scheduling may require linkages to a variety of other project implementation measures at the same time.

Co-Benefits Are Often Not Included in the Cost-Benefit Analysis for Energy Efficiency Projects

Although additional co-benefits or non-energy benefits (NEBs) from energy efficiency projects may be substantial for the industrial customer, they are generally not included in the cost-benefit analysis for energy efficiency projects. This is despite extensive evidence that NEBs can be a key part of project benefits and can reduce payback times for new investments. Co-benefits may even exceed the value of energy savings. A 2003 study of commercial and IEE programs in Wisconsin valued these benefits at approximately 2.5 times the projected energy savings of the installed technologies (Hall and Roth 2003). In a recent survey of 30 energy managers, engineers, sustainability managers, plant managers, presidents, and vice presidents from a diverse pool of companies nationwide, 90% of energy projects were found to also have a broader productivity impact (Russell 2013a). For one company surveyed, energy improvements provided a fourfold return in the form of production improvements and some companies claimed that NEBs "dominated" the returns from energy projects. NEBs are further discussed in Chapter 6.

4.2. Industrial Participation in Energy Efficiency Programs

Historically, energy efficiency program administrators have struggled to create programs that overcome concerns from manufacturers about perceived or real costs, potential risk for production disruptions, or lack of flexibility in prescriptive incentive programs. When new ratepayer energy efficiency programs are being contemplated, large industries may resist paying systems benefits charges. In cases where some types of industrial programs have already been put in place as part of resource acquisition efforts, some industries remain lukewarm about participating. Several common reasons for this include:

- Saving energy is already claimed to be a business imperative and many industrial customers feel they can best manage their own energy needs, so they may think there is no added value in participating in IEE programs.
- Manufacturers are not aware of the IEE program offerings that may be most useful for their operations.
- IEE program offerings may not be flexible enough to meet the most pressing energy efficiency investment priorities of manufacturers and may be considered administratively complex and burdensome.
- Available IEE programs are perceived as being unresponsive to core energy issues in plants that are subsector- and site-specific.
- IEE program administrators may be perceived to have insufficient expertise in manufacturing and/or are not knowledgeable about key customer concerns and needs.
- There is a mismatch between industrial planning and project cycles and IEE program terms. Equipment replacement or refurbishment or plant retrofits can often only occur at the end of appointed times in operational cycles.

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Synapse
Energy Economics, Inc.

Commercial & Industrial Customer Perspectives on Massachusetts Energy Efficiency Programs

Prepared for the Massachusetts Energy Efficiency Advisory Council

April 3, 2012

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Executive Summary

This report includes a forecast of economic conditions in Massachusetts for 2013 through 2015, as well as a survey of commercial and industrial (C&I) customer perspectives on the Massachusetts energy efficiency programs. The Massachusetts Energy Efficiency Advisory Council (EEAC) asked Synapse Energy Economics, Inc. (Synapse) to conduct this assessment in order to inform the development of the Three-Year Statewide Energy Efficiency Plans for 2013 through 2015.

The primary purpose of this report is to assess the extent to which C&I customers are likely to participate in the Massachusetts energy efficiency programs over the next few years. The economic forecast is intended to provide an indication of the extent to which economic conditions might create barriers to C&I customer participation in the energy efficiency programs. The survey is intended to assess the variety of barriers that C&I customers face with regard to energy efficiency program participation.

Economic Forecast

Our economic forecast relies upon historic and forecast data from Moody's Analytics, a source that is fequently used by planning agencies for economic forecasts. We present forecasts for the five regions of the state, based on county borders: (1) Bristol County, (2) Greater Boston, (3) Central Massachusetts, (4) Cape Cod and the Islands, and (5) Western Massachusetts. We also present economic forecasts for several industry types including: construction, healthcare, industrial, large/small office, miscellaneous commercial, restaurant/lodging, retail/grocery, schools/colleges, warehouse industrial, and wholesale.

The economic forecast suggests that, in general, the state's economy will see improved performance over the next several years. At the statewide level, gross state product, construction activity, residential construction permits, and retail sales are expected to grow, while unemployment rates, business bankruptcies, and commercial rental vacancy rates are expected to decline. The same overall trend of improvement can be seen within each region, as well. One exception to this trend is gross state product and retail sales in the Cape Cod/Islands region, which are expected to stay essentially flat between now and 2015.

On a statewide basis, most industries are projected to grow in Massachusetts over the next few years. Figure ES-1 below presents the forecast of employment growth, in percentage terms over 2011 through 2015, by the different industry types. Note that the growth rates by industry are different in the different regions of the state, and in some regions there are several industries that are expected to see reduced employment levels over this period. This regional information is presented in Section 2.2.

Healthcare and office industries are projected to grow strongly in every region of the state, and both are large components of every region's employment. Restaurant/lodging is projected to grow significantly in every region except the Cape/Islands. Construction is projected to have robust growth in Bristol, but less growth in other regions. Bristol County, the region hit hardset by the economic downturn in Massachusetts, is expected to see a large fall in unemployment over the 2011 through 2015 period, in part due to the construction growth expected there.

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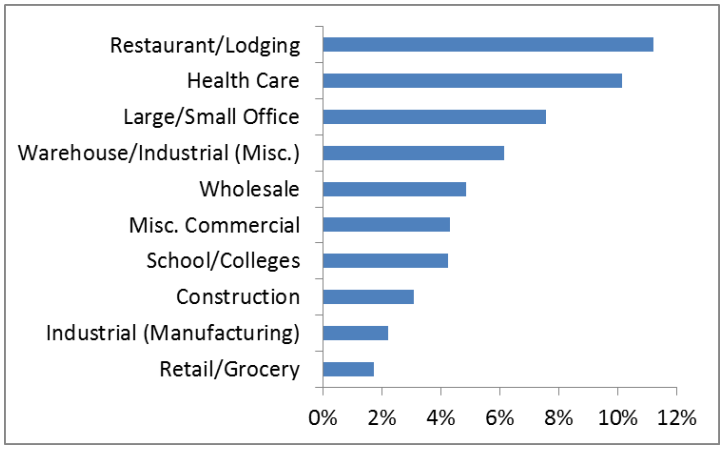
Figure ES-1. Employment Growth in Massachusetts, Percentage Increase 2011 – 2015



Survey Methodology

We began our survey by identifying a set of targets for customer types to interview. We planned to interview a total of 40 customers across the state. We identified a target set of customers to interview by first spreading the 40 interviews across the five state regions based on economic activity in those regions; and second by spreading the interviews in each region across the different industry types according to the level of economic activity within each industry type. We limited our target set of interviews to medium and large C&I customers, and we excluded governmental agencies from the target set. Furthermore, we attempted to focus our interviews on customers that have not participated in the Massachusetts energy efficiency programs for at least the past five years.

We then collected customer contact information from the Massachusetts energy efficiency program administrators and a few other stakeholders. We sent invitations to all of the 137 customers provided to us that were eligible and included contact information. Many of these customers did not respond to, or declined, our invitation. We conducted a total of 36 interviews.

The interviews that we conducted are presented by region and industry type in Table ES-1. Since a large number of customers did not respond to the survey invitations, the distribution of interviews by region and industry were determined more by customer interest and availability than by the information and priorities that we used to determine the target region and industry distribution. Nonetheless, the set of interviews that we were able to conduct is close enough to the target region and industry distribution that we believe it will provide the geographic and industry diversity that we set out to survey.

The one exception is that the vast majority of our interviews were with customers that have participated in the Massachusetts energy efficiency programs. We did not receive as many non-participant contacts from the stakeholders, and those that we did contact were much less likely to participate in our survey than the program participants. It is important to note that our survey results are likely to be influenced by the fact that so many of the respondents are program participants.

Table ES-1. Interviews Completed, by Industry Type and Region

Industry Type	Boston	Central Mass	Cape Cod	Western Mass	Bristol County	**Total**
Heavy industry	2	1	0	5	1	**9**
Warehouses & Distribution	0	0	0	1	0	**1**
Retail	1	1	0	1	2	**5**
Office	5	1	0	3	0	**9**
Schools & Colleges	4	0	0	0	0	**4**
Healthcare	3	1	1	0	0	**5**
Restaurants & Lodging	1	1	0	0	0	**2**
Miscellaneous	0	0	0	0	1	**1**
Total	**16**	**5**	**1**	**10**	**4**	**36**

It is also important to note that a sample size this small will not provide results that can be considered statistically significant. Nonetheless, we believe the results from these interviews provide useful insights for the EEAC and other stakeholders, consistent with the purpose of this study.

Survey Results

Overview of Common Themes

Most customers that we interviewed were program participants at some level and stated that they either will participate or are considering participating in programs in the next few years. In general, the customers we interviewed consider energy efficient equipment regularly when they make purchasing decisions.

Another theme we heard from most of our interviews was that payback period was the main criteria for evaluating energy efficiency investments and that energy efficiency investment payback periods compete with the payback periods for other capital investment projects.

A third theme we heard from many customers we interviewed was that capital constraints are a key barrier to moving forward with energy efficiency projects. Many customers have access to capital, but energy efficiency projects have to compete with other projects for that capital.

A fourth theme is that the general process for vetting and approving energy efficiency investments is similar across many customers. Projects are scoped, analyzed, and proposed on an annual basis and submitted to a higher level team for review and approval. Energy efficiency investments are frequently categorized as discretionary expenditures.

A fifth theme is that financing mechanisms, such as loans, are seldom, if ever, used. Instead, customers use existing capital to pay for the efficiency projects up-front, despite the widely recognized fact that the efficiency cost savings are experienced over many years.

It is clear from even our small sample that there are many different types of customers with different needs and barriers to participating in energy efficiency programs. This

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diversity of customers creates a significant challenge for program administrators, because reaching additional customers and achieving deeper levels of savings per customer will likely require offering program technical and financial support that is more tailored to the unique needs of the many different types of electric and gas customers.

Positive Feedback

Many of the customers provided positive feedback on the programs. Some of the highlights include the following points.

- Many customers were grateful for the sustained incentives and technical assistance provided by energy efficiency program administrators over the years, and indicated that energy efficiency investments could not compete with other capital investments without the incentives and technical assistance received.
- Several customers mentioned that they appreciate the level of outreach that they receive from energy efficiency program administrators and have had a long-standing, trusting relationship with their account executives.
- Some customers recognized and appreciated the variety of efforts and approaches (such as the upstream lighting program and the Memorandum of Understanding approach) that the energy efficiency program administrators are leveraging.
- Several customers recognized the positive impacts of the program administrators' efforts over time, such as the ability to accelerate energy efficient product development and manufacturing and make energy efficient solutions affordable.

Summary of Barriers Identified by Customers

The barriers to participation that have emerged from the interviews can be organized in two categories: customer barriers and program barriers. Customer barriers are barriers that stem from a customer's internal decision-making processes. Program barriers are barriers that stem from the way the programs are designed or administered. The customer barriers were subdivided into the following categories: customer's capital constraints, economic climate, unsupportive corporate review and approval process, the customer is convinced it has done all the efficiency measures it can within its facilities, or distrust of new technology.

The program barriers were subdivided into the following categories: insufficient marketing and outreach, high transaction costs, inadequate responsiveness and timing, limited measures offered through the programs, insufficient incentives, the desire to opt out of the energy efficiency charge, the programs are not tailored to the unique needs of customers, and other barriers.

Figures ES-2 and ES-3 present a summary of the number of times each of these barriers was mentioned by customers in our interviews.[1] In general, program barriers were mentioned more frequently than customer barriers. Insufficient marketing and outreach as well as customer's capital constraints were mentioned most often, with transaction costs the next most frequently mentioned barrier.

[1] Note that each customer mentioned more than one barrier, and not all customers identified the same number of barriers. We present these figures simply to provide a summary of the frequency with which the different barriers were identified.

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Figure ES-2. Customer Barriers Mentioned in the Interviews

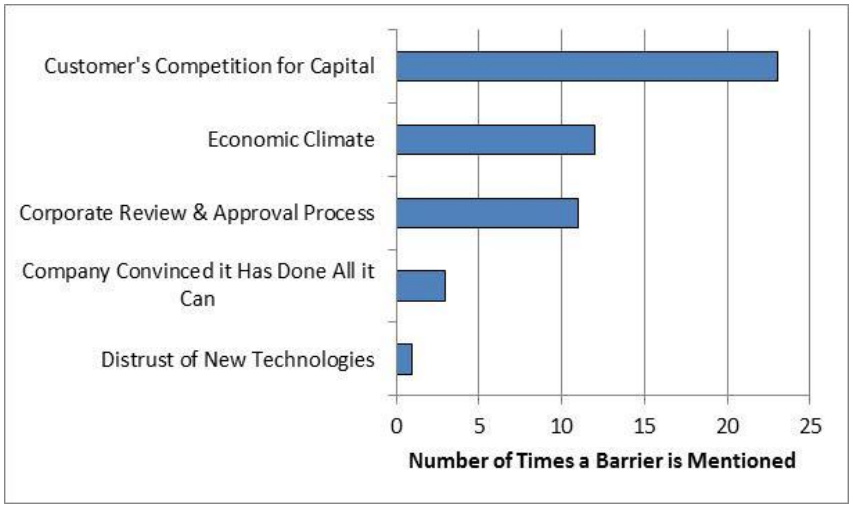
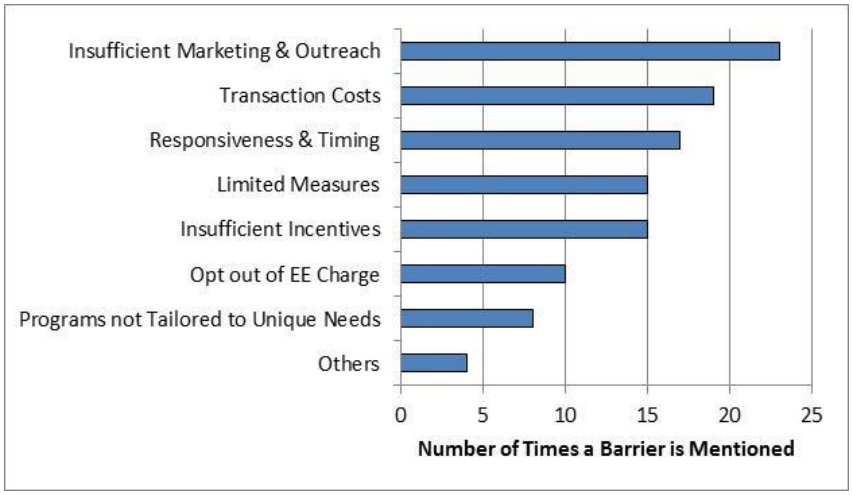


Figure ES-3. Program Barriers Mentioned in the Interviews



Customer Barriers

Customer's capital constraints. This is one of the most frequently cited and important barriers that customers face in energy efficiency program participation. Many customers, although not all, do not have a problem accessing capital. Their chief problem is with the competition for capital between energy efficiency investments and other investments, especially those investments that are more germane to the core business of the customer. Some customers have global operations, and face competition for capital in Massachusetts, in the United States, and elsewhere in the world. This competition for capital is so important to customers that it results in greater adherence to payback period constraints, as that is often the criteria that is used to determine which project deserves the constrained capital. Further, some customers mentioned that the significant upfront cost of efficiency measures, especially larger projects beyond lighting upgrades, created a barrier to participation.

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Economic climate. The economy appears to have a relatively indirect impact on a customer's ability to participate in efficiency program, as many customers were not clear on the connection between economic conditions and efficiency program participation. When asked, customers held several views on the extent to which the economy affects their participation:

- Some customers do not see the economy as a barrier to participation.
- Other customers were quick to mention that the economy has affected their employee base, profit, or capital availability, making it more difficult to undertake nonessential projects.
- Some customers see efficiency as even more important in tight economic conditions, as a means to better manage budgets and reduce costs with minimal capital outlay.
- For other customers, the downturn in the economy exacerbates the competition for capital problems discussed above, in that capital might be harder to access or payback periods may need to be shorter.
- Still other customers noted that in a tight economic context they are more likely to let existing equipment run through its useful life, rather than retrofit it early. This creates a barrier to implementing efficiency measures as there is often insufficient time and resources to identify and procure the most efficient option at the time of equipment failure.

Unsupportive corporate review and approval process. Many customers noted that they have no problem getting support from corporate executives to implement energy efficiency projects. However, corporate decision-making practice often requires efficiency projects to compete for capital with investments that are more germane to a customer's business (see above), and sometimes corporate practices place very tight payback periods constraints on all investments, limiting the energy efficiency measures that can obtain corporate approval.

Customer convinced it has done all it can. This was not a commonly identified barrier, as only three customers identified this barrier. When mentioned, it was seen as a transient barrier that would disappear over time. Customers mentioned that they had done several efficiency projects, and that, while additional savings opportunities likely exist within their buildings, the savings are not likely to outweigh the transaction costs. One customer indicated that savings opportunities from the next generation of efficient equipment would likely propel them to participate in the future.

Distrust of new technology. Only one of the customers interviewed indicated that they were reluctant to implement energy efficiency measures because they did not trust or fully understand the efficiency technology. This customer was concerned that reducing energy consumption could reduce its production capability.

Other barriers. A few customers mentioned barriers or topics that did not fit into the categories above. These include: people have been lulled into a sense of security with prices of electricity and natural gas being relatively low, and participants are distracted by other energy projects like solar or geothermal.

Program Barriers

Insufficient marketing and outreach. Many of the customers feel that the program administrators could be more proactive in reaching out to and educating customers about

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efficiency opportunities. Some customers felt program administrators were inconsistent in their outreach, or had limited contact with their representative. Others thought that, while the program administrators do reach out to them, the customer was driving the process and had previously researched the opportunities. Several customers noted that their gas program administrator has not reached out to them with energy efficiency opportunities, or provided any technical or financial support. This is particularly troubling to several customers who are very active in the electric efficiency programs and who believe they have significant gas efficiency opportunities. Some customers have regular, annual cycles of budgeting and investing in energy efficiency equipment, and they would prefer that the program administrators coordinate their program services with the customer's annual cycle.

High transaction costs. Many customers indicated that the paperwork and legwork involved in participation is too great, and that the overall process needs to be simplified. Some customers claimed that, for long lead-time projects, the time required to receive a financial incentive, as well as the uncertainty about obtaining a financial incentive, especially across program years, create a barrier to their participation.

Inadequate responsiveness and timing. Several customers thought their program administrator was unresponsive to their needs, and a few customers attributed it to the program administrators being overworked. Others thought it was difficult to time their participation, such as when major equipment fails and needs to be replaced immediately, or during new construction when projects need to go forward and cannot be held up by program participation.

Limited measures offered through the programs. Many customers expressed a desire for the programs to be more flexible and to allow the customers to recommend efficiency projects to undertake. Other customers suggested that specific equipment, such as more efficient elevators, should be offered incentives through the programs.

Insufficient financial incentives. Many customers noted that they would implement additional efficiency measures if they were provided with greater financial incentives. Additional financial incentives would help overcome the competition for capital that many customers face, as well as reduce the payback periods needed to meet corporate requirements. Many companies indicated that there is not enough coverage of technical support costs or availability of technical support in general. Some customers wished the programs offered different incentive structures and better addressed upfront costs as well as costs over the life of the measure.

Desire to opt out of the energy efficiency charge. Many customers claimed that they would be able to achieve much greater energy efficiency saving if they were able to keep all of the funds that they contribute to the Massachusetts energy efficiency programs and dedicate those funds to efficiency projects at their own facilities. This was especially true among the large customers, including those in the industrial, healthcare and schools/colleges industry types.

Programs not tailored to unique needs. Some customers thought that the program administrators did not make an effort to understand the unique needs of their industry. This was especially true for customers in the healthcare industry.

Other barriers. A few customers mentioned barriers or topics that did not fit into the categories above. These include: (a) the lack of transparency with regard to the amount that the customer is providing to efficiency program funding is a barrier when employees try to convince management to take advantage of efficiency programs offered by the

program administrators; and (b) customers appear to be confused by the number of energy efficiency providers in the market (i.e., ESCOs vs. renewable installers vs. lighting manufacturers/distributors vs. utilities/municipal aggregators/municipals).

Implications for Energy Efficiency Programs

The results of our economic forecast and customer survey lead us to draw the following conclusions with regard to energy efficiency program planning.

1. The Three-Year Energy Efficiency Plans should include savings goals that recognize that (1) the Massachusetts economy is forecasted to improve steadily over the next few years, (2) many customers do not see the state of the economy as a barrier to participation in the energy efficiency programs, (3) many customers have additional efficiency opportunities in their facilities and (4) many customers have an interest in participating in the programs again. In fact, several customers noted that in a tight economy they might be more likely to participate in energy efficiency programs as one of the few options they have to cut costs (as long as the payback periods are short enough).

2. The Three-Year Energy Efficiency Plans should recognize the potential savings available from the C&I New Construction programs, given that the economic forecast indicates that business construction activity is expected to steadily increase over the next few years.

3. Encouraging customers to adopt a deeper level of efficiency measures will likely require additional efforts to overcome some of the key barriers identified above, particularly customer budget limits and competition for capital, burdensome transaction costs of participating in the efficiency programs, and limited efficiency measures available by the efficiency programs.

4. Encouraging customers to adopt a deeper level of efficiency measures will also likely require increased engagement from the program administrators' account executives and efficiency support staff. This will be important both to reduce the transaction costs associated with the energy efficiency programs and to better serve the unique needs of the different customers.

5. The Three-Year Energy Efficiency Plans should recognize that many customers have apparently not received much outreach regarding gas efficiency opportunities, and that additional outreach and support from gas program administrators might lead to increased gas efficiency savings.

6. Program administrators should be required to collect and report more comprehensive data regarding the customers who participate in their energy efficiency programs. A better understanding of customer participation would provide the program administrators with very useful information about where the untapped efficiency opportunities lie and how to pursue them. It would also be very useful to identify and track the different types of participation, including: active participants (i.e., recent participants), inactive participants (i.e., past participants), non-participants, and proactive participants (where the customer prefers to take the lead with assistance from the program administrator) versus reactive participants (where the customer prefers the program administrator to take the lead).

Recommendations for Further Research

Our survey indicates that there are several areas where additional research might help to increase the participation of C&I customers over the next few years.

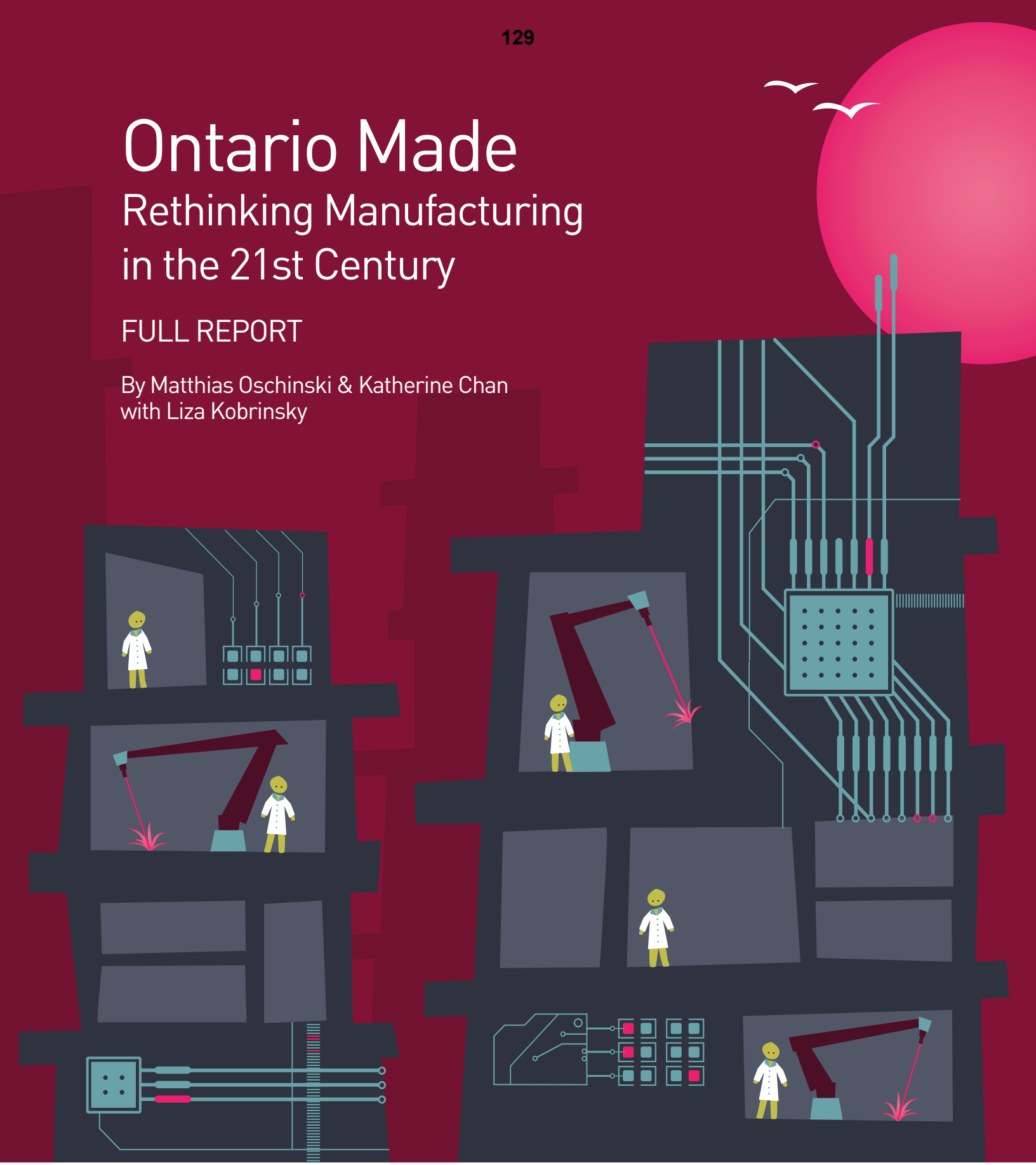
1. Most importantly, it would be helpful to continue efforts to better assess the perspectives of the C&I customers who have not participated in the Massachusetts energy efficiency programs to date.
2. It may be helpful to conduct statewide research into opportunities for reducing the transaction costs (including timing concerns) associated with participation in the energy efficiency programs. This could include a statewide effort to identify best practices within the state and from other parts of the country.
3. It may be helpful to conduct statewide research into training the program administrators' account representatives and support staff so that they have a better understanding of the needs of different customer types and different industries. This could include a statewide effort to train account executives and support staff and to share knowledge and experience across the program administrators.
4. It may be helpful to conduct statewide research into ways to expand the types of efficiency measures eligible for financial support, reduce the time required to accept measures for eligibility, and streamline the process that is used in deciding measure eligibility.
5. It may be helpful to conduct statewide research into opportunities for the gas program administrators to better coordinate their outreach and support services with electric program administrators.
6. It may be helpful to conduct statewide research into practices for spending the efficiency budgets more evenly over the course of a year, in order to avoid the year-end blitz that sometimes occurs in order to meet annual targets.

Ontario Made

Rethinking Manufacturing in the 21st Century

FULL REPORT

By Matthias Oschinski & Katherine Chan
with Liza Kobrinsky



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This implies greater affordability of ICT investments for Canadian manufacturers relative to firms in the overall business sector, a further advantage over US manufacturers when prices are compared to US total business sector ICT investment. This trend presents an opportunity for Canadian manufacturers to invest more heavily in ICT M&E now if the sector is to remain competitive in the long run.

Ontario has also made significant headway in restructuring the business tax system to make it easier for firms to invest, through the harmonization of provincial and federal goods and services tax, the elimination of the capital taxes for manufacturing firms in 2007, and the reduction of Ontario's corporate income tax rates.[23] Furthermore, the lower relative price of M&E from the rising Canadian dollar provides additional incentive for manufacturers to invest more heavily in new M&E. However, Ontario manufacturers have yet to take full advantage of these opportunities. Why?

There are a few possible explanations to new capital investments lag. Firm size, access to financing and the issue of scalability remain obstacles for firm expansion. However, risk aversion and lack of competitive pressure are also factors that contribute to the under-investment in machinery and equipment and the widening productivity gap.[24]

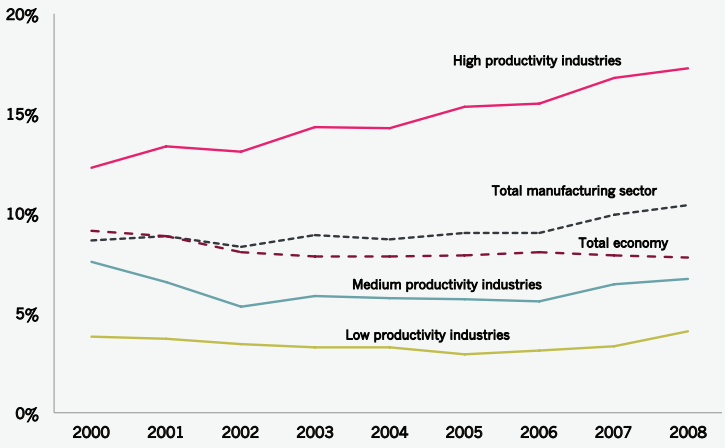
Energy efficiency

In addition to labour and capital, energy and water utilities are important input factors in the manufacturing production process.

Taking into account production numbers sheds some light on the efficiency with which these input factors are being used. Calculating the ratio of real value added to total utility costs for manufacturing in Ontario, Quebec and the rest of provincial Canada shows that Ontario's utility efficiency is actually highest in this group (see Figure 27). In other words, the data suggest that, in general, Ontario's manufacturing sector uses energy and water more efficiently than industries in other Canadian provinces—which might, in part, be due to the larger scale of production in this province.

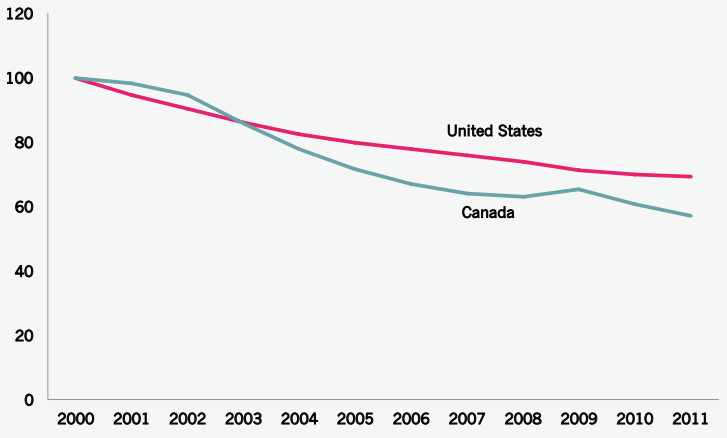
A look at disaggregated industries also reveals that energy is of varying importance as an input factor within the manufacturing sector. Figure 28 below illustrates that petroleum and coal manufacturing, paper manufacturing, primary metal manufacturing, non-metallic mineral manufacturing, chemical products manufacturing and wood product manufacturing are relatively energy intensive compared to other industrial subsectors.

FIGURE 24
Capital expenditures on M&E as a percentage of total output, 2000-2008



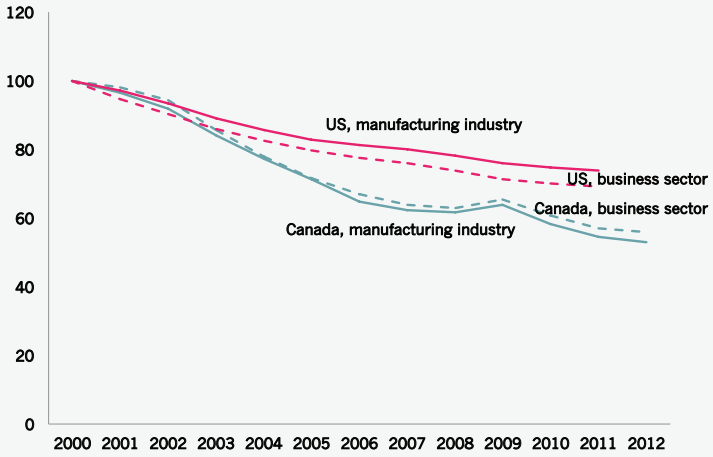
Source: Statistics Canada, CANSIM Tables 379-0025 and 029-0005

FIGURE 25
Price trend of total ICT investments in Canada vs United States (Price Index 2000 = 100)



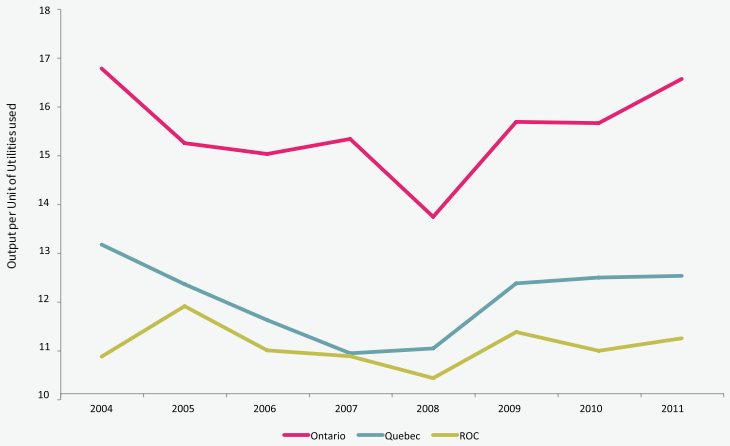
Note: Calculated as the change from total ICT investment implicit price deflators for total computer, communication and software ICT in the business sector in the US and Canada.
Source: CSLS Database of Information and Communication Technology (ICT) Investment and Capital Stock Trends: Canada vs. United States, available online: http://www.csls.ca/data/ict.asp

FIGURE 26
Price trends of ICT Investments, by sector (Price index 2000 = 100)



Note: Calculated as total ICT investment implicit price deflators for total computer, communication and software ICT investment in the US and Canada.
Source: CSLS Database of Information and Communication Technology (ICT) Investment and Capital Stock Trends: Canada vs. United States, available online: http://www.csls.ca/data/ict.asp

FIGURE 27
Utility Cost Effectiveness – Ontario, Quebec and Rest of Canada, 2004-2011



Source: Statistics Canada, CANSIM Table 301-0006, 379-0025

In order to assess Ontario's competitiveness with regard to energy usage, we compare energy efficiency in manufacturing industries relative to that of U. S. peers and peer jurisdictions in Germany. Given that Germany is currently the most productive manufacturing country, an inclusion of German peer jurisdictions in this analysis serves as a useful benchmark for Ontario's manufacturing sector.[25]

With regard to energy usage itself, our analysis focuses on the consumption of electricity and natural gas as input factors in the manufacturing production process. According to data provided by Natural Resources Canada, electricity and natural gas combined amounted for nearly 60 percent of energy consumption in manufacturing in 2010.

At around 30 percent, electricity usage was slightly higher than the consumption of natural gas, which had a share of roughly 28 percent of total energy usage. Oil, another common input factor in energy usage, was not considered in this analysis because consumption data is often missing at the detailed industry level. Moreover, as opposed to prices for electricity and natural gas, the price of oil is largely determined on international markets. Hence, regional variations in cost structures are likely to be less pronounced with regard to oil consumption compared to the use of electricity and natural gas.

To account for a proper comparison between Ontario and its peer jurisdictions, all energy consumption data were re-calculated to KWh.

Figure 29 displays energy efficiency—in terms of electricity and natural gas consumption only—in total manufacturing for Ontario relative to U.S. and German peers. As the ranking shows, Baden-Württemberg is the most energy productive jurisdiction in this group both with regard to electricity and gas usage, followed by Indiana, Bavaria and North Carolina. Out of these 19 jurisdictions, Ontario ranks 17th, or third last, in terms of energy efficiency.

It is important to note here that the results here reflect, at least in part, the composition of the manufacturing sector in each jurisdiction. As such, jurisdictions with a relatively high share of very energy intensive industries, such as paper manufacturing, primary metals and coal, will always end up at the lower end of the ranking.

To get a more detailed picture, it is therefore important to disaggregate the manufacturing sector and compare sub-industries. When this is done for Ontario and its international peers in the U.S. and in Germany, our main result still holds—that Ontario lags most international peers in energy efficiency. This is in line with anecdotal evidence,

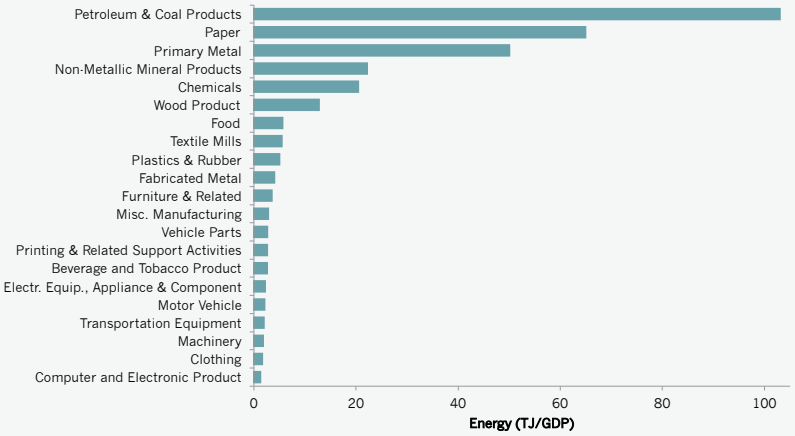
which asserts that comparatively low electricity prices for industrial consumers in the past provided little incentive to upgrade machinery and equipment for more energy efficient production. In more recent years, however, energy costs in Ontario have been increasing and will continue to do so at least over the medium term. This should lead an added incentive to make energy efficiency a higher priority.

Over the past while, there has been ongoing discussion regarding rising electricity prices in Ontario and an increasing concern that price differences relative to U.S. states would harm the competitiveness of Ontario's manufacturers.

Does this concern hold? Figure 30 depicts electricity rates for industrial consumers in Ontario and its U.S. peers from 2000 and 2012. In 2000, the average price for electricity in U.S. peers was 3.4 cents per kWh compared to 5.4 cents per kWh in Ontario. The gap in electricity prices narrowed in subsequent years and reached a difference of roughly 0.7 cents per kWh by 2010.

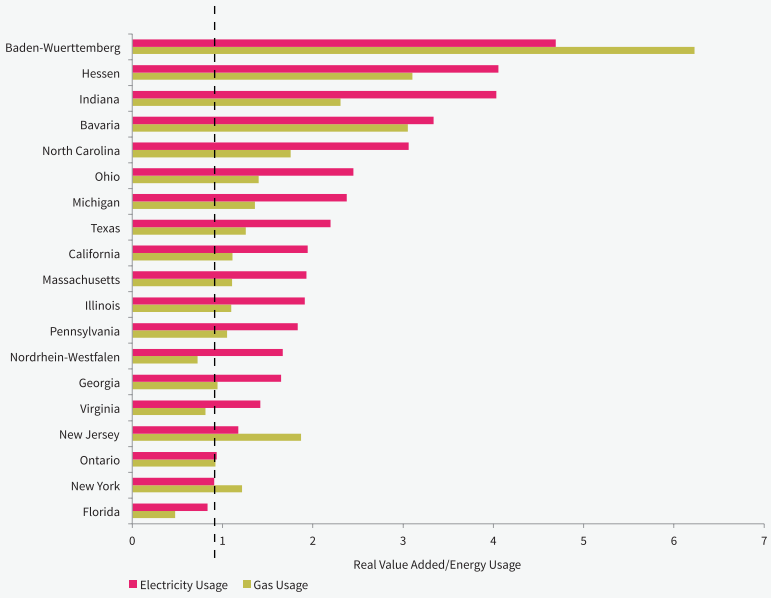
Yet, as Figure 30 also shows, prices began diverging drastically in 2011 and 2012 with Ontario experiencing a significant increase from around 8 cents per kWh in 2010 to 10.9 cents per kWh in 2012. At the same time, electricity prices in U.S. peer states dropped slightly from 7.4 cents per kWh in 2010 to 7.2 cents per kWh in 2012.

FIGURE 28
Energy Intensity in Canadian Manufacturing Industries, 2011



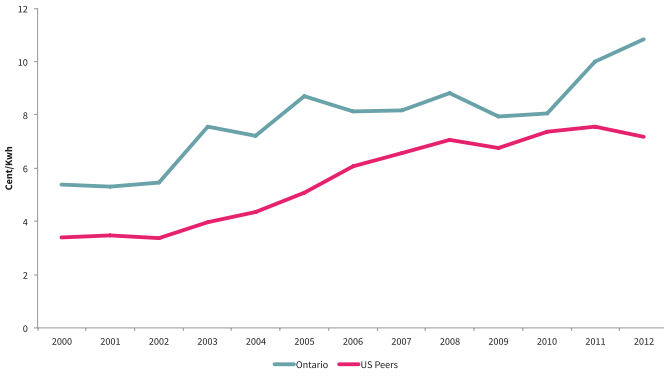
Source: CIEEDAC, Simon Fraser University

FIGURE 29
Energy Productivity Total Manufacturing - Ontario vs. US and German Peer Jurisdictions, 2010



Source: Source: Statistisches Bundesamt, US Energy Information Administration, AMPCO and IESO.

FIGURE 30
Electricity Cost Ontario vs US Peers, 2000-2012 (in Cents/KWh)



Source: NEB and EIA

A direct comparison between selected Canadian provinces and U.S. states illustrates this point further (see Figure 31). In 2000, electricity rates for industrial consumers were 5.4 cents/kWh in Ontario, compared to 3.2 cents/kWh in Michigan, 3.4 cents/kWh in New York and 2.8 cents/kWh in Ohio. By 2010, prices had converged, significantly narrowing these differences. From 2011 onward, however, the gap in prices has started to increase again.

The last column in Figure 31 reveals another interesting fact. While price levels were higher in Ontario compared to most North American peers in recent years, annual price increases occurred at similar speed: from 5.27 percent per year in New York to 7.2 percent per year in Alberta. The only notable exception in this group is Quebec where prices grew on average by 2.65 percent per year.

While comparing electricity costs across jurisdictions is important, a more insightful question might be around the efficiency of Ontario manufacturers in using electricity in production. Figure 32 below illustrates that manufacturers in U.S. peer jurisdictions manage to gain more output using the same amount of electricity compared to Ontario firms. Hence, while companies are not able to control the price of electricity in the province, they can, at least to a certain extent, influence the actual cost of electricity in the production process by addressing the issue of energy efficiency.

A look at international jurisdictions outside North America reveals that prices for electricity are about twice as high in Germany compared to the U.S. and prices for natural gas are about four times as high.

How, then, are German manufacturers able to stay competitive? A recent study by the European Commission shows that the answer is higher energy efficiency, i.e. the smarter use of energy in production.[26]

Thus, with electricity prices set to rise further in Ontario over the medium term, addressing the issue of energy efficiency in manufacturing production will become a crucial issue.

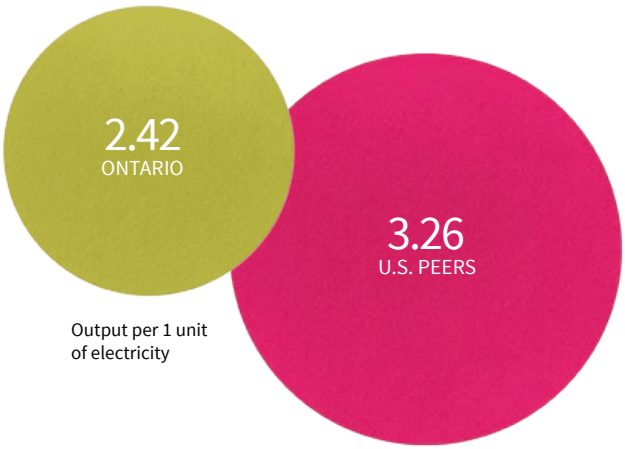
Alongside productivity and the related costs of inputs to production, additional success indicators serve to demonstrate the potential of firms to scale up and the possibilities for sustainable growth. The following two sections analyze Ontario's current situation at the sub-industry level.

FIGURE 31
Electricity Prices in selected Canadian provinces and U.S. states.

JURISDICTION	2000	2005	2010	2012	CAGR
Ontario	5.4	8.7	8.0	10.9	6.03
Alberta	4.6	6.1	7.2	10.6	7.20
Michigan	3.2	4.2	6.5	7.2	6.99
U.S. Peers Avg.	3.4	5.1	7.4	7.2	6.45
New York	3.4	6.4	8.1	6.3	5.27
Ohio	2.8	4.0	5.9	5.9	6.41
Quebec	3.8	4.3	5.2	5.2	2.65

Note: Values in real Canadian dollar; CAGR=year-over-year growth rate from 200-2012
Source: NEB and EIA.

FIGURE 32
Efficiency of electricity use in manufacturing—Ontario vs. U.S. peers



Source: NEB and EIA.

Scalability

A firm's ability to scale up production is an important indicator of success. In order to analyze and quantify the situation for Ontario's manufacturing sector, this analysis focuses on three aspects: high growth firms, survival rates and bankruptcies. Taken together, this can help identify the sector's resilience and those sub-industries with the highest growth potential.

High growth firms

Although productivity is an important ingredient to firm success, it is not the sole ingredient and should not be the end-goal for policymakers. Rather, empirical evidence shows that high growth entrepreneurial firms are responsible for a considerable share of job creation along with the added value they generate in an economy.

Though it is important for policymakers to focus on increasing the number of entrepreneurial manufacturing firms in Ontario, we recognize that growth does not automatically follow. Rather, it is imperative to foster the *quality* of entrepreneurship and to build on the support systems that help promising firms reach their full potential.[27]

As previously noted, the vast majority of manufacturing firms are small, accounting for as much as 86.6 percent of all firms. Small firms may be intentionally small in size to serve different needs. These include niche markets with customized products, since stylized products do not lend themselves to more standardized processes.

Correspondingly, while this report acknowledges the value smaller firms bring to the sector, it focuses on the opportunities for small firms to expand. Larger firms have a greater tendency to exert the potential direct and indirect benefits on employment, wages and value added on the economy. Empirically, the use of advanced production technology also tends to increase with plant size, with large manufacturing firms being more likely than smaller ones to engage in productivity-enhancing (albeit, riskier) production and process innovations.

This is significant for manufacturing firms in particular, since relatively larger firms (100 employees or more) are as much as 24 percent more productive than smaller firms, even after controlling for industry composition effects, firm age and organizational types. This trend does not appear in non-manufacturing sectors, where the relationship between size and productivity appears to be statistically insignificant within industries.[28]

A smooth and accessible growth path is therefore critical for small and medium-sized manufacturing firms. Expansion support for firms has a significant impact on the economy, especially considering that around 20 percent of the Canadian-US productivity gap can be explained by the relatively larger small business sector in Canada.

Furthermore, assisting smaller firms to scale up would not only increase the quantity and quality of employment, it would also place the necessary pressure for larger existing firms to remain competitive and help steer an innovation-driven manufacturing sector forward. The potential economic benefit becomes even more apparent when taking into account that as much as 58.3 percent of all manufacturing employment flows from total small and medium-sized enterprises in Ontario.[29]

ONTARIO ENERGY BOARD

FILE NO.: **EB-2015-0029** **Union Gas Limited**
EB-2015-0049 **Enbridge Gas Distribution Inc.**

VOLUME: **Technical Conference**

DATE: **August 18, 2015**

MR. ELSON: Ms. Malone, if you would like, I could walk you through this with some smaller steps. Would you like me to ask you another couple of questions in relation to this?

MS. MALONE: Sure.

MR. ELSON: So my understanding is that if the utilities have lower targets, it will be easier for them to meet those targets, and therefore easier for them to achieve their financial incentives; would you agree with that?

MS. MALONE: I would agree with that.

MR. ELSON: So when they are putting together their DSM plans, they have an incentive to propose lower targets that are easier for them to meet.

MS. MALONE: Yes.

MR. ELSON: So it seems to me that they have incentives to meet targets once their plans have been developed, but they don't have an incentive to develop a plan that maximizes the overall gas savings.

Is that a fair characterization?

MS. MALONE: That's where I keep getting hung up a little bit. So I'm going to put you on hold for one more second while we discuss the answer.

What I'm struggling with is that the incentive structure as established in Ontario requires the utilities to account for the Board's key priorities. And if they're doing that fully, then it's -- they may be setting goals that are appropriate.

MR. ELSON: I guess what I'm asking you is more from an economic financial incentive perspective.

Now, of course, they have to set targets that are reasonable; they can't set lowball targets. But they don't have an incentive to develop a plan that maximizes the overall gas savings, because the incentive is capped at a certain level regardless.

Do you see that? Do you agree with that?

MS. MALONE: Yes. I agree from a financial perspective, yes.

MR. ELSON: Okay, thank you. This is what this all comes to. We understand these guidelines are up for review in a couple of years and so, with that in mind, what are some of the ways in which the shareholder incentive could be tweaked to give utilities an incentive to propose plans that are as aggressive as possible in terms of gas savings?

You can provide that answer now, or some thoughts now, and follow up with an undertaking, if you'd like. I will leave it up to you.

MR. MILLAR: Just while they're thinking, Mr. Elson, I don't object to this question.

Certainly there are or there may be some things in their report authority they can point to, and I don't mind them answering if they have some further thoughts on it right now.

Again, we're not going to ask them to go do additional research on this topic. But I'm happy to have them provide an answer, either now or by way of undertaking, that

hopefully assists you.

MR. ELSON: And the reason I'm asking them is that they have obvious expertise, and have looked at other Jurisdictions. And I would appreciate the thoughts of the panel on the phone, as well as Tim Woolf on this.

MR. MILLAR: Synapse, would this be one for an undertaking?

MS. MALONE: Yes.

MR. MILLAR: Let's call that JT4.15. Mr. Elson, why don't you describe it?

MR. ELSON: The question is: What are some mechanisms in which the shareholder incentive could be tweaked to give utilities a financial incentive to propose DSM plans that are as aggressive as possible in terms of gas savings.

UNDERTAKING NO. JT4.15: TO DESCRIBE MECHANISMS IN WHICH THE SHAREHOLDER INCENTIVE COULD BE TWEAKED TO GIVE UTILITIES A FINANCIAL INCENTIVE TO PROPOSE DSM PLANS THAT ARE AS AGGRESSIVE AS POSSIBLE IN TERMS OF GAS SAVINGS

MS. MALONE: Okay.

MR. ELSON: I sent another report around from the Mowat Center, and it is entitled "Ontario-Made: Rethinking Manufacturing in the 21st Century". Would you be able to pull that up, please, and perhaps we could mark it as an exhibit. And I think it makes sense if we just refer to the excerpt, which is about seven pages long.

MR. MILLAR: Okay. The exhibit number will be KT4.3, and that's the Mowat Centre report entitled "Ontario-Made:

Rethinking Manufacturing in the 21st Century".

EXHIBIT NO. KT4.3: MOWAT CENTRE REPORT ENTITLED "ONTARIO-MADE: RETHINKING MANUFACTURING IN THE 21ST CENTURY".

MR. ELSON: Thank you. I'm going to review some of the conclusions of this report and ask you to comment on them. But first I'll start by referring you to page 29 of this report.

UNIDENTIFIED FEMALE SPEAKER: Okay.

MR. ELSON: And on page 29 there is reference to a comparison, in terms of energy efficiency of Ontario, with 18 other jurisdictions, which is 19 in total, and the Mowat Centre concludes that Ontario ranks 17th or third-last in terms of energy efficiency.

Do you see that there in the underlying paragraph?

MS. NAPOLEON: Yes. This is Alice Napoleon.

MR. ELSON: Thank you, Ms. Napoleon. And further down the page, the authors of this report disaggregate the numbers and find that even when you do a comparison on a sub-industry level that Ontario lags most of its international peers in terms of energy efficiency. Do you see that there, as well?

MS. MALONE: Yes.

MR. ELSON: If you turn over the page to page 30 and you see figure 29, this is the figure that corresponds to what we were just discussing; do you see that there?

MS. NAPOLEON: Did you say figure 29?

MR. ELSON: Yes, figure 29, which is on the following

page, page 30.

MS. MALONE: Yes, I do.

MR. ELSON: And this figure breaks out the electricity use and the gas use of Ontario versus these other jurisdictions; do you see that there? The gas use is in green and the electricity use is in pink. The pink is the upper bar and the green is the lower bar for each jurisdiction.

MS. MALONE: Okay, yes, I see that.

MR. ELSON: And I just want to confirm that I'm reading this figure correctly, and it looks to me that Ontario would be the fourth-least efficient of all these jurisdictions when you are looking at gas usage.

MS. NAPOLEON: The third, right, of these jurisdictions that were selected for this report; correct.

MR. ELSON: Now, that's third in terms of the electricity usage, but if you look at the gas usage, and you will see there is a dotted line here -- I'm just looking for confirmation that I'm reading this figure correctly, that there are three other jurisdictions which -- - that are less efficient in terms of gas, so it is the -- Ontario is the fourth-efficient; do you see that there?

MS. NAPOLEON: That's correct, yes, we see that now. Thank you.

MR. ELSON: Thank you. Now, because Ontario's manufacturing sector uses natural gas less efficiently than these other jurisdictions, would it be reasonable to conclude that there is a higher DSM potential in Ontario in

this sector compared to the other jurisdictions?

MS. NAPOLEON: Based on my limited review of this report, I do not -- I don't see the evidence specifically supporting the paragraph at the end of page 29, where they say that it's -- if you disaggregate the manufacturing sector and compare sub-industries for Ontario specifically.

However, if we hold the manufacturing sectors constant for each of these jurisdictions, it does suggest to me that there is substantial potential for improvement -- energy efficiency improvement, that is.

MR. ELSON: That is available. In other words, that would be -- a DSM potential would be the same way of describing that.

MS. NAPOLEON: Yes, DSM potential.

MR. ELSON: Thank you. I have no further questions.

MR. MILLAR: Thank you, Mr. Elson.

Mr. Poch, did you have a couple of things?

QUESTIONS BY MR. POCH:

MR. POCH: Just a very few. Panel, you --

MR. MILLAR: Could you introduce yourself?

MR. POCH: Yes, I'm David Poch, I'm counsel for the Green Energy Coalition, and we are the organization that sponsored the evidence of reports of Mr. Chernick and Mr. Neme in this case.

I just wanted to confirm, in the evidence there is a reference to an AESC, or avoided energy supply cost, in New England, 2013 report, that includes DRIPE, demand reduced -- demand reduction induced price effects for electricity,

UNDERTAKING JT4.15

UNDERTAKING

August 18, 2015 Technical Conference Transcript, page 72.

To describe mechanisms in which the shareholder incentive could be tweaked to give utilities a financial incentive to propose DSM plans that are as aggressive as possible in terms of gas savings.

RESPONSE

We are not aware of any particular modifications to the current shareholder incentives that would encourage the utilities to propose DSM plans that are as aggressive as possible in terms of gas savings.

However, other policy mechanisms can be used to encourage utilities to propose aggressive levels of gas savings, and to discourage utilities from understating the potential amount of gas savings. One of the most influential policy requirements is to mandate achievement of all cost-effective energy efficiency resources. The American Council for an Energy Efficient Economy (ACEEE) released a report on the effectiveness of the seven states in the United States that have enforced all cost-effectiveness energy efficiency requirements, and determined that:

> On average, states with all cost-effective mandates are targeting and achieving savings that are significantly higher than states with more traditional EERS policies. These states are pushing the envelope, attempting to capture efficiency in traditionally hard-to-reach markets. Though some express doubt that high levels of savings are sustainable, targets continue to rise, and in coming years targets will reach over 2% of annual electricity sales in several states.[1]

This ACEEE report also discusses the target setting processes in each jurisdiction, the importance of allowing stakeholder comments, and the incentive structures that can ensure successful achievement of savings. For convenience, this ACEEE report is provided as Exhibit JT4.5, Attachment 1.

[1] See, Gilleo, A., "Picking All the Fruit: All Cost-Effective Energy Efficiency Mandates," 2014, available at: http://aceee.org/files/proceedings/2014/data/papers/8-377.pdf.

Witnesses: T. Woolf
K. Takahashi
E. Malone
J. Kallay
A. Napoleon

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Picking All the Fruit: All Cost-Effective Energy Efficiency Mandates

Annie Gilleo, American Council for an Energy-Efficient Economy

ABSTRACT

As of April 2014, 25 states have adopted and fully funded an energy efficiency resource standard (EERS) policy. Though every state requires that efficiency programs be cost-effective, seven of these states have chosen to enforce *all* cost-effective efficiency requirements, in which utilities are required to determine and invest in the maximum amount of cost-effective efficiency feasible. In this paper, we examine policies and progress in the seven states with all cost-effective efficiency mandates. States use a variety of methods to determine cost-effectiveness, but typically rely on the total resource cost test to assess efficiency programs. Stakeholder groups also play a significant role in determining final multiyear efficiency targets. Though mandates in these seven states require investments in the complete set of available cost-effective efficiency resources, in reality targets tend to be slightly more conservative than what potential studies suggest is achievable. Nonetheless, on average, states with all cost-effective mandates are targeting and achieving savings that are significantly higher than states with more traditional EERS policies. These states are pushing the envelope, attempting to capture efficiency in traditionally hard-to-reach markets. Though some express doubt that high levels of savings are sustainable, targets continue to rise, and in coming years targets will reach over 2% of annual electricity sales in several states.

Introduction

Over the past decade, more than half of states have adopted policies establishing mandatory energy savings targets that utilities and third-party program administrators must meet through customer energy efficiency programs. The policies that create the framework for these mandatory energy savings targets are called energy efficiency resources standards (EERS). Similar to renewable energy standards, EERS policies create a binding, long-term vision for the role of energy efficiency within a state's energy portfolio. As of April 2014, a total of 25 states have adopted and fully funded an EERS policy. Figure 1 shows all states implementing an EERS.[1] These states are both geographically and politically diverse, and they have embraced energy efficiency for a variety of reasons, including customer cost savings, economic development, grid reliability, and pollution control.

In the absence of federal requirements for energy savings, states with EERS policies are leading the way with highly effective, forward-looking energy efficiency policies. These long-term savings targets not only set out a long-term vision for a state's energy portfolio, but also spur utilities and nonutility program administrators to invest in deeper savings measures. By setting long-term targets, EERS policies go beyond annual program planning to allow utilities to incorporate energy efficiency into their long-term integrated resource plans. Multiyear targets

[1] Indiana rolled back its EERS in early 2014, but is included in some research for this paper since its EERS was in effect in 2012. At the time of writing, the Ohio Senate passed a bill canceling annual EERS targets for two years. This bill is not considered in this paper.

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offer regulatory certainty and encourage utilities to think of efficiency as a resource equivalent to supply-side assets as they plan to meet their customers' energy needs.

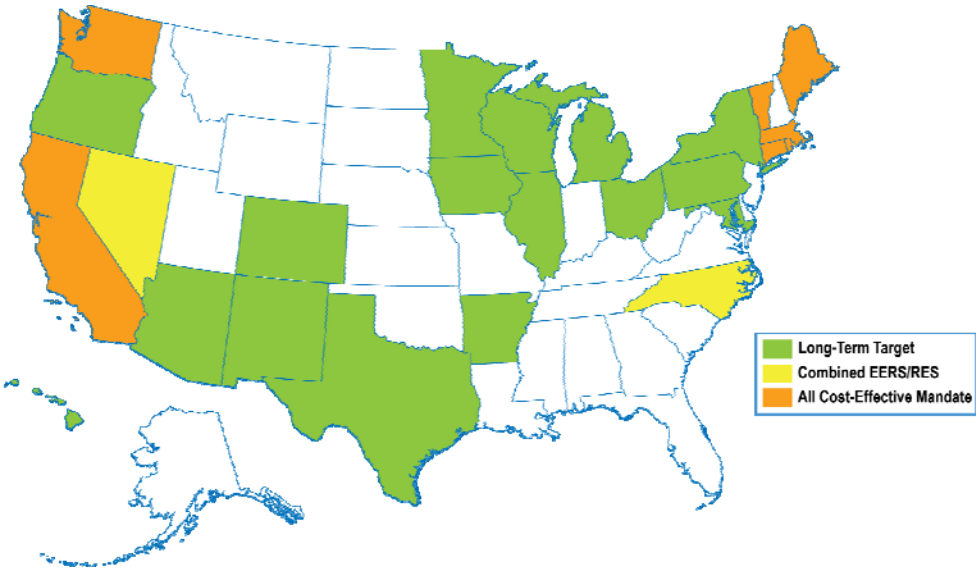

Figure 1. States with EERS policies in place as of April 2014. *Source*: ACEEE (2014).

As a means to establish targets, several states have chosen to enforce "all cost-effective" efficiency requirements, under which utilities and program administrators are required to define and invest in the highest level of efficiency determined to be cost-effective. While all cost-effective requirements are not in themselves definitive savings targets, they do require utilities and program administrators to determine—and achieve—the maximum amount of cost-effective efficiency available in any given year.[2] Therefore, the American Council for an Energy-Efficient Economy (ACEEE) considers states with all cost-effective requirements to have EERS policies in place once these policies lead to multiyear savings targets. In fact, some of these states are testing the limits of achievable efficiency. In this report, we examine the policies and progress in seven states with all cost-effective efficiency mandates.

California, Connecticut, Maine, Massachusetts, Rhode Island, Vermont, and Washington have all enacted legislation that requires utilities and program administrators to capture all cost-effective efficiency resources available to them. All cost-effective efficiency mandates are unique to typical EERS targets in that they require an additional level of analysis by utilities and other stakeholders to determine maximum levels of cost-effective efficiency available within a state. Policymakers choose to set targets in this way in order to avoid artificially limiting the level of efficiency captured by program administrators. For example, a state with a traditional EERS policy may set a savings target of 1% per year. More energy efficiency may be available within the state, but utilities will likely not be incentivized to pursue efficiency beyond the required 1% level. In a state with an all cost-effective efficiency requirement, no artificial

[2] Note that all cost-effective mandates are distinct from requirements for cost-effective energy efficiency more generally. All cost-effective mandates go beyond simple cost-effectiveness requirements to direct utilities and program administrators to plan to achieve the *maximum* amount of energy savings available within the state through efficiency. Other states have alternative cost-effectiveness criteria that may constrict, rather than maximize, the level of available energy efficiency measures. For example, Illinois, Michigan, Wisconsin, Pennsylvania, and Texas have cost-caps in place that limit the costs utilities may incur.

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savings target is set in statute for efficiency measures. These states have prioritized energy efficiency as a resource, requiring that customer needs be met to the greatest extent possible through energy efficiency. To fulfill this requirement, program administrators must clearly define the level of efficiency they believe to be cost-effective—in essence, they must set efficiency targets. All cost-effective mandates offer some flexibility in target determination, recognizing that energy efficiency potential in a state may change over time as electricity prices fluctuate and new efficiency programs are tried and tested. However, each piece of legislation has led to the setting of multiyear targets, serving the same purpose as a more traditional EERS.

The legislative language requiring implementation of all cost-effective efficiency measures is given in Table 1, below. Though each piece of legislation is worded differently, the spirit is typically the same. Each requires that utilities or third-party program administrators maximize the amount of cost-effective efficiency captured to their best ability. Methods for determining specific cost-effective efficiency targets are left largely to public utility commissions (PUCs) and advisory bodies, and are discussed further below.

Table 1. Legislative language requiring all cost-effective energy efficiency

State	All Cost-Effective Efficiency Language	Policy Source
California	The commission in consultation with the Public Utilities Commission and local publicly owned electric utilities, in a public process that allows input from other stakeholders, shall develop a statewide estimate of all potentially achievable cost-effective electricity and natural gas efficiency savings and establish targets for statewide annual energy efficiency savings and demand reduction for the next 10-year period.	California PRC § 25310
Connecticut	Resource needs shall first be met through all available energy efficiency and demand reduction resources that are cost-effective, reliable, and feasible.	Public Act No. 07-242
Maine	The commission shall select capacity resources that are competitive and the lowest price when compared to other available offers.… The commission shall choose among capacity resources in the following order of priority: 1) New interruptible, demand response or energy efficiency capacity resources located in this state It is an objective of the triennial plan to design, coordinate, and integrate sustained energy efficiency and weatherization programs that are available to all energy consumers [and] that advance the targets of…capturing all cost-effective energy efficiency resources available for electric and natural gas utility ratepayers.	M.R.S.A. §3210-C M.R.S.A §10104, sub-§4
Massachusetts	The department shall require a mandatory charge of 2.5 mills[3] per kilowatt-hour for all consumers, except those served by a municipal lighting plant, to fund energy	MA Gen L ch. 25 § 19

[3] A mill is a tenth of a cent.

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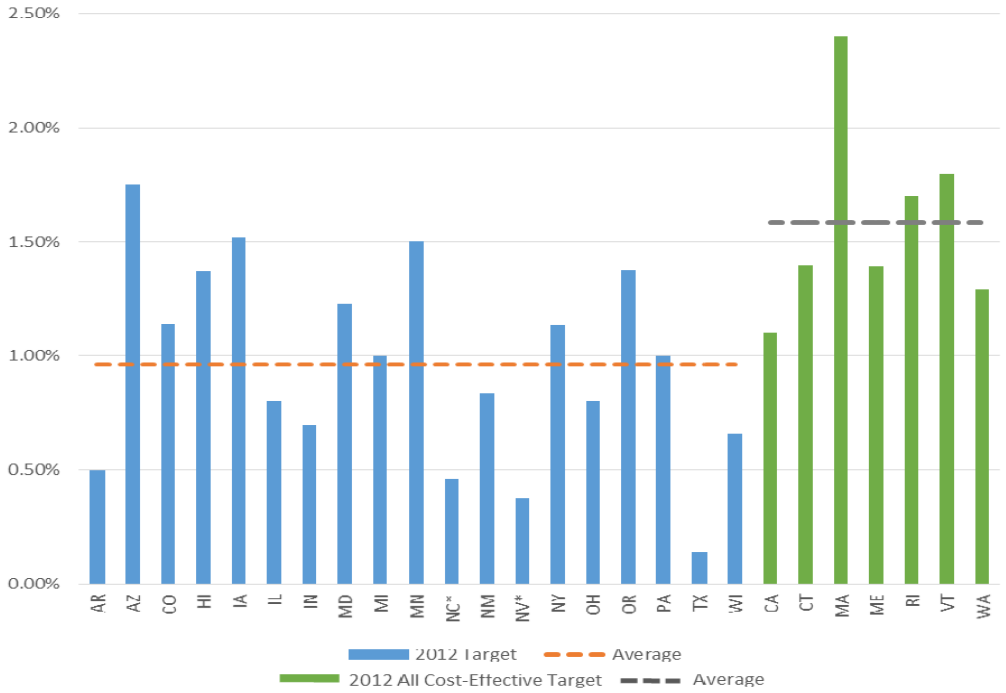

Figure 2. Incremental electricity savings targets, 2012. States with all cost-effective efficiency mandates are shown in green. All other states with EERS policies are shown in blue. Note that Indiana's EERS was rolled back in early 2014. *Source:* Adapted from Downs and Cui (2014).

Incentivizing Success

Setting targets alone does not ensure success. Many states with EERS policies in place have also implemented complementary rules that help remove disincentives for investments in efficiency. In many cases, these policies go beyond simply removing a disincentive, offering utilities financial benefits for meeting or exceeding savings targets.[9] The three main mechanisms utility regulators have used to incentivize success include:

- *Program cost recovery* allows utilities to recover investments in energy efficiency either by treating these investments as capital expenses in rate cases or by adding costs of efficiency programs to the rate base and capitalizing them as they would investments in power plants.
- *Decoupling or implementation of a lost revenue adjustment mechanism (LRAM).* Decoupling is a mechanism that allows utilities to recover investments in efficiency independent of the volume of electricity or natural gas sold. Regular true-ups ensure that utilities recover costs equal to allowed fixed costs. LRAM is a rate adjustment mechanism that allows utilities to recover "lost" revenues due to energy savings resulting from efficiency programs. LRAM allows for upward adjustment of rates to recover costs, but does not allow for the "symmetrical" true-up accounted for in decoupling.
- *Performance incentives* reward utilities financially for meeting energy savings goals. Performance incentives may be offered for meeting or surpassing goals, or may increase

[9] For a complete discussion on utility business models and the "three-legged stool," see York and Kushler (2011).

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in proportion to the level of savings achieved by a utility. These incentives are typically awarded by the PUC upon verification of the achievement of goals.

Performance incentives in California, Connecticut, Massachusetts, Rhode Island, and Vermont take slightly different forms, but all emphasize achievement of efficiency program goals. Incentives are largely based on overall portfolio energy savings. However, shareholder incentives can also be used to reward additional outcomes. In Connecticut, performance incentives are program specific and may include actions targeted at specific customer classes. In Massachusetts, program administrators receive incentives based on the value of net benefits created in their plan and other design features. Incentives can be received prior to ex-post evaluation of the complete three-year portfolio, although a large portion of the incentive is directly tied to energy savings performance. Similarly, Efficiency Vermont receives performance awards based on operations and quantifiable performance indicators, including total net benefits. While energy savings is the major goal of these efficiency programs, incentive design allows emphasis on simultaneous non-energy benefits. Table 3, below, outlines the mechanisms these states use to remove barriers to efficiency implementation and encourage program administrators to meet targets. The table also outlines states with penalty mechanisms, or regulatory sanctions for utilities and program administrators that fail to meet savings targets.

Table 3. Utility business models and performance incentives

	Decoupling or LRAM		Performance incentives		Penalty mechanism	
	Electric	NG	Electric	NG	Electric	NG
California	Yes	Yes	Yes	Yes	No	No
Connecticut	Yes	Yes	Yes	Yes	No	No
Maine	No	No	No	No	No	No
Massachusetts	Yes	Yes	Yes	Yes	No	No
Rhode Island	Yes	Yes	Yes	Yes	No	No
Vermont	Yes	Yes	Yes	No	No	No
Washington	Yes	Yes	No	No	No	No

Source: Downs et al. (2013)

These methods of incentivizing success have been widely embraced by states with all cost-effective energy efficiency mandates. Maine is the only state surveyed that does not rely on performance incentives or an adjustment to the traditional utility business model. However, the state's efficiency programs are administered by an independent third-party rather than an energy provider. Efficiency Maine does not face the same disincentives to invest in efficiency as a distribution utility might.[10]

[10] Having a third-party administrator does not necessarily remove incentives as a useful tool for regulators. Vermont has used financial incentives to encourage success in its third-party administrator.

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Summary of Reports Re: Necessity of Large Volume DSM Programs

#	Report	Conclusions
1.	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.[1]	• 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)
2.	Navigant Consulting and EMI Consulting, "Evaluation Report for Utah's Self-Direction Credit Program (PY 2012 through 2013), prepared for Rocky Mountain Power (a division of Pacificorp), March 18, 2015.[2]	• An 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
3.	Chittum, Anna, "Follow the Leaders: Improving Large Customer Self-Direct Programs", ACEEE Report Number IE112, October 2011.[3]	• ACEEE report regarding self-direct programs for large industrial customers: • The report states as follows: "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

[1] EB-2015-0029/0049 Exhibit M.GEC.APPrO.1 Attachment 1.
[2] EB-2015-0029/0049 Exhibit M.GEC.ED.4 Attachment 1
[3] EB-2012-0037 at Exhibit D6.1

		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)." (p. 17)
4.	Russell, Christopher and Rachel Young, "Understanding Industrial Investment Decision-Making", published by the American Council for an Energy Efficient Economy, Report Number IE124, October 2012[4]	• "Recently, an unprecedented volume of public and utility ratepayer funds have been poured into energy incentive and assistance programs for the manufacturing sector (Chittum and Nowak 2012). While assistance programs frequently reveal improvement opportunities of all kinds and magnitudes, many facilities tend to favor solutions that involve low- and no-cost improvements to existing assets. Meanwhile, a sluggish economic recovery combined with uncertain future tax and regulatory consequences have discouraged many companies from making strategic capital investment in energy-intensive systems. In sum, **great potential remains for industrial energy improvement.**" (p. 2, emphasis added)
5.	Shipley, Anna and R. Neal Elliott, "Ripe for the Picking: Have We Exhausted the Low-Hanging Fruit in the Industrial Sector?", published by the American Council for an Energy Efficient Economy, Report Number IE061, April 2006[5]	• "Numerous analytic studies have found that abundant, low cost efficiency opportunities exist in all parts for the industrial sector. These savings projections have been corroborated by actual evaluated program results in regions that have implemented robust programs and also at individual companies." (p. iii) • "It is frequently argued that the opportunities to improve efficiency in industry have been exhausted, and that the free market dictates that efficiency improvements will be made when they are cost-effective…(but) industrial market data…indicate that there still is significant potential for improving energy efficiency… **Does low-hanging fruit still exist in the industrial sector? We believe that the answer is yes.**" (p. viii, emphasis added)

[4] http://aceee.org/sites/default/files/publications/researchreports/ie124.pdf
[5] http://aceee.org/research-report/ie061

6.	U.S. Department of Energy. 2015. Barriers to Industrial Energy Efficiency: Report to Congress.[6]	• "Manufacturers have limited capital for investments in new equipment, process upgrades, and plant improvements, and energy efficiency projects need to compete for this capital. In a 2010 survey, respondents from a number of industry sectors (e.g., health care, manufacturing, finance, consulting, retail, and government) in the United States and Canada cited capital availability as their top barrier to investing in energy efficiency. This survey indicated that decision-makers in the industrial sector typically expect capital investments to have short payback periods of 1 to 3 years. In interviews, 44 percent of energy managers indicated that they need a payback of less than 3 years for energy efficiency projects, and other evidence suggests that under difficult economic conditions companies may look for a payback period of 18 months or less. Short payback periods were also identified in a 2013 report by the Alliance to Save Energy. In this report, payback and return on investment expectations were evaluated for three different types of investors. If the capital was being provided by an internal capital equipment budget, the payback period was in the range of 1–3 years (see Table 8) as opposed to longer payback periods for other types of investors (up to 30 years for funding from government sources). Even when end-use energy efficiency projects do meet corporate investment thresholds, manufacturers may still not go ahead with such projects if they do not have a direct connection with the company's core business. For example, the ability to increase production is often viewed more favorably than being able to produce a product/good with less energy, even if the economic impacts are equal for both alternatives." (p. 39-40, Study Appendix)
7.	State & Local Energy Efficiency Action Network. 2014. Industrial Energy Efficiency: Designing Effective	• "[E]nergy efficiency often cannot compete with other capital demands, even with similar or better paybacks. Moreover, industrial staff members often report that it is difficult to effectively navigate

[6] http://www.energy.gov/sites/prod/files/2015/06/f23/EXEC-2014-005846_6%20Report_signed_v2.pdf and http://www.energy.gov/sites/prod/files/2015/06/f23/EXEC-2014-005846_5%20Study__0.pdf

	State Programs for the Industrial Sector.[7]	corporate project decision-making systems to get management endorsement for even quick payback energy efficiency projects. In addition, small- or medium-sized energy savings projects often do not compete well with other projects in garnering management attention and enthusiasm. Finally, limitations on staff resources and knowhow can further hinder implementation of cost-effective energy efficiency measures.
		In states where ratepayer-funded energy efficiency programs are in place, industrial programs can make a significant difference…" (p. ES-1,2)
		• "There is a range of reasons why internal decision-making processes may not result in implementation of highly cost-effective energy efficiency opportunities, including:
		  • Energy efficiency projects may compete with core business investments that dominate attention, as well as investments for safety, environmental, and other regulatory requirements
		  • Decision-making is often split across business units
		  • The skills required to identify and pursue energy efficiency opportunities are not always present."(p. 24)

8.	Synapse Energy Economics. Commercial & Industrial Customer Perspectives on Massachusetts Energy Efficiency Programs. Prepared for the Massachusetts Energy Efficiency Advisory Council. April 3, 2012.[8]	• "Another theme we heard from most of our interviews was that payback period was the main criteria for evaluating energy efficiency investments and that energy efficiency investment payback periods compete with the payback periods for other capital investment projects." (p. 3) • "[C]apital constraints are a key barrier to moving forward with energy efficiency projects. Many customers have access to capital, but energy efficiency projects have to compete with other projects for that capital." (p. 3)

[7] http://www.iipnetwork.org/IEE_Effective_State_Programs.pdf2
[8] Exhibit M.Staff.GEC.12, Attachment 1.

		• "Energy efficiency investments are frequently categorized as discretionary expenditures." (p. 3) • "[S]ometimes corporate practices place very tight payback periods constraints on all investments, limiting the energy efficiency measures that can obtain corporate approval." (p. 6)
9.	Mowat Centre, Ontario Made: Rethinking Manufacturing in the 21st Centry, February 2014	• "Figure 29 displays energy efficiency—in terms of electricity and natural gas consumption only—in total manufacturing for Ontario relative to U.S. and German peers. … Out of these 19 jurisdictions, Ontario ranks 17th, or third last, in terms of energy efficiency." (p. 29) • "To get a more detailed picture, it is therefore important to disaggregate the manufacturing sector and compare sub-industries. When this is done for Ontario and its international peers in the U.S. and in Germany, our main result still holds—that Ontario lags most international peers in energy efficiency." (p. 29)