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September 1, 2017

VIA COURIER AND RESS

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, Ontario
M4P 1E4

Dear Ms. Walli:

Re: Ontario Energy Board
EB-2017-0127 / EB-2017-0128 – DSM Mid-Term Review
Comments of Enbridge Gas Distribution Inc.

In accordance with the Ontario Energy Board's letter issued on June 20, 2017, enclosed please find the submission of Enbridge Gas Distribution Inc.

Please contact the undersigned if you have any questions.

Sincerely,

(Original Signed)

Bonnie Jean Adams
Regulatory Coordinator

Attach.

DEMAND SIDE MANAGEMENT MID-TERM REVIEW

EB-2017-0127/0128

SUBMISSION FROM ENBRIDGE GAS DISTRIBUTION INC.

September 1, 2017

Executive Summary

1. On January 20, 2016, the Ontario Energy Board ("the Board" or "the OEB") issued its Decision and Order regarding Enbridge Gas Distribution Inc.'s ("Enbridge" or the "Company") and Union Gas Ltd.'s ("Union") 2015 to 2020 Demand Side Management ("DSM") Plans in EB-2015-0029/0049. The Board's Decision and Order characterized the DSM Mid-Term Review to be undertaken before June of 2018 as an opportunity to, "assess performance on annual metrics, budget levels, impact on customer rates and shareholder incentives. The mid-term review will also allow the OEB to consider the DSM Framework relative to the overall energy conservation landscape, including any new or revised government direction."[1]

2. In its subsequent letter dated June 20, 2017, the Board clarified that the DSM Mid-Term Review would include "…review of the DSM Framework in the context of the Cap and Trade Program."[2] The letter further requested that by written submission on September 1, 2017 interested parties comment on two issues. First, the OEB requested comments regarding "Consideration of the relationship between the current suite of DSM programs and actual C&T activities of customers with their own compliance obligations."[3] Second, the OEB requested comments regarding "Consideration of the attribution of costs and savings to ratepayer-funded DSM programs where natural gas utilities offer carbon abatement programs in the market."[4]

3. The following submission responds to the two specific issues highlighted in the Board's June 20, 2017 letter. In specific response to the second issue identified by the Board, Enbridge highlights the impact that Cap and Trade has had on the DSM

[1] EB-2015-0029/0049, Decision and Order, January 20, 2016, p.85
[2] EB-2017-0127/0128, DSM Mid-Term Review, June 20, 2017, p. 2
[3] Ibid, p. 3
[4] Ibid

Framework, and offers recommendations to better align the DSM Framework with the Cap and Trade Framework as part of the Board's review.

4. In sum, Enbridge believes that Cap and Trade has increased the complexity of Ontario's energy efficiency landscape, while simultaneously increasing the importance of regulated DSM. While the number of agents involved in energy efficiency is increasing, the Cap and Trade Program has also increased the value proposition of DSM for ratepayers and positioned DSM as an essential component of the cost-effective management of Enbridge's customers' greenhouse gas ("GHG") emissions. In order to maximize the benefits of DSM within the context of a carbon-priced environment Enbridge believes it is essential to modernize the policies of the DSM Framework to align with the Cap and Trade Framework and the new reality that Cap and Trade has created.

5. Both Framework alignment and value for ratepayers will be maximized where ratepayer and shareholder benefits are closely linked, ensuring that both of these parties realize meaningful benefits through the aggressive reduction of energy use and GHG emissions amongst Enbridge's customers. The following proposed solutions, outlined in greater detail within the body of this submission, represent the best available opportunities to achieve this alignment and maximize benefits for all parties:
    i. Modernize the approach to calculating and applying net to gross values to reflect the complex policy environment created by Cap and Trade;
    ii. Re-align DSM budgets and targets to recognize the increased need for a robust DSM presence in the energy efficiency market as a result of Cap and Trade; and
    iii. Align the timing and magnitude of benefits as between shareholders and ratepayers by revising the weighted scorecard incentive formula, maintaining the annual incentive cap of $10.45 million per utility approved by the Board.

INTRODUCTION

6. The first regulatory framework governing DSM activities in Ontario's natural gas sector was established in 1993 under EBO 169-III. Since that time, Enbridge has been an ardent supporter of the efficient use of natural gas and the associated reductions in GHG emissions which the Company helps facilitate. Between 1995 and the end of 2016, Enbridge helped its customers save approximately 11.1 billion m3 of natural gas; the equivalent of 20.8 million tonnes of atmospheric carbon dioxide.[5] The Company is proud of its energy efficiency efforts to date, and intends to play an integral role in assisting the Province to meet its GHG reduction targets.[6]

7. Enbridge's most recent Multi-Year DSM Plan (2015-2020) was filed on April 1, 2015 in response to the OEB's Report of the Board: Demand Side Management Framework for Natural Gas Distributors (2015-2020) and accompanying Filing Guidelines (together the "DSM Framework"). The Company's proposed Multi-Year DSM Plan was responsive to the Board's direction and carefully considered both the guiding principles and the key priorities outlined in the Framework.

8. The Board released its Decision and Order (the "Decision") regarding Enbridge's Multi-Year DSM Plan on January 20, 2016. In light of the broad spectrum of issues addressed in the gas utilities' DSM Plans and the subsequent arguments of the utilities and interested parties, the Board's Decision made determinations in a number of important areas including, but not limited to, DSM programs, budgets, scorecard design elements, targets and various matters of a policy nature.

9. In its Decision the Board approved the majority of DSM offers as filed, generally expressing support and noting that the programs proposed balanced the main

[5] Assumes 1.875kg of CO2 are emitted for each m3 gas that is consumed
[6] Ministry of the Environment and Climate Change (2016) "Ontario's Climate Change Action Plan 2016," Government of Ontario, p.13.

components of the DSM Framework.[7] The Board did however reject some of the gas utilities' proposed DSM programs including My Home Health Record; a third-party delivered offer proposed by Enbridge which comprised a significant portion of the Company's Market Transformation Program. In rejecting Enbridge's My Home Health Record offer and subsequently reducing the overall budget of Enbridge's Market Transformation Program, the Board determined that overheads associated with market transformation should be reduced proportionally.

10. One of the most significant elements of the Board's Decision was the application of a 10% increase to all 2016 targets, without any commensurate increase to DSM budgets to fund the incremental 10% in customer financial incentives that would be required to facilitate these results. In the Board's view the targets as filed were not sufficiently aggressive, and an increase to targets without a proportional increase to budgets would encourage greater cost-efficiency.[8] It is worth noting that expert evidence brought forward by the Green Energy Coalition in EB-2015-0029/0049 indicated that Enbridge's proposed targets for key sectors such as large commercial and industrial customers and the residential sector were consistent with historical experience.[9] As such, the 10% increase applied in conjunction with a shift of the upper level of target achievement from 125% to 150% of target resulted in stretch targets that in Enbridge's view are not achievable.

11. Another element of the Board's Decision regarding DSM targets was the establishment of a Target Adjustment Mechanism ("TAM") to establish all future targets beyond 2016 using a formula driven by prior years' results (e.g. 2017 targets would be established based upon 2016 results among other inputs). The TAM, which was based upon a proposal by Union specific to a few CCM metrics, would be applied to all metrics within utility DSM scorecards. The Board also determined that when applying the TAM to market transformation targets an annual

[7] EB-2015-0029/0049, Decision and Order, January 20, 2016, p.10, p.24, p.32
[8] Ibid, p.66
[9] EB-2015-0029/0049, Exhibit L.GEC.1, pp.34

productivity factor of 10% should be applied to ensure aggressive target increases, as well as a 2% productivity factor to low income and resource acquisition targets.

12. The Province's Climate Change Action Plan ("CCAP") was released on June 8, 2016 on the heels of the Government of Ontario's Low Carbon Economy and Climate Change Mitigation Act ("the Act") released on May 18, 2016 which outlined the province's greenhouse gas reduction targets out to 2020 among other matters. The CCAP, which signaled a strong commitment to reach the Province's greenhouse gas reduction targets, introduced the Government's intention to create a "Green Bank" which would reinvest Cap and Trade auction proceeds into GHG reducing initiatives and programs.

13. On July 1, 2016, Ontario's Cap and Trade Regulation was released instructing that the first Compliance Period would begin January 1, 2017. The Board subsequently issued its Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities ("the Cap and Trade Framework") on September 26, 2016. The Cap and Trade Framework outlined compliance options available to the utilities to meet their obligations including allowances, offset credits and abatement activities. The Cap and Trade Framework provided that the utilities would be responsible for deciding the exact makeup of activities to be included in their Compliance Plans, including how to best prioritize and pace compliance options, including abatement activities. The Board asserted that any potential overlap between DSM and abatement activities could be addressed through the evaluation, measurement and verification ("EM&V") process of the DSM Framework, and that the DSM Mid-Term review would provide an appropriate opportunity to assess the DSM Framework in light of the Cap and Trade Framework[10].

14. On November 15, 2016, the Company filed its 2017 Compliance Plan (EB-2016-0300) with the Board. In its 2017 Compliance Plan Enbridge stated its

[10] EB-2015-0363 Report of the Board: Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities, September 26th, 2016, p. 28

agreement with the Board regarding the potential for overlap between DSM programs and future Compliance Plans. Further, the Company affirmed its view that DSM is an abatement activity, and that the relationship between DSM and Compliance Planning should be considered during the DSM Mid-Term review.

15. On December 15, 2016 the Ministry of the Environment and Climate Change ("MOECC") announced legislation to bring into effect the Ontario Climate Change Solutions Deployment Corporation, formerly referred to as the Green Bank. This Corporation was formed to dispense Cap and Trade proceeds held in the Greenhouse Gas Reduction Fund ("GGRF") to initiatives identified in the CCAP.

16. On December 16, 2016 Enbridge submitted written comments to the Ministry of Energy regarding Ontario's 2017 Long Term Energy Plan. In its comments, the Company expressed its belief that the most effective way to dispense funds held in the GGRF was to leverage existing program delivery channels, including Enbridge's existing DSM programming, in order to maximize expediency and efficiency.

17. On June 20, 2017 the Board issued a letter regarding the DSM Mid-Term Review, noting that it would include "…review of the DSM Framework in the context of the Cap and Trade Program."[11] Enbridge is supportive of the Board's reasoning, and submits that the vast majority of the DSM Framework remains appropriate. What follows are the views of Enbridge Gas Distribution Inc. on these matters, with a high degree of relevance to the 2017 and 2018 Compliance Plans and the two subsequent DSM Mid-Term Review submissions that will follow on October 1, 2017 and January 15, 2018.

18. It should be noted that as of the time of the preparation of this submission the Company has not had the benefit of receiving the Board's decision in EB-2016-0300 with respect to Enbridge's 2017 Cap & Trade Compliance Plan.

[11] EB-2017-0127/0128 DSM Mid-Term Review, June 20th, 2017, p. 2

Given the EB-2016-0300 Decision could contain information or direction relevant to Enbridge's submissions in the DSM Mid-Term Review regarding the alignment of DSM and Cap & Trade, the Company reserves the right to file a supplementary submission in this proceeding following the Board's release of its decision on the Company's 2017 Compliance Plan.

Issue 1: DSM and Customers with Compliance Obligations

19. The first issue on which the Board requested comment in its June 20, 2017 letter is: "Consideration of the relationship between the current suite of DSM programs and actual C&T activities of customers with their own compliance obligations."[12]

20. Enbridge does not see a requirement to differentiate between participants and non-participants in Cap and Trade when determining eligibility for its DSM programs.

21. Ultimately the objective of Cap and Trade is to reduce the emissions of consumers and businesses in Ontario. Whether participating directly, as Large Final Emitters do, or indirectly, as small consumers do all sectors which fall under the Cap and Trade regulations will now pay a financial cost for the emission of greenhouse gases. Within the context of DSM, this means that the business case for both participants and non-participants to undertake energy efficiency projects has improved.

22. Though these parties may experience the costs of Cap and Trade in a different way, the end result is largely the same. For this reason, the Company does not see a rationale for drawing a distinction between these two groups within the context of DSM. Just as non-participants do, participants in Cap and Trade will have the opportunity to ease their compliance burdens by participating in DSM and taking advantage of the technical expertise and financial incentives made available to them.

23. To the degree that an argument may be put forth to cease delivery of DSM programming to large customers that have been deemed Large Final Emitters this discussion should proceed on its own merits, irrespective of the implementation of Cap and Trade. This was effectively the case in EB-2015-0029/0049 in which the

[12] EB-2017-0127/0128 DSM Mid-Term Review, June 20th, 2017, p. 3

Board determined that Union should reinstate its Large Volume program[13], which presumably would service many customers that are also Large Final Emitters. The implementation of Cap and Trade should not materially alter this outcome.

24. It is not clear from the wording of the June 20, 2017 letter whether the Board intended this issue to also encompass those Cap and Trade participants that participate voluntarily. Enbridge's views regarding voluntary Cap and Trade participants are the same as those regarding Large Final Emitters. Namely, the fact that some customers voluntarily participate in the Cap and Trade program does not diminish the need to provide DSM programs that assist such customers. Many customers who are eligible to become Voluntary Participants do not, and will look to the DSM programs of the gas utilities to assist in their efforts to reduce gas consumption and GHG emissions. Like Large Final Emitters, even Voluntary Participants will likely look to the DSM programs of the gas utilities as a means to reduce GHG emissions and, therefore, the need to purchase the necessary allowances or offset credits. In summary, Enbridge sees little logic in the elimination of gas conservation program eligibility simply because of the volume of a customer's GHG emissions.

[13] EB-2015-0029/0049, Decision and Order, January 20, 2016, p.50

Issue 2: Aligning DSM & Abatement

25. The second issue on which the Board requested comment in its June 20, 2017 letter is: "Consideration of the attribution of costs and savings to ratepayer-funded DSM programs where natural gas utilities offer carbon abatement programs in the market."[14]

26. In its simplest form, the Company believes that DSM is carbon abatement programming. It is a policy instrument that the Board can leverage to help the Government achieve its objectives, and to help ratepayers maximize the benefits of lower GHG emissions and reduced energy costs. There is no need to create duplicative governance for alternate DSM programming. In fact, it would be inefficient to do so. What is needed is a greater alignment of the Cap and Trade and DSM Frameworks to ensure that both are mutually supportive in striving to maximize benefits for ratepayers.

27. In this new context and new policy environment Enbridge wishes to be clear regarding the Company's intention to be at the forefront of carbon abatement activity. Enbridge will continue to offer highly cost effective and meaningful DSM services to the best of its ability and will seek to find ways to partner with government and stakeholders to continue to enhance energy efficiency programming. The Company anticipates that its efforts will also seek to develop other forms of carbon abatement, such as renewable natural gas and geothermal heating and cooling. Enbridge's purpose in this consultation is to enhance the deliverability of energy efficiency in, for, and with the Province of Ontario.

28. In the remainder of this submission Enbridge will outline the impact that the implementation of Cap and Trade has had on the DSM Framework and subsequently provide recommendations to modernize the DSM Framework, enabling alignment with Cap and Trade.

[14] EB-2017-0127/0128 DSM Mid-Term Review, June 20, 2017, pg. 3

29. The political and regulatory environment in which the Board established the DSM Framework in 2014 and subsequently issued in its Decision and Order in EB-2015-0029/0049 in early 2016 has changed considerably as a result of Cap and Trade. In particular, this significant change in government policy has resulted in an influx of funding and delivery agents in Ontario's energy efficiency space, while simultaneously elevating the economic value and strategic importance of regulated natural gas DSM far above historic levels. Both of these new dynamics create the requirement for necessary enhancements to the DSM Framework.

Increase in Funding and Delivery Agents due to Cap and Trade

30. Cap and Trade has fundamentally altered both the quantity of funding available to reduce GHG emissions and the number of agents involved in the distribution of such funding. Above all else this noticeable increase in funding sources, public attention, and the number of actors engaged in Ontario's efforts to combat climate change should be a welcome and positive development. This situation does however create challenges in effectively coordinating such funding and activities both within and outside of the OEB's regulation.

31. While the Company is not proposing a large expansion of its DSM customer abatement activities as part of the Mid-Term Review, it is important that parties recognize the realities of the current market and the resulting need for modifications to current DSM methodologies.

32. Unfortunately, the current budget and target setting DSM methodologies are directionally working at odds with Cap and Trade. Rather than ensuring meaningful customer incentives to drive incremental activity, the current methodologies of the Target Adjustment Mechanism and the associated "productivity factors" of 2% or 10% annually, as the case may be, actually reduce customer incentives available by assigning productivity to customer incentives. Under this structure, the only place to achieve lower program costs is by reducing customer incentives. Ironically, it is expected that greater customer incentives will be needed to

encourage ever greater levels of conservation and GHG emission reductions moving forward. As a result, the current DSM Framework will require the cannibalization of DSM programs; preserving some at the expense of others.

33. Focusing first on activity inside of regulation, on July 1, 2016 Ontario's Cap and Trade Regulation came into effect and Enbridge became a mandatory participant with compliance obligations related to its facility emissions and the majority of its customers' emissions. As previously noted, one of the options offered to utilities to meet their compliance obligation was to undertake various GHG abatement activities intended to reduce the number of allowances and/or offset credits that would otherwise need to be purchased in order to remain compliant. In Section 2.1, Table 2 of the Cap and Trade Framework, the Board lists potential carbon abatement measures a utility may undertake including renewable energy and fuel switching, building retrofits, renewable natural gas, and customer abatement activities.

34. Enbridge believes that customer incentives remain an important feature in the delivery of energy efficiency programming to drive abatement, though the Company anticipates that some parties may argue that a reduction in such incentives may be in order due to the creation of a carbon cost. If this assertion were true, there would be no need for the CCAP and associated GreenON funding, which will be offering programs likely to incorporate rich incentives relative to DSM programming. While likely to dispense more funds than ratepayer-funded DSM in its current form, these other agencies do not operate in the same construct for cost effectiveness testing that the gas utilities do; potentially reducing Enbridge's ability to drive meaningful results. As Ontario's Environment Commissioner has pointed out, "natural gas utility conservation programs make good sense – delivering roughly three dollars in benefits for every dollar spent."[15]

[15] Every Joule Counts, Ontario's Energy Use and Conservation Year in Review, Environmental Commissioner of Ontario, August, 2017, p. 11.

35. While an increase in customer incentives beyond the rate of inflation in future years is both likely and necessary, the impact of the 10% increase in targets and the annual "productivity" increases in targets applied in EB-2015-0029/0049 without a proportionate increase in budgets is such that the Company is left attempting to attract more participants with fewer dollars per participant in customer incentives.

36. This being said, Enbridge submits that this Mid-Term Review is an opportunity to learn from recent experience and amend current policies and methodologies in order to generate greater savings and emission reductions from the current suite of approved DSM abatement programs. By using the DSM Mid-Term Review to align the methodologies which govern DSM abatement activities with the requirement to maximize emission abatement, and subsequently minimize the cost of allowances and/or offset credits, the Board can increase benefits for ratepayers using a proven and effective tool that is already in place; utility-led DSM. Without implementing needed modifications the savings achieved through ratepayer funded DSM will be less than would otherwise be the case, meaning that emission abatement cannot be maximized.

37. The Board goes on to state in its Cap and Trade Framework that the utilities will "likely develop targeted programs for their residential, commercial and industrial customers… and will allocate costs to the appropriate customer classes, similar to DSM programs"[16]. Enbridge notes that service-based customer abatement "programs" are but one of many available avenues to abate GHG emissions, with many other activities that more closely resemble infrastructure investments, such as low-carbon technologies, or supply-side activities, such as renewable natural gas. However, for ease of communication the remainder of this submission will use the term "customer abatement" in a manner that does not address such activities, instead focusing only on the subset of customer abatement programs focused on energy efficiency which resemble DSM.

[16] EB-2015-0363 Report of the Board: Regulatory Framework for the Assessment of Costs of Natural Gas Utilities' Cap and Trade Activities, September 26, 2016, p. 29

38. Enbridge submits that because the Company's obligation is specific to emissions resulting from natural gas volumes, practically speaking it is likely that most of the current opportunities for "targeted [abatement] programs" referenced in the Cap and Trade Framework are essentially DSM programs. Whether entitled "DSM" or "abatement", the activities being undertaken are the same activities; namely the use of consumer education, technical expertise, financial incentives, and other methods to help customers reduce their natural gas consumption.

39. In its Cap and Trade Framework the Board states that any overlap between additional energy efficiency focused abatement programs and DSM would be appropriately addressed through the EM&V process of the DSM Framework, and that the DSM Mid-Term Review would provide an appropriate venue to consider the linkages between the DSM and Cap and Trade Frameworks.

40. Enbridge believes that the creation of a new, different, and separately governed framework or similar policy guidance specific to the same or similar customer abatement programs would be sub-optimal. For this reason Enbridge believes that in the event incremental regulated energy efficiency abatement programs are desirable, the most appropriate and efficient approach is to use the DSM Framework created by the Board as a foundation, and that any incremental activity should be built upon the utilities' successful DSM Plans as opposed to being developed and governed separately.

41. The implementation of Cap and Trade has also increased the complexity of Ontario's energy efficiency environment outside of the OEB's regulation. Shaping much of the increased attention on energy efficiency is a provincial mandate set by the Ontario government. Attainment of Ontario's short, medium and long-term

emission reduction targets[17] will be supported through the collection and re-distribution of proceeds from the Cap and Trade market. As outlined in the CCAP[18], funds from the GGRF have been earmarked to enhance existing energy efficiency efforts, launch new energy efficiency programs, and create a new government agency known as the Ontario Climate Change Solutions Deployment Corp., (also known as "GreenOn", formerly known as the "Green Bank").

42. Looking at the full Provincial landscape, energy efficiency now boasts a growing number of new and existing market actors and funding sources. In addition to established natural gas DSM by the gas utilities and electricity Conservation & Demand Management[19,20] administered by the Independent Electricity System Operator ("IESO") and electric utilities, several other sources have come to the fore to promote and deliver energy efficiency:

    i. The Green Investment Fund[21] ("GIF"), created in early 2016 has distributed $325 million to promote emission reduction projects, many of which champion energy efficiency. These efforts include but are not limited to augmentation of Enbridge's DSM program[22] in addition to many other delivery agents such as Canadian Manufacturers and Exporters ("CME"), Ontario Centre of Excellence ("OCE") and the Ministry of Municipal Housing and Affairs.

[17] Reduction of emissions to 15% below 1990 levels by 2020, 37% below 1990 levels by 2030 and 80% below 1990 levels by 2050. See *Climate Change Action Plan (2016-2020),* Government of Ontario (June 8, 2016)
[18] *Climate Change Action Plan (2016-2020),* Government of Ontario (June 8, 2016)
[19] $1.8B allocated to local distribution companies to promote energy efficiency as per Target and Budget Allocation Methodology, Conservation First Framework LDC Tool Kit, Ontario Power Authority, December 16, 2014
[20] Within the IESO's CDM portfolio, industry associations like the Heating, Refrigeration and Air Conditioning Institute of Canada ("HRAI") and Canadian Manufacturers and Exporters ("CME") have initiated programs to assist small and medium-sized manufacturers in reducing greenhouse gas emissions through improved energy efficiency.
[21] "Green Investment Fund" Government of Ontario, February 4th, 2016 https://www.ontario.ca/page/green-investment-fund
[22] "Home Energy Conservation Incentive Program" Government of Ontario, https://ohecip.ca/en/

ii. Drawing from the proceeds of Cap and Trade, the Ontario government recently announced the provision of $200 million in new funding[23] to promote energy efficiency retrofits in schools across the province. The Government continues to make similar announcements up to the time of this submission including $100 million in new funding for municipalities[24] and up to $657 million to help social housing apartment buildings complete repairs and retrofits while lowering emissions[25].

iii. Also drawing from the GGRF, Ontario is investing $377 million over the course of the 2017-2018 fiscal year in GreenON to "make it easier for households and businesses to adopt proven low-carbon technologies."[26]

iv. At the federal level, $2 billion has been directed to support the Low Carbon Economy Fund[27], $1.4 billion of which will be used to support provinces and territories in achieving the emissions reduction priorities contained in the Pan-Canadian Framework on Clean Growth and Climate Change.

v. OCE recently partnered with Sustainable Development Technology Canada[28] to offer $45 million to drive commercialization[29] of technologies that reduce greenhouse gas emissions for industrial production sites and throughout the industrial value chain.

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[23] "Schools Receiving $1.4 Billion for Repairs and Renewal this year ," Government of Ontario, June 13, 2017 https://news.ontario.ca/opo/en/2017/06/schools-receiving-14-billion-for-repairs-and-renewal-this-year.html

[24] "Ontario Supporting Municipalities in Fighting Climate Change," Ministry of the Environment and Climate Change, August 14, 2017, https://news.ontario.ca/ene/en/2017/08/ontario-supporting-municipalities-in-fighting-climate-change.html

[25] "Ontario Making Major Investments in Social Housing Repairs and Retrofits," Ministry of Housing, August 24, 2017, https://news.ontario.ca/mho/en/2017/08/ontario-making-major-investments-in-social-housing-repairs-and-retrofits.html?utm_source=ondemand&utm_medium=email&utm_campaign=p

[26] Ontario Budget (2017), Chapter III: Creating Opportunities and Security, pp.95, http://www.fin.gov.on.ca/en/budget/ontariobudgets/2017/budget2017.pdf

[27] "Low Carbon Economy Fund," Government of Canada, June 15th, 2017 https://www.canada.ca/en/environment-climate-change/news/2017/06/low_carbon_economyfund.html

[28] "Sustainable Development Technology Canada", Government of Canada https://www.sdtc.ca/en

[29] "Target GHG Collaborative Technology Development Program," Ontario Centres of Excellence http://www.oce-ontario.org/programs/strategic-initiatives/TargetGHG/targetghg-collaborative-technology-development-program/how-it-works

43. Enbridge notes that the natural gas utilities' efforts to reduce energy use and GHG emissions pre-date all of the above, making Enbridge and Union the entities with the most experience delivering customer abatement programs in Ontario. As a result, there exists an unprecedented opportunity for the gas utilities to lead in this market and assist other parties in both achieving results efficiently and coordinating collective efforts rationally. These developments should be a welcome one for Ontario's rate and tax payers, as the gas utilities, under the regulation of the OEB, conduct their DSM activities within a context that requires cost-efficiency, evaluation, verification, and program delivery review.

44. The challenge for governments, regulators and market players will be to ensure that governance structures respond appropriately to the new realities created by Cap and Trade in such a way that public or ratepayer funds are spent prudently, and the customer's needs are always forefront in decision-making.

45. With all of the above in mind, the Company does not oppose the current policy contained within the DSM Filing Guidelines to the Framework regarding the attribution of savings. In the scenario where Enbridge collaborates with a local distribution company ("LDC") or the IESO to promote energy efficiency, the Board's DSM Filing Guidelines clearly articulate that "all the natural gas savings should be attributed to rate-regulated natural gas utilities and vice versa for electricity savings."[30] This arrangement is appropriate and purposeful, removing upfront barriers to collaboration and, in the best of outcomes, setting the stage for increased energy savings, decreased costs, or both.

46. Where Enbridge collaborates with a party other than a LDC however, the DSM Framework states that savings should be attributed according to a "partnership agreement reached prior to the program's launch".[31] Where Enbridge is the recipient of funds other than rate regulated DSM funds to either deliver on behalf of

[30] EB-2014-0134, Filing Guidelines to the Demand Side Management Framework for Natural Gas Distributors (2015-2020), December 22, 2014, p.22
[31] Ibid

another party or augment its existing DSM programming, this approach to attribution is appropriate; allowing the parties involved to create a policy which reflects the context, objectives and interests relevant to the situation at hand.

47. Enbridge is concerned however that the requirement for collaborating parties to conclude an agreement regarding the attribution of energy savings will create a disincentive to partner with other entities where program delivery is not consolidated within the gas utilities (e.g. industry associations, Government agencies other than the IESO). All else being equal, if collaborating parties are forced to claim fewer savings as a result of collaboration, a rational economic actor would avoid partnerships in order to reach performance targets. While ignoring potential partnerships may be to the benefit of the delivery agent in this scenario, it is hard to imagine such an approach being in the best interest of consumers, who should be permitted to participate in all available energy efficiency programs in light of their collective funding of such programs in the first place.

48. Enbridge submits that where the gas utilities are informally partnering with other delivery agents to the mutual benefit of the customer, the Board should only consider the influence of these other parties within the context of net to gross adjustments. In the Company's view, attribution and net to gross are effectively two sides of the same coin; different terms for evaluating the degree to which a program delivery agent influenced a customer's decisions. To the degree that by some methodology, whether it be an explicit attempt to quantify influence through a net to gross study or a fixed negotiated approach, attribution should simply be included within established net to gross values rather than be incorporated into results as a distinct adjustment.[32]

49. In light of the close relationship between attribution and net to gross evaluation, Enbridge further submits that the confluence of these many funding sources and delivery agents has created a complex environment where traditional policies to

[32] Appendix A – Research Into Action (Jane Peters, 2017), p.25

evaluate and manage net to gross values (a.k.a. free-ridership and spillover) are no longer appropriate, accurate or effective in measuring a utility's impact on customer decision-making. Even in simpler times the Board's consultant, Synapse Energy Economics, Inc. in EB-2015-0029/0049 provided evidence characterizing free-ridership as "more an art than a science."[33]

50. In light of this changing reality the frequently used method for assessing influence, known as the self-reporting model, can no longer be expected to credibly determine the influence of a single entity on a customer's decision to adopt an energy efficient technology or practice. While self-reporting surveys are one of several methods to estimate utilities' influence, and all approaches offer strengths and weaknesses, the accuracy risks inherent to these studies should dictate that they cannot and should not be given undue influence in determining whether the efforts of a delivery agent have been successful.

51. As outlined in expert evidence provided by Dr. Jane Peters of Research Into Action, attached as Appendix A to this submission, these commonly accepted self-reporting practices frequently suffer a variety of short-comings. Some of these challenges include, but are not limited to:

    i. Inaccuracy attributing influence to various sources, including the impact of respondents' own bias to provide socially desirable answers which reflect higher levels of environmental conscientiousness than may in fact be the case;[34]

    ii. Survey flaws such as poor samples, response bias, double-barreled questions and leading or unclear questions;[35]

    iii. Respondents' tendency to rationalize past decisions in a way that avoids contradiction between their actions and their stated attitude regarding energy efficiency. Respondents commonly avoid this disconnect between attitude and action during survey responses by reporting that they would

[33] Energy Efficiency Program Impact Evaluation Guide, SEEAction, pp. 5-3, www.seeaction.energy.gov
[34] Appendix A – Research Into Action (Jane Peters, 2017), p.8
[35] Ibid, p. 7

have installed an energy efficiency technology regardless of an energy efficiency program's involvement;[36]

iv. Common evaluation approaches regularly fail to tease out all of the direct and indirect pathways through which programs influence customer behaviour. By way of example, Enbridge's efforts working with contractors and installers may influence many end-user decisions without those customers' direct knowledge of such influence taking place;[37]and,

v. Respondents' difficulty remembering the specific intentions, motivations or other influences which underpinned their past energy efficiency decision. This difficulty increases as time elapses between the decision point and evaluation efforts, with increased difficulty remembering subsequently increasing the likelihood that customers defer to existing biases to internalize energy efficiency decisions as self-originated.[38]

52. The situation described above is exacerbated in a jurisdiction where multiple independent entities are simultaneously marketing programs, engaging customers, and dispensing financial incentives. As such, the inherent inaccuracies of assigning customer influence amongst multiple parties stands to increase.

53. Beyond the efficacy of these approaches to measuring the influence of parties, the Company submits that allowing adjustment factors such as net to gross and attribution undue influence in determining whether a delivery agent is successful is not in alignment with the policy framework created by Cap and Trade.

54. Enbridge has been assigned an obligation to produce cost-effective Compliance Plans, inclusive of abatement opportunities such as DSM. In order to achieve this objective and aggressively pursue volume reductions to create cost effective Cap and Trade Compliance Plans and maximize ratepayer benefits, the Company requires a fair, transparent and stable business environment. The uncertainty of

[36] Ibid, p.8
[37] Ibid, p.9
[38] Ibid, p.10

adjustment factors such as free-ridership, let alone their application on a retro-active basis wherein Enbridge has no reasonable opportunity to have known future prevailing conditions or to take any remedial action, does not create the business environment which will enable the success that ratepayers, the Board, the Province and the Company all desire. Allowing these uncertainties to persist increases the likelihood of future Compliance Plans leaning heavily on allowances and offset credits.

Recommendation 1: Net to Gross Policy

55. **As per the recommendations found in the attached expert evidence of Research Into Action, Enbridge recommends the implementation of a fixed net to gross ratio, or series of ratios, across the gas utilities' DSM results for the remaining years of their 2015 to 2020 DSM Plans that have not yet undergone the EM&V process.**

56. A fixed rate would have the dual benefit of creating the stable, fair and transparent business environment that is required in order for the utilities to continue to deliver successful results, while maintaining the inclusion of net to gross for the purpose of calculating cost-effectiveness and reporting on the energy saving outcomes of DSM activity.

57. This approach is the recommendation of Enbridge's expert, Dr. Jane Peters' firm Research Into Action, as a result of the many potential problems with the way in which net to gross assessments are often completed.[39] Further, Research Into Action makes the point that adopting this approach, and the improved governance and reduced cost benefits that it can entail, does not preclude the Board from continuing to conduct research into net to gross, as such research may be valuable for both program planning purposes and to inform future adjustments to the

[39] Appendix A - Research Into Action (Jane Peters, 2017), p. 25

negotiated value.[40] The analysis and recommendations of Research Into Action are outlined in full in Appendix A to this submission.

58. The Company believes this to be a matter of great importance and urgency, in order to both align the DSM and Cap and Trade Frameworks and to create the right business environment to optimize benefits for ratepayers that it recommends the Board set a prospective, fixed rate in this proceeding. In determining an appropriate fixed free-ridership rate, Enbridge recommends applying a fixed net to gross adjustment of 70-80% (or a free-ridership rate of 20-30%) for programs other than Low Income, which should be subject to 100% net to gross (0% free-ridership) as they presently are. This is consistent with the range of free-ridership rates filed in the utilities' input assumptions filing (with some values above, and some below), consistent with rates that have been applied by the IESO, and is considerably higher than rates used in many US jurisdictions, as reported by Research Into Action. In fact, as reported there, many U.S. jurisdictions apply a net to gross adjustment of 100% (or 0% free-ridership) because spillover has been found to offset free-riders.

59. As stated by Dr. Peters in her report, "Stipulated NTG values of 1.0 are common because many research studies estimating NTG factors have found that free-ridership and spillover roughly cancel each other out (Haeri and Khawaja 2012; Nowak and Witte 2014). Low-income programs and pilot programs targeting emerging technologies generally assume a NTG value of 1.0 because the target audiences demonstrate little free-ridership, as they are unlikely to purchase the newer, more expensive, energy-efficient products on their own."[41]

60. Enbridge believes a ratio of this magnitude appropriately reflects not only free-ridership but also the positive spillover effect that over 20 years of Enbridge DSM programming continues to generate in Ontario. The Company believes its

[40] Appendix A - Research Into Action (Jane Peters, 2017), p. 26
[41] Ibid, p. 22

programs have influenced policy and program decisions well beyond its participants, and it might be argued that many of the other actors now entering the energy efficiency marketplace will implicitly reap the benefits of efforts that Enbridge began in 1995.

61. The Company's position in this respect is that the application of inaccurate free-ridership rates, let alone the retro-active application of inaccurate free-ridership rates, acts as a significant impediment to abatement activities at exactly the time when policy makers, market players, and customers are working to maximize abatement. Application of this policy would make the EM&V process more streamlined and transparent, and would allow parties to focus on generating results, rather than focusing on the determination of whether the results were wholly, partially, or not at all influenced by the Company's efforts. Enbridge is concerned that scenarios may arise in which the Company must reject working with government, partners, participants, and customers due to a false determination that the results should not be counted. This misalignment could result in a failure to abate volumes, and therefore higher than necessary Cap and Trade compliance costs.

62. The situation described above is clearly not congruent with the requirement to abate volumes in the Cap and Trade Framework. A critical point is that in developing Compliance Plans, the business case for carbon abatement should rest on gross volumes and future carbon costs. Free-ridership rates that are erroneously set will negate the utility's ability to pursue abatement. Indeed, erroneously high free-ridership rates would suggest that there is no need for policy makers to concern themselves with carbon abatement, no need for the Government's GreenON agency, no need for Compliance Planning abatement activity, and no need for conservation funding at all as customers would be undertaking all reasonable abatement activities anyway, facts that we know to be untrue.

63. An additional and immediate further benefit of utilizing a fixed net to gross ratio (or market segmented rates) is that it would significantly streamline the EM&V process. The significant investiture of time and expense that this process currently entails would be drastically reduced. Such savings could then be diverted to DSM abatement programs and the generation of additional benefits for ratepayers.

64. Alternative to Enbridge's process suggestion, the Board could commence a policy consultation with expert evidence to study the issue further with the goal of developing a more practical, workable policy that will allow for maximization of GHG abatement, while appropriately recognizing free-ridership.

65. Regardless of the value used, it is Enbridge's strong assertion that such a policy can only be successfully applied if all targets are adjusted to be neutral relative to these new net to gross values such that the gas utilities have a reasonable opportunity to achieve the expected results, which simultaneously maximize ratepayer value in the form of reduced Compliance plan costs.

Recommendation 2: Re-Align Targets and Budgets

66. **Enbridge recommends re-alignment of targets and budgets that appropriately account for approved customer incentive rates in order to maximize carbon abatement**.

67. While there are a plethora of new energy efficiency entrants in Ontario it is undeniable that in the near-to-mid-term the gas utilities' existing DSM Plans are a foundational element of this market by way of their customer relationships, business relationships, internal expertise, customer expectations and the continued delivery of highly cost-effective programming.

68. In this vein, Enbridge believes that the effort to drive enhanced carbon abatement in the province is enhanced by its meaningful presence. Access to experienced sales, technical, and evaluation infrastructure can be leveraged for the benefit of all. Add to this the utilities' customer relationships (a customer bill is an important point of

contact), access to consumption data, business intelligence and experience, Enbridge and Union are uniquely positioned to drive enhanced value for all stakeholders, including customers and the government.

69. In order to play a leadership role and secure meaningful abatement volumes, Enbridge requires the ability to remain relevant with incentives that attract the interest of customers and business partners. The 10% increase in targets applied without a commensurate increase in budget in EB-2015-0029/0049, coupled with a significant decrease to administrative and overhead budgets, leaves the Company with little choice but to reduce incentives available to customers at some point. This is counter to the objectives of the Cap and Trade Framework to produce the most cost-effective abatement plan possible, and risks the Board's regulated DSM activities becoming irrelevant at a time when the gas utilities' expertise is greatly needed.

70. An illustration of the impact that the Decision has had may prove helpful. For simplicity, assume a program budget of $1,000,000 comprised of a $1,000 incentive payment for 1,000 customers. Increasing the target arbitrarily to 1,100 customers while leaving the total program budget at $1,000,000 leaves the Company with 2 choices; reduce incentives or reduce program participants. If the Company reduces incentives it is unlikely to drive as many participants as targeted and if it leaves incentives alone, it will target fewer customers than desired or targeted, by design. In both cases, there is a missed opportunity to maximize GHG abatement, a failure to assist in desired policy outcomes, and more allowance purchases in future years than would have otherwise been required.

71. Enbridge submits that the re-alignment requested can be accomplished by way of either of a 10% budget increase or a 10% target decrease applied to the 2018 sales year. Either outcome will enable the utility to achieve the outcomes sought in the Cap and Trade Framework. If the Board determines that maximizing abatement is more desirable, Enbridge submits that the Board should provide the utilities with the budget required to produce such abatement. If the Board determines that lower

budgets are desirable, it should be recognized that less abatement volumes will likely be delivered and reduce targets accordingly.

72. For clarity, other than establishing the appropriate target and incentive budget alignment noted above, Enbridge does not propose material increases to DSM funding within the Mid-Term Review, as the Government's CCAP and subsequent communications have clearly indicated an intention to undertake such activities using Cap and Trade revenues. The Company is highly cognizant of the significant contributions its ratepayers already make to the GGRF. Enbridge will look to help the province achieve its goals either through partnership with existing DSM programs or in the delivery of new programs where it can provide value added services using Cap and Trade revenues secured from the GGRF. In these instances, the Company will not seek to generate a ratepayer-funded reward using tax payer funding, and it would ensure that any GGRF program covers all of the required fully allocated costs to ensure no cross-subsidization on the part of ratepayers.

Aligning Benefits for Ratepayers and Shareholders

73. The primary objective of Cap and Trade is the reduction, or abatement, of greenhouse gas emissions. Emission abatement is achieved by creating a financial disincentive at a macroeconomic level for consumers to emit carbon, while at the same time using the funds provided by Cap and Trade to incent lower carbon options, subsequently reducing emissions as abatement becomes more financially attractive than business-as-usual. Thus while the details and mechanics of Cap and Trade may sometimes appear focused on the creation and distribution of emission allowances and offset credits, these financial instruments are only a means to an end. The end sought is greenhouse gas abatement.

74. Within this context, Cap and Trade effectively places a premium on the importance and economic value of DSM due to its role in abating carbon. Not only is rate regulated DSM directly accomplishing the end sought by Cap and Trade, it is also one of the few mechanisms through which ratepayers can be assured that their

financial contribution to abatement efforts will flow back to ratepayers, as opposed to some other jurisdiction.

75. Enbridge, on behalf of its customers, will purchase allowances or credits for customer emissions in order to remain compliant with Cap and Trade requirements. Money collected from ratepayers for the purchase of allowances is collected into the GGRF, where it will be spent on initiatives identified in the CCAP that support the reduction of GHG emissions. Post 2017, when Ontario is anticipated to link with the California and Quebec markets through the Western Climate Initiative, the Company will have access to a larger pool of allowances and offset credits. This larger pool of allowances and offset credits may mean that compliance entities, like Enbridge, procure these from the other jurisdictions sending the money that has been collected from ratepayers outside of the Province.

76. Cap and Trade revenues that are sent to another jurisdiction are inherently lost to ratepayers, as they are not re-invested in the province. However, funds that are directed to the GGRF should not automatically be assumed to benefit Enbridge ratepayers either. Funds from the GGRF will be spent on a range of programs and initiatives that may or may not benefit Enbridge ratepayers. Thus while some ratepayer funds spent on allowances or offset credits may be returned to Enbridge ratepayers via their participation in GGRF initiatives, there is no assurance that each initiative will be applicable and offer value to ratepayers. This effectively means that some portion of this funding is lost to ratepayers for all intents and purposes.

77. As a result of Ontario's Cap and Trade Program cost-effective carbon abatement will be a better investment for ratepayers than the purchase of an allowance or offset credit. That is, the cost of an allowance may in full or in part be a net loss for ratepayers, creating a return benefit for their investment only where GGRF funds are reinvested specifically for Enbridge's ratepayers as opposed to some other segment of Ontario. An investment in DSM on the other hand produces direct and

ancillary benefits specifically for Enbridge ratepayers that cannot be redirected elsewhere within or outside of Ontario.

78. Clearly the value of cost-effective abatement activities to ratepayers will increase over time as the cost of carbon increases in future years. While Enbridge is well-positioned to be a leader in this effort, it is important to identify the impact on the Company and ratepayers as increasingly aggressive abatement programming results in increasingly material reductions in natural gas volumes. Where the abatement program is undertaken within the DSM framework, the LRAM will adjust for the resulting decline in volumes relative to the forecasts used to set rates. Where the abatement program is undertaken without the use of rate payer funding, Enbridge looks to the costs of the program for the recovery of earnings on lost volumes. Perhaps in future, having the LRAM apply to non-ratepayer funded abatement activities should be considered. Either way, without proper mitigating mechanisms and an attractive earnings prospect, eradicating gas volumes is counter to the shareholder's interests and the interests of ratepayers.

79. As volumes decline, O&M costs and depreciation will be spread over the remaining declining forecast volumes. This will result in rate increases that have nothing to do with inflation and cannot be managed by an incentive regulation formula. As the Board's expectations regarding the gas utilities' efforts to reduce their own volumes may also increase over time, there is need for offsets to avoid the inevitable rate increases that accompany declining volumes. One offset is to insure that the shareholder incentive by undertaking DSM activities is just and reasonable. This can be accomplished by more closely aligning the value and benefits being realized by customers as a result of customer abatement programs with the shareholder incentive.

80. Under the current DSM Framework the annual shareholder incentive cap is $10.45 million; an amount which Enbridge believes to be fair and appropriate based on current conditions. The Company submits however that the current formula underpinning the weighted scorecards used by the Board to reward utility success

in DSM delivery includes two provisions which create a misalignment in the timing and magnitude of ratepayer and shareholder benefits respectively.

81. First, the current DSM Framework includes a 75% minimum achievement level, stipulating that for a score of below 75% on a weighted scorecards basis the utilities' shareholders should reap no benefits from DSM, despite the benefits achieved for ratepayers.

82. Enbridge submits that a minimum threshold is not an effective or appropriate means to incent DSM activity. Minimum thresholds suggest a customer's natural gas savings achieved at the beginning of a program's implementation are somehow worth less than savings achieved at the end of a program's implementation period. Enbridge submits that all natural gas savings have value for ratepayers, regardless of when they are achieved in a program's annual cycle.

83. Historically the Board has set lower minimum achievement levels than 75% to trigger a shareholder incentive for DSM results. In the 2012 DSM Guidelines (EB-2008-0346) for example, the Board set the minimum level at 50%. Further back in time, the Board's governance in 2007 allowed for shareholder earnings to begin with the first result achieved, ensuring that ratepayer and shareholder interests were aligned.[42] The 2007 approach creates a greater level of alignment between ratepayer and shareholder benefits, for while the first results achieved may not have been as valuable to the utility as higher levels of achievement, the creation of some value was recognized. This is ever truer today when one considers the GHG emission reductions that occur at all levels of achievement.

84. The second formulaic misalignment created by the current DSM Framework is the creation of a pivot point which rewards only 40% of the available shareholder benefit for performance which meets Board-approved targets. While the Company understands the Board's motivation in creating such a pivot point is to inspire performance above target, the current pivot creates a misalignment in which the

[42] EB-2006-0825, Decision with Reasons, August 25, 2006, pp.28-29

Company receives only 40% of available incentive amounts at a point in time when ratepayer benefits are 66% of the amount achievable.

85. In 2012 when the pivot point was first established and applied up until the end of 2015, achievement over the 100% target was challenging but achievable for many DSM offers. During these program years the Company set ambitious targets with appropriate budget amounts, and realized total economic benefits of $722.8 million for ratepayers[43]. However, at the conclusion of EB-2015-0029/0049 Enbridge's 2016 targets were subject to a uniform increase of 10% and were further subjected to a target adjustment mechanism from 2017 onwards which may cause significant swings in targets and render them unachievable.

86. As a result of this new reality, 100% target achievement is both more significantly challenging and yet yields only a modest shareholder incentive. In order to push the utilities to aggressively pursue abatement which is both in the ratepayers' interest and the Province's interest, but in a normal course of business is counter to the utility's interest, the benefits for all parties should be closely linked and commensurate in their timing and magnitude.

Recommendation 3: Revise the Weighted Scorecard Formula

87. **Align the timing and magnitude of ratepayer and shareholder benefits within the weighted scorecard formula while maintaining the annual incentive cap of $10.45 million.**

88. Enbridge recommends the following escalating incentive thresholds to mitigate the misalignment identified above:
    - 50% achievement yields 20% of the available incentive
    - 100% achievement yields 60% of the available incentive
    - 150% achievement yields 100% of the available incentive

[43] Net present value of TRC benefits achieved in the 2012, 2013, 2014 and 2015 program years. 2015 figures are unaudited, subject to change and have yet to undergo an OEB Clearance of DSM Accounts proceeding.

89. This revised incentive curve will achieve the improved alignment required to modernize the DSM Framework in response to Cap and Trade, while maintaining the following positive elements of the current incentive mechanism:
    i. The shareholder benefits at lower levels of achievement remains far lower than those available at higher levels above target. This aligns ratepayer and shareholder benefits while maintaining the spirit of the original calculation which sought to push the utilities to achieve aggressive results;
    ii. The revised curve maintains an upper target of 150%; and
    iii. The revised curve maintains the annual incentive cap of $10.45 million; an amount considered by the Board to be a reasonable reward for exemplary efforts.

90. In Summary, the Company has proposed three recommendations to better align the DSM and the Cap & Trade Frameworks:
    i. As per the recommendation found in the attached expert evidence of Research Into Action, Enbridge recommends the implementation of a fixed net to gross ratio, or series of ratios, across the gas utilities' DSM results for the remaining years of their 2015 to 2020 DSM Plans that have not yet undergone the EM&V process.
    ii. Enbridge recommends re-alignment of targets and budgets that appropriately account for approved incentive rates.
    iii. Align the timing and magnitude of ratepayer and shareholder benefits within the weighted scorecard formula while maintaining the annual incentive cap of $10.45 million.

91. The Company respectfully submits that there is no reason that these changes cannot be implemented in time for the 2018 DSM operational year. The sooner such alignment can and does take place, the sooner the Company, the Board, and ratepayers can maximize benefits for ratepayers.

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Appendix A

Review and Analysis of Net-to-Gross Assessment Issues for Natural Gas Demand Side Management Custom C&I Programs

August 25, 2017



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Review and Analysis of Net-to-Gross Assessment Issues for Natural Gas Demand Side Management Custom C&I Programs

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Table of Contents

Executive Summary

As part of its mission to regulate Ontario's natural gas sector, the Ontario Energy Board (OEB) has developed guidelines specifying adjustments the natural gas utilities should make to gross energy and demand savings to estimate how much savings actually resulted from the programs' activities (that is, *net* savings). These adjustments include reducing savings accomplished through the program that would have occurred without program involvement (free-ridership) and adding savings caused by the program but without program participation (spillover). OEB also has produced guidelines on the allocation of savings to parties other than the program that may have influenced the energy-saving activities.

This report presents a review and analysis of literature relating to the adjustments described above, particularly as they relate to the natural gas utilities' custom C&I programs. This review and analysis demonstrates that many potential problems exist with the way that net savings assessment has been conducted. Particularly problematic are self-report methods, which are very common for their low cost and ease of administration. Such methods, however, can easily result in over-estimation of free-ridership for multiple reasons: respondent self-selection bias; a tendency to provide a "socially desirable" response to questions about what would have occurred absent the program; the tendency to rationalize past decisions as arising from internal motives; difficulty envisioning hypothetical alternatives; lack of awareness of all the factors that may have influenced an action.

Apart from the above issues – which limit the ability of a program participant to provide an accurate description of what would have occurred absent the program's influence – there are multiple methodological challenges to assessing net savings. A lack of statistical precision can produce estimates that may change notably from year to year. Spillover often is not included in net savings research and, when it is, it may very likely be under-estimated. Although OEB guidelines indicate that spillover should be accounted for in estimating net savings, OEB currently does not approve a spillover adjustment to the natural gas utilities' gross savings from custom commercial and industrial (C&I) programs.

Several policy considerations relate to how net savings are defined and assessed. For one, applying variable and unpredictable net savings adjustments retroactively can lead to conflict and litigation from dissatisfied shareholders (Kushler, Nowak, and Witte 2014). While it might be bad policy to settle for a clearly inaccurate net savings assessment to avoid such conflicts, it would be reasonable policy to search for an approach that is defensible and avoids conflict.

Another policy issue is whether the value of conducting net savings research on a regular basis justifies the cost. Some evaluators (e.g., Violette et al. 2015) have concluded that it may not, even when the research is conducted with relatively inexpensive self-report methods.

At least partly as a result of one or more of the above issues, recent years have seen strong trends toward estimating net savings by applying a negotiated (also called "deemed" or "stipulated") net-to-gross (NTG) ratio to gross savings (Kushler, Nowak, and Witte 2012, 2014; SBW, Research Into Action, Inc., New Horizon Technologies, Inc., and Ridge & Associates. 2013).

A final policy issue this report relates to is OEB's requirement to establish a method to allocate some energy savings from program-funded projects to other parties that might have influenced those projects (Ontario Energy Board 2014, pp. 21-22). Our reading of the requirement is that such savings should be

allocated out of the program's *net* savings – that is, after adjusting for free-ridership and spillover. We argue that such an approach is inconsistent with the definition of free-ridership, which should include the influence of such other parties. If the allocation is done after the application of free-ridership and spillover adjustments, then the utility is penalized twice for the effects of the same external influences.

Based on our review and analysis, we offer the following recommendations to OEB and the natural gas utilities:

- **Develop a negotiated (also called "deemed" and "stipulated") NTG value.** This value should be based on a range of inputs, including a review of researched NTG values from similar programs in comparable jurisdictions that account for free-ridership and spillover, at a minimum, but also market effects if possible. Assessment of applicable NTG values from multiple studies should not treat all inputs equally but should follow a meta-analytic approach, which includes reviewing the study quality, assessing study heterogeneity, and developing a pooled estimate of variability based on the variabilities reported in the studies. The pooled estimate is a better representation of what the true estimate is in the population and it can provide insight into variability around NTG that are important to consider when determining what the value should be. Part of reviewing study quality should include assessing efforts taken to reduce the self-report biases identified in section 3. Other inputs to the negotiated NTG value should include structured expert judgment and any available market data or macroeconomic analyses. In developing the negotiated value, it may be valuable to employ a "value of information" approach, such as described by Violette et al. (2015).

- **Allocate any savings to parties other than the program only from the free-ridership portion of gross savings.** By definition, free-ridership represents the program-claimed savings that would have occurred without program assistance, which must include savings attributable to other parties. Allocating savings net of free-ridership to other parties doubly penalizes the program.

As noted in the body of this report, establishing a negotiated NTG value does not preclude doing NTG research, as such research may be valuable for program planning and implementation as well as to inform periodic adjustments to the negotiated NTG value. We recommend that OEB and the natural gas utilities observe the following when NTG research is conducted:

- **Always include spillover and, if feasible, market effects assessments.** As documented in the body of this report, failure to account for these factors will underestimate NTG.

- **If using self-report, employ methods to reduce the bias toward high free-ridership.** Energy Trust of Oregon, with input from Research Into Action, Inc., developed an approach to free-ridership assessment that attempts to control for the high-free-ridership bias of other self-report methods in addition to reducing customer fatigue (see Bliss, McClaren, Folks, and Kociolek, 2015; Roy and Bliss 2012). This alternative approach balances the counterfactual assessment with a component that assesses the influence of the various program interventions, which typically produces a lower free-ridership estimate than the counterfactual (PWP and Evergreen Economics 2017).

- **Assess free-ridership as close as possible to project implementation.** The longer the time that has elapsed between the implementation of the project and the assessment of the decision-making that went into the project, the less salient the external influences (including the program

influence) will be to the program participant and the more likely that participant will be affected by the biases toward free-ridership responses.

- **Use multiple methods and triangulate the NTG estimate.** The use of multiple methods, such as surveys of contractors as well as program participants, is now generally regarded as best practice among energy efficiency experts (Kushler et al. 2014; PWP and Evergreen Economics 2017).

Following the above recommendations may allow the natural gas utilities to continue offering large C&I customers in Ontario opportunities to generate high energy savings through custom programs that may not otherwise be achievable.

1. Introduction

The Ontario Energy Board (OEB) regulates Ontario's natural gas sector. As part of its mission, OEB has specified that the natural gas utilities should adjust gross energy and demand savings totals by free-ridership (energy savings accomplished through the program that would have occurred without program involvement) and spillover (energy savings caused by the program but occurring without program participation). OEB also has produced guidelines relating to the allocation of savings to parties other than the program that may have influenced the energy-saving activities. The purpose of these adjustments is to estimate programs' *net savings*, or the savings that actually resulted from the programs' activities.

Currently, OEB approves adjustments to the natural gas utilities' gross savings from custom commercial and industrial (C&I) programs based on researched free-ridership but not spillover.[1] This report presents a review and analysis of literature relating to net savings estimation to shed light on OEB's guidelines and requirements as they relate to the natural gas utilities' custom C&I programs. The report argues that estimating net savings through annual research is problematic for multiple reasons and argues instead for establishing a negotiated (also called deemed or stipulated) net savings approach for custom C&I programs.

1.1. Background

The Ontario Energy Board (OEB) regulates Ontario's natural gas sector. As part of its mission under the Framework for natural gas demand side management (DSM; see OEB 2014a), OEB developed filing guidelines for natural gas DSM programs (OEB 2014b). Among other things, these guidelines identify adjustment factors to be applied to the gross energy and demand savings totals reported by DSM programs to "ensure that the energy savings that are the result of DSM programs truly reflect those which the gas utilities directly influenced" (p. 20). Those adjustment factors include free-ridership and spillover. They also include attribution, which the OEB explains as relating "to whether the effects observed after the implementation of a natural gas utility's DSM activity can be attributed to that activity, or at least partly results from the activities of others" (p. 21).

In May 2015, the natural gas utilities contracted with DNV KEMA (now DNV GL) to carry out a study of free-ridership for their custom commercial and industrial (C&I) programs (Ontario Energy Board 2015a).[2] However, this research, now under OEB management, addresses free-ridership only, and not spillover (Ontario Energy Board 2015b). As of the preparation of this report, the results of the DNV GL evaluation have not been made public.

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1 In fact, the Evaluation, Measurement, and Verification (EM&V) plan (DNV GL 2016) included a plan to conduct spillover research, but OEB determined there would not be sufficient time to complete the spillover research (Marc Hull-Jacquin, Enbridge Gas Distribution, personal communication). Note that the plan was to collect spillover data only through a participant survey. As argued in section 4.2.2 of this report, such an approach likely would underestimate spillover.

2 This study was undertaken with the endorsement of the Ontario Natural Gas Technical Evaluation Committee (TEC). In August of 2015, OEB announced a plan to transition the TEC's evaluation activities to OEB under the new DSM evaluation governance structure.

1.2. Purpose and Organization of This Report

The purpose of this report is to review and analyze literature on net savings estimation as it relates to OEB's guidelines and requirements and offer a recommendation on an appropriate method to be applied going forward. Section 2 of the report briefly summarizes the various approaches to assessing net savings (the savings that resulted from program activities) and developing a NTG ratio – the ratio of a *net savings* to *gross savings*, or the total savings that occurred through program-funded energy efficiency activities. The remainder of the report then presents information from a wide range of sources that brings into question whether OEB's selected approach accurately assesses the savings that resulted from the natural gas utilities' custom C&I programs' activities.

Section 3 focuses on the challenges inherent in the use of customer self-report survey data to assess free-ridership. This is the most common free-ridership assessment approach because of its low cost, and it is the approach that was used to estimate free-ridership and NTG for the Ontario natural gas utilities' custom C&I programs. Such challenges include several well-researched and -documented psychological tendencies as well as research design and implementation practices that would tend to exaggerate free-ridership values. This section argues that such challenges may particularly affect assessment of free-ridership in custom programs.

Section 4 presents information on why – apart from the above challenges to the self-report methodology – researched NTG values likely are not accurate in any given year. Section 5 then discusses the policy issues related to the identified research limitations. These include the weighing of the cost of NTG research against the value of that research and the conflicts that may arise when researched NTG is retroactively applied to a program's gross savings. Section 5 also discusses how the logic behind NTG assessment relates to OEB's requirements regarding the attribution of energy and demand savings to parties other than the program.

Following the above sections, we present a brief conclusion and our recommendations to OEB and the natural gas utilities.

2. Review of Net Savings Assessment Methods

Evaluators are often required to calculate a program's net savings by applying net-to-gross (NTG) adjustments to the gross savings. Evaluators use a variety of methods to estimate NTG (Violette and Rathbun 2014), but our review of the literature reveals that the industry largely recognizes free-ridership and spillover to be the primary components of NTG estimation.[3]

Free-ridership (free-ridership, FR) refers to the portion of energy savings that participants would have achieved in the absence of the program through their own initiatives and expenditures (Violette and Rathbun 2014). Free-ridership ranges from 0 to 1, with 0 being no free-ridership (or, total program attribution) and 1 being total free-ridership (or, no program attribution). The values in between represent varying degrees of partial free-ridership. Spillover (SO) refers to the program-induced adoption of measures or actions by non-participants and participants who did not receive financial incentives or technical assistance from the program (Violette and Rathbun 2014). Spillover ranges from 0 to infinity, with 0 being no spillover and values greater than 0 demonstrating the existence and magnitude of spillover. Evaluation teams use the following formula to calculate a NTG ratio when relying solely on these components:

$$NTG = 1 - FR + SO$$

The following sections review some of the more common methods for estimating NTG.

2.1. Self-Report Surveys

Self-report survey is the most commonly used method for estimating NTG for those programs that target consumers directly and for which it is not possible to randomly assign consumers into a control and experimental groups. Our review of the literature reveals considerable variation in how evaluators and jurisdictions estimate NTG via self-report surveys – both in the questions asked and the algorithms used to estimate free-ridership and spillover. In the following sections, we report some basic tenants of the self-report survey method.

2.1.1. Free-ridership Estimation

Evaluators typically survey program participants to estimate free-ridership, but some evaluators conduct surveys with market actors (such as program-affiliated contractors) to inform free-ridership estimates (Violette and Rathbun 2014). To estimate free-ridership, evaluators typically ask survey respondents about what would have happened in absence of the program (the "counterfactual") and/or how much influence the program had on the upgrade decision (Violette and Rathbun 2014). Evaluators may ask participants to assess the counterfactual or program influence regarding their upgrade project as a

[3] Although some jurisdictions incorporate leakage and market effects when considering net impacts (Messenger et al. 2010), these components are rarely estimated. Market effects are changes in the adoption of energy-efficient products, services, or behaviors due to program or policy interventions. Leakage refers to indirect or unintended program effects. For example, if a program provides a discount for an LED at retail stores to increase LED adoption in the residential sector, some of those discounted bulbs could "leak" (be installed) in the nonresidential buildings because contractors are buying them.

whole or may ask participants about each specific measure or groupings of measures. Specific question and scoring design varies considerably in the industry. However, the industry is unanimous in the theoretical minimum of 0, or 0% free-ridership, and a maximum of 1, or 100% free-ridership.

The measure- or program-level free-ridership value typically is calculated as the mean of the sample values from the self-report research, often weighted by the total savings of the sampled projects.

2.1.2. Spillover

Evaluators often use self-report surveys to estimate both participant and non-participant spillover. Participant spillover refers to program-attributed savings from additional non-incented measures installed by participants who were influenced to do so by their experience participating in the program. Non-participant spillover refers to program-attributed savings from measures installed by non-participants who were influenced to do so by either directly or indirectly by the program.

Evaluators may survey program participants and non-participants to estimate spillover or may survey market actors (such as program-affiliated contractors) to inform spillover estimates. Evaluators use a variety of survey techniques to gather information on the measures installed outside of the program and the relative program influence on said measures. Evaluators may use primary or secondary research to estimate savings values for measures installed outside of the program.

Not all energy savings from measures installed without program incentives count as spillover. A common approach is to determine the amount of savings to attribute to the program based on the level of program influence on the decision to install the measures, as assessed from the surveys with participants, non-participants, or market actors. One approach is to establish a threshold level of influence and count all the savings from an installed measure if the rated program influence exceeds that threshold. Another is to attribute a portion of the savings for a given measure based on the rated influence. For example, a rated program influence of “3” on a 1-to-5 influence scale (from “no influence” to “great influence,” say) might result in attribution of 50% of the savings to the program, while a rated program influence of “1” might result in 0% attribution and “5” might result in 100% attribution.

While self-report approaches to free-ridership yield a free-ridership percentage for each respondent, self-report spillover research typically yields a total spillover energy (or demand) savings value for each respondent. The measure-, project-, or program-level spillover percentage is calculated as the total spillover savings divided by the total measure, project, or program savings.

2.2. Experimental Approaches and Billing Analyses

Randomized control trials (RCT) or quasi- experimental methods (QEM) rely on billing data for estimating net savings. The distinction between the two is that RCT allows random assignment of customers to treatment and control groups while QEM may use a control group that is not randomly selected or, in some cases, does not even use a control group. Both methods typically use before-and-after-program billing data from the treatment and control groups to assess program effects, often attempting to control for other factors, such as weather. Both methods generally require large samples and selection of an appropriate control group and can be costly to carry out. Incomplete billing data can contribute to the challenge of conducting this type of analysis.

An RCT approach, which is recommended by the State and Local Energy Efficiency Action Network for behavior based programs (SEE Action 2012), will produce an estimate of net energy savings that is internally valid and unbiased, but it is not always feasible to implement (e.g., one cannot randomly assign subjects to naturally occurring groups). Naturally occurring groups occur when the program is an open-enrollment or opt-in program. Most custom C&I programs are opt-in programs.

The key challenge of opt-in program is self-selection bias. Self-selection bias refers to pre-existing differences (e.g., building square footage) between those in the experimental and control groups. The selection bias can be minimized through the use of statistical methods for sampling such as "regression discontinuity"[4] or "matched controlled group"[5] (SEE Action 2012 and Hall et al. 2004). However, the heterogeneity of large C&I custom participants makes matching a challenge. Moreover, unless Advanced Metering Infrastructure (AMI) is in place, billing data are not likely to be sufficiently granular to see the effect.

2.3. Market Sales Data Analysis

Sales data analysis is another method for estimating free-ridership and various components of spillover. The most common approach involves cross-sectional comparisons of sales of energy-efficient products or services in the area served and not served by the program. For example, efficient water heater sales in Ontario could be compared with efficient water heater sales in other areas of Canada, including regions with and without water heating programs. Water heater purchases in a specific time period serves as the dependent variable in a regression-based model. Independent variables in the model can include elements of program support, water heater technology saturation at the beginning of the time period, the length of prior program support in the area, and household-level measures of demographic, economic, or social characteristics.

The primary challenge is the selection of an appropriate comparison area and the availability of market sales data. The regression does reduce the need for a perfect comparison area as demographic and social characteristics can be adjusted for. Nevertheless, this method suffers from omitted variable bias – that is, the regression will likely not be able to account for all influencing factors.

2.4. Top-Down or Macroeconomic Modelling

Evaluators can rely on top down or macroeconomic models of sector-level state, regional, or national data on programs and target markets to estimate net impacts. Such models are based on changes in aggregate energy consumption (rather than changes in consumption for a specific account, as analyzed in billing analyses) as a function of energy efficiency efforts. Such analyses require a standardized measure of energy efficiency "effort" (e.g., program expenditures) as well as sophisticated modeling to identify the impact of a given program year's efforts over several succeeding years.

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4 The regression discontinuity method selects a group of households just below the energy usage cutoff level as the control group and a group of households just above the energy usage cutoff level as the treatment group.

5 The matched control group method selects a control group with demographic and usage characteristics similar to those of the treatment group. The Regional Technical Forum (2010) recommends that, at a minimum, home type, location, and total baseline consumption characteristics of the control group should be similar to those of the treatment or experimental group.

2.5. Structured Expert Judgment

Some jurisdictions rely on a panel of experts to provide information used to calculate NTG. In these jurisdictions, a panel of experts knowledgeable about specific technologies and markets are asked to estimate baseline market share or to forecast market share, assuming common facts about the program, technologies, and other factors. In the Pacific Northwest, the Regional Technical Forum (RTF) helps utilities determine deemed savings values that take into the account baseline conditions, which includes free-ridership and spillover. The RTF uses an advisory committee, composed of regional experts, and subcontractors to regularly develop, update, and review a list of energy efficiency measures and determine appropriate deemed savings values based on engineering and market research.

2.6. Negotiated or Deemed Values

Deemed, stipulated, or negotiated values are NTG ratios that the program or commission determines are applicable and reasonable to apply to a program or portfolio. The NTG value deemed acceptable by the commission may come from a variety of sources, including:

- Literature review of other NTG studies from similar jurisdictions
- Structured expert judgement
- Market sales data analyses
- Top-down or macroeconomic models of data on programs and target markets
- Engineering estimates

Typically deemed values are adopted for consumer-facing or downstream programs. They typically are employed to save money and time compared to conducting monthly or annual research to determine NTG values, but they may also be used to avoid arguments concerning the calculation and award of utility shareholder incentives that may occur when researched NTG estimates are applied retroactively to gross savings estimates (Kushler, Nowak, and Witte 2014). We discuss these motives for using negotiated values in more detail in section 5.2.

Many jurisdictions rely, at least partially, on deemed values. To arrive at the deemed values, jurisdictions may use evaluations of programs and measures that include assessments of free-ridership and spillover. These evaluations may use some combination of the aforementioned methods to determine NTG and then, rather than conducting NTG research monthly or annually, rely on the deemed NTG values for a longer period of time. The jurisdictions revisit the deemed NTG values on some predetermined research schedule or when some element of the program changes or the market appears to be shifting somehow. To save money and resources, about 70% of all states apply deemed values determined from other jurisdictions' research (Kushler, Nowak, and Witte 2012).

One potential tradeoff of using the deemed approach is the lack of insight deemed values give program planners about how the market may be changing over time. In many cases, jurisdictions will allow the application of the researched NTG values for some programs or measures and apply deemed values to other programs where they are less concerned about insights into the market. As discussed in greater detail in section 5.3, some jurisdictions use deemed NTG values (or base compliance on gross savings,

which is logically equivalent to having a deemed NTG value of 1.0) but also require NTG research to inform program planning.

3. Disadvantages of Self-Report Method

As noted in the previous section, self-report is the most common method for NTG estimation for downstream incentive programs, including C&I custom programs. It is the primary approach used to assess NTG among such programs in Ontario. The limitations of self-report to assess free-ridership, and consequently, NTG, are numerous, and several have received considerable attention in the literature (Peters and McCrae 2008; Ridge et al. 2009). It is important to note that the limitations of self-report are problematic not just for estimating free-ridership but for survey research more generally. The limitations may be organized into three broad categories: factors limiting the ability to respond accurately, research design and implementation issues, and factors specific to custom programs that would tend to exacerbate the effect of the other limitations.

3.1. Factors Limiting the Accuracy of Responses

Psychological research provides numerous reasons for why the responses people provide on self-report measures should be interpreted with caution. Below, we describe several pertinent and well-researched theories that highlight the potential for inaccurate self-reporting. While these tendencies and biases are found to reduce the accuracy of responses, it is important to note that they do not suggest that respondents are entirely unable to notice the program's influence, nor do they mean that there are no respondents who are not completely clear-eyed about their own motives and external influences. Rather, the research suggests a tendency to obscure respondents' judgment in the aggregate, with a resulting impact on the evaluation of program attribution.

3.1.1. Difficulty Estimating and Reporting Attribution

To assess free-ridership, respondents may be asked whether they, or the organization they represent, would have engaged in the energy efficiency behavior had the program not been in place. They may also be asked to account for what specifically caused them to decide on this energy efficiency action. In other words, respondents are tasked with determining the correct attribution for their behavior – who gets credit for the actions they took. Decades of research have documented that the attributions we make for our and others' behavior are often incorrect or at the very least, do not recognize the range of factors that lead to a given behavior.

Research suggests that a variety of motivations – the desire to maintain consistency between attitudes and behavior, to see oneself in a positive light, or to present oneself in a positive light to others – might all contribute to inaccurate or limited accounts for behavior (Kunda 1987). This means that when respondents (those that have opted for the energy efficiency behavior) are asked about the reasons for their behavior, their motivations will likely bias how they respond.

For example, the motivation to maintain consistency between attitudes and behavior suggests that respondents might infer that since they engaged in the energy efficiency behavior, they must in fact have favorable attitudes toward energy efficiency. This would bias them to reason that, since they have positive attitudes toward energy efficiency, they would likely have engaged in this behavior regardless of the program. This would overestimate free-ridership.

Relatedly, people tend to take credit for their successes and explain away their failures (Miller and Ross 1975). This self-serving bias suggests that if the energy efficiency behavior elicited positive outcomes for the respondent, they would be even more likely to believe that the success rests on their decision as opposed to something external to themselves. Thus, they would attribute the decision to themselves and subsequently believe that they would have engaged in the behavior even if the program did not exist. Ultimately, this would overestimate free-ridership. Additionally, when interviewed by an evaluator of an energy efficiency program, respondents might be nudged to attribute their behavior to their, socially desirable energy efficiency-positive attitudes, a tendency which we describe next.

3.1.2. Difficulty Reporting the Hypothetical Alternative (Counterfactual)

When respondents are asked whether they would have engaged in the energy efficiency behavior without the program, they are being tasked to imagine an alternative reality. Without having been in that situation, they are asked to imagine what they would have done if the program in question, that was designed to promote energy efficiency, never existed. This is asking the respondent to imagine the hypothetical with the hope that their speculation leads to an accurate assessment of their assumed behavior. Not only do they need to imagine a fictitious scenario, they then must imagine what their behavior would have been. To construct this alternative reality, respondents need to speculate, drawing from any information that may be available to them. This act of imagining would be influenced by numerous factors including what is salient to them at the time of the interview (energy efficiency is likely at the top of their mind), as well as the biases (attribution bias, the tendency to rationalize past decisions) we discussed in this section -- all of which should lead the participant to say they would have done the energy efficiency behavior regardless of the program and, consequently, lead to an overestimate of free-ridership.

While solutions are provided including by Ridge et al. (2009) and Violette and Rathbun (2014), the proposed solutions may simply increase the chances of arbitrariness in the free-rider score calculation, a topic which we will discuss in more depth later in this section.

3.1.3. Tendency to Rationalize Past Decisions

Because people prefer consistency, when they are made aware that their actions do not align with their attitudes, they experience a basic feeling of discomfort known as cognitive dissonance (Festinger 1957; see also Stone et al. 1997). Notably, this desire for people to make their behavior consistent with their attitudes has been applied to encouraging environmental sustainability (Dickerson et al. 1992). Pertinent to our discussion, when a person is asked to imagine whether they would have engaged in the energy efficiency behavior had the program not existed, they may be faced with a conundrum. Given that they have already, publicly, done the energy efficiency action, if they express an attitude inconsistent with their behavior, their attitudes would be out of step with their behavior, and subsequently cause them discomfort. The easiest route to reduce the dissonance should be to bring one's attitudes in line with their energy efficiency behavior. Thus, this would cause the person to change their attitudes to be more positive to energy efficiency, which would make it more difficult to imagine a world in which they would not have engaged in that behavior to begin with. Essentially, the avoidance, or attempt to resolve, dissonance should bias the respondent to say they would have engaged in the behavior regardless of the program (Peters and McCrae 2008).

3.1.4. Tendency to Provide Social Desirable Responses

Another potential limitation to self-report methods is the tendency for respondents to provide answers that are socially desirable (termed the "social desirability bias"). For example, to assess free-ridership, a respondent who indicates they have performed the energy efficiency behavior would then be asked (through either a single question or a series of pointed questions) whether they would have engaged in the energy efficiency behavior if the program did not exist. A responded who says "yes, I would have done the same energy efficiency behavior without the program" would be considered a free-rider. Psychological literature presents multiple reasons for why the response should be interpreted with caution, at the least. For one, the response to the question could simply be due to the possibility that the respondent wants to provide the socially appropriate answer, which would be that the energy efficiency behavior is the "right" thing to do, thus, it would be adopted by the respondent even if the program never existed.

Researchers and evaluators have proposed several solutions to address the likely possibility that respondents will be biased toward providing the socially desirable, though potentially untrue, response (see Ridge et al. 2009; Keating 2009). One of these solutions is to use a questionnaire where the "right" or socially appropriate answer might not be so obvious to the respondent; the California method seeks to do this. Another way to mitigate the social desirability bias is to ask multiple questions that may converge on a true estimate of free-ridership. Ridge et al. (2009) identified research on various for minimizing bias, which they believe will mitigate potential problems. They further noted a potential countervailing bias to exaggerate the influence of the program to help ensure that the program incentives continue.

While incorporating the various techniques that Ridge et al. (2009) mentioned may help, doing so lengthens the questionnaire, which adds other concerns, including increasing respondent fatigue (and potentially loss of engagement), and increasing cost of administering the survey. It also may make calculating a final free-ridership estimate more arbitrary, which we discuss in more detail at the end of this section.

Further, while these solutions are elegantly defended and may mitigate some of the contribution of the social desirability bias on the estimate of free-ridership, even accounting for this phenomenon does not remove the impact of other psychological phenomena and biases on self-report. These other biases also suggest the limitations of self-report and argue for caution when using this methodology, especially to assess the presumed impact of intentions on behavior. Below, we describe each of these documented biases and psychological phenomena and how they obscure an accurate estimation of free-ridership.

3.1.5. Failure to Recognize All Direct and Indirect Pathways of Program Influence

It is conceivable that the individual respondent may be unaware of all direct and indirect pathways of program influence. Primarily, when accounting for their energy efficiency behavior and assessing whether they would have engaged in the energy efficiency behavior without the program incentives, they may fail to recognize all the pathways of program influence and erroneously conclude they would have engaged in the behavior even if the program has not existed. For example, while respondents may note the influence of contractors or equipment vendors (who may be salient to respondents since they may have interacted to set up the energy efficiency solution), they may not recognize the degree to which the program influenced those trade allies. Thus, they may not fully appreciate the degree to

which the program indirectly influenced their adoption of the energy efficiency behavior (Bliss, Sage, and Diebel 2017). Respondent tendencies to neglect these indirect pathways of program influence on their decision to opt for energy efficiency would thus inflate the free-rider estimate.

3.1.6. Difficulty Isolating Program Influence from Longer-Term Market Transformation Effects

The decisions and behaviors of people and organizations are not solely influenced by an individual program, but by a variety of other forces. As described by Vine et al. (2010), numerous public policies and market interventions influencing energy efficiency often operate simultaneously, and it is likely impossible to extract the influence of a single program. This is an especially difficult task for a single respondent. For example, in addition to the specific program in question, public policy (e.g., state government messaging advocating for energy efficiency, tax credits for energy efficiency measures) as well as market interventions (e.g., media coverage of energy efficiency issues, other private-sector advertising) and other forces such as energy efficiency education in universities and other schools likely all exert their influence on the consumer's behavior. The individual respondent would conceivably have difficulty identifying the unique contribution of the program on their behavior apart from the other numerous influences, including market transformation effects.

3.2. Research Design and Implementation Issues

There are several issues relating to how surveys are designed and implemented that can affect accurate attributions of behavior, by exacerbating the psychological forces described above or by other means. Three such issues are response bias, survey timing, and arbitrariness in scoring free-ridership.

3.2.1. Survey Design and Response Bias

Good data are predicated on good survey design. The hurdles at this initial stage of research include response bias, more general issues related to sampling, and questionnaire construction. Most NTG research attempts to incorporate good instrument-design practices, such as avoiding double-barreled questions[6], making questions as clear as possible to respondents, and avoiding leading questions (e.g., "How satisfied are you with the program's generous incentives?"). NTG surveys may not be as likely to incorporate multiple-item scales, as advocated by Baumgartner (2013). Experienced NTG researchers also generally understand the importance of attempting to reach and interview a contact who (theoretically) can report knowledgeably on the decision to do the energy efficiency project in question.

One looming issue within the area of survey design, however, is response bias. Pertinent to our discussion, response bias may inflate free-ridership estimates. For example, in the case of a person or organization that participates in a program to encourage taking an energy efficiency action, to assess free-ridership we would want to know whether that organization or person would have taken the action if the program had not existed. It is possible that those adopters who have less positive attitudes toward

[6] Double-barreled questions that do not allow the respondent to differentiate separate things in the response. For example, asking the respondent to rate satisfaction "with the program and its incentive" does not allow the respondent to indicate satisfaction separately for the program and for the incentive.

energy efficiency might not have engaged in the energy efficiency behavior without program incentives (i.e., not a free-rider) but may also be less likely to want to take a survey about this behavior. Conversely, those with positive attitudes toward energy efficiency behavior may have indeed engaged in the energy efficiency behavior regardless of the program (making them a free-rider) but should also be more likely to take a survey about energy efficiency behavior. Thus, this response bias would overestimate the number of free-riders.

3.2.2. Timing of Surveys

Several researchers (Schwarz 2007; Keating 2009; Peters et al. 2010; Violette and Agapay-Read 2016) have noted that the timing of surveys is particularly important to ensure the most valid responses. The longer the time that has elapsed between the behavior and the self-report about the behavior, the more likely the respondent is to forget their intentions, the motivations, and other influences on their behavior (even if the respondent had been aware of them at the time of action). Returning to attribution theory, the respondent's difficulty in accurately attributing their energy efficiency behavior is increased the longer the time between the energy efficiency action and the survey because the less obvious influencers on the respondent's decision and action fade in their memory. Further, with a longer amount of time between the behavior and the self-report, the more likely the respondent is to be influenced by other psychological biases. For example, research on the mere-ownership effect (Beggan 1992) suggests that people value an object more once they own it. Once an object is theirs (as a gift or after purchase), people are more favorable than when it was not their possession. Hence, one may imagine that the respondent has begun to value the energy efficiency product simply by possessing it. When asked if they would have done the energy efficiency behavior without the program, their ownership of the product should bias their ability to imagine themselves without it, and to increase the value of the energy efficiency product. The more that time has passed, the more difficult it may be to imagine oneself without that now-valued object.

3.2.3. Potential Arbitrariness in Free-Ridership Scoring Methods

Finally, some (Violette and Rathbun 2014) have noted that there is considerable arbitrariness in scoring methods to create free-rider estimates. By using a lengthy survey, combining open-ended and close-ended questions, and interview methods that point out respondent's inconsistent answers, the interpretation of the data from these questionnaires becomes largely dependent on the interpretation of the evaluator. Granted, if evaluations are using the same calculation, they should reach the same estimation of free-ridership, making their estimations reliable. However, their relative agreement does not necessarily indicate accuracy. Their estimation, though agreed upon, may still be incorrect, and therefore invalid.

3.3. Challenges Particular to Custom Programs

Haeri and Khawaja (2012) argued that no traditional approach adequately accounts for either free-ridership or spillover, especially for commercial, industrial, and new construction programs. Particularly relevant to the discussion here, they argued that self-report is especially problematic for assessing free-ridership in C&I programs because of the complex decision making involved in those types of projects.

If Haeri and Khawaja (2012) are correct, the issues they cite may be particularly a concern for custom programs. Moreover, custom projects often are larger and have a longer planning horizon than prescriptive projects. The longer planning horizons complicate assessments of the degree to which programs influence project planning, which could exacerbate the psychological forces that would tend to exaggerate free-ridership.

This added complexity would naturally muddy respondents' ability to accurately identify attributions for their energy efficiency behavior. With multiple forces influencing their behavior, and at different times, it would be especially difficult for the individual respondent, who has a limited perspective, to determine whether the program had its intended effect or to identify the factors that truly did influence their behavior. Particularly, as previously discussed, respondents have difficulty isolating program influence from market effects as well as differentiating all the direct and indirect pathways of program influence. Adding increased complexity to this already less-than-transparent situation may especially impede respondent's ability to answer accurately. Importantly, obscuring respondents' ability to answer accurately would likely nudge them to rely on their biases; they are unsure and need to rely on something to guide their judgements.

A concrete example may help illustrate the above point. Large C&I programs often work with larger customers over a long period of time – sometimes, for a decade or more – to identify and catalog available energy efficiency projects. In such scenarios, it is possible that, when a particular project becomes prioritized for implementation, the customer's staff retain knowledge of the project as an option but have forgotten that it was the program staff who identified it in the first place.

As decades of decision making as well as social psychological literature document, complexity and ambiguity increases the likelihood that people will rely on their biases to make judgments (Frisch and Baron 1988). In this case, their biases (e.g., social desirability bias, self-serving bias) will nudge them to say they would have taken the energy efficiency route regardless of the program and therefore, lead to an overestimation of free-ridership.

3.4. Summary

The above discussion provides several reasons why self-report surveys probably do not provide accurate estimates of free-ridership. Much well-researched and validated psychological theory indicates that self-report research may overestimate free-ridership, and the complexities of decision-making in custom C&I projects may make self-report a particularly problematic way to assess free-ridership for such programs. Our review of the literature, in both psychological theory and that specific to energy efficiency Evaluation Measurement and Verification (EM&V), found little argument and no evidence that self-report assessment under-estimated free-ridership. The one possible exception, as noted above, is that surveyed participants may explicitly exaggerate the importance of the program to help ensure the continued availability of the incentives. While this possibility cannot be dismissed out of hand, it must be weighed against all the well-documented psychological tendencies that would bias self-report in the other direction. While attempts at varying levels of success have been implemented to mitigate the issues and biases that may influence free-ridership estimates, the theory and research cited above suggests that they are likely leading to bias in one direction. That is, psychological biases and issues related to survey design largely lead to over (and rarely under) estimation of free-ridership.

4. Other Methodological Concerns with Researched NTG

The previous section provided several reasons why self-report research may overestimate free-ridership and, hence, underestimate NTG. Those are important considerations, but they are not the only arguments for using a negotiated NTG value. The following subsections document two key issues with relying on researched NTG:

- Lack of statistical precision can mean that the researched NTG in a given year may not be accurate.
- Spillover is a potentially important part of NTG, but it often is not sufficiently accounted for in researched NTG.

4.1. Researched NTG Can Lack Precision

The components of NTG – free-ridership and spillover – can vary greatly from year to year and across programs. While both the use of different assessment methodologies and differences in program implementation can contribute to differences in estimated NTG, a lack of precision in the individual assessments also contributes to the differences. The issue of lack of precision is important and worth a brief discussion before we proceed to the reported NTG findings.

4.1.1. The Meaning of Statistical "Precision" and "Confidence"

In statistics, "precision," strictly speaking, refers to the range of values that repeated samples from a given population will produce. Every sample produces an estimate of some characteristic of the population it is drawn from but, obviously, no two samples will produce the same exact estimate of that characteristic. Thus, calculating free-ridership in two samples of custom projects from the same program in the same program year will produce two different estimates of free-ridership for the program. A sample has high precision if most repeated samples of the same size, and drawn using the same methods, would produce estimates within a small range of values.

But what do we mean by "most" repeated samples or a "small" range of values? The meaning of "small" refers to the stated precision level and the meaning of "most" relates to the desired level of "confidence." When evaluators talk about precision, it is always in the context of the confidence level. In evaluation, we often seek 10% precision at 90% confidence at the program level. That is, we want a sample such that, if we continued to draw additional independent samples, 90% of those samples would produce an estimate that is no more than 10% higher or lower than the estimate our sample produced. (This often is interpreted as meaning that such a sample gives us 90% confidence that the true population mean is within 10%, higher or lower, of the sample mean. While many statisticians believe this is not strictly speaking true, it is a useful way to think of the results.)

It should be clear, then, that even when samples are designed to produce 10% precision at 90% confidence, it is possible for two samples to produce noticeably different estimates of the same

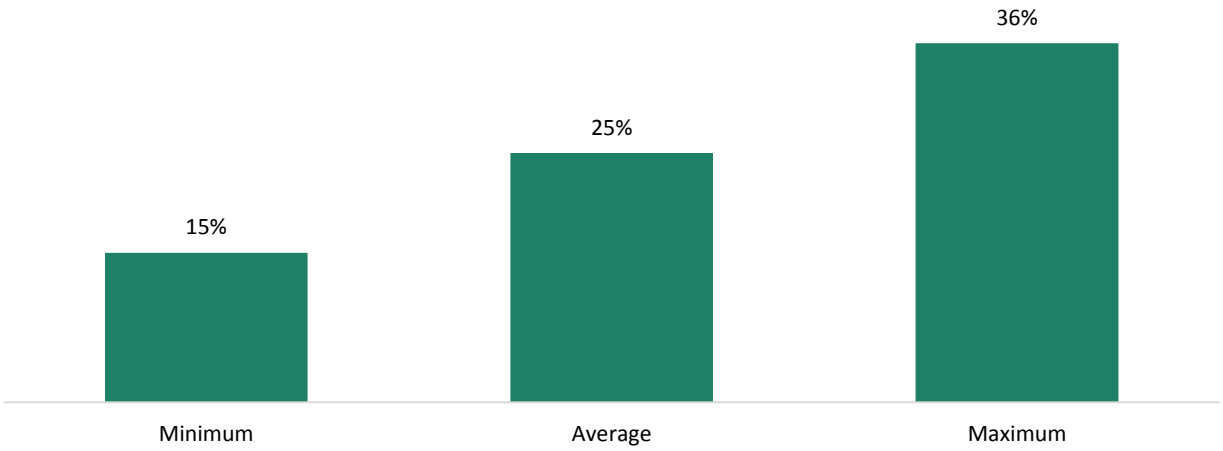
population value. One further point is important here, which is that a sample may be *designed* to produce 10% precision and 90% confidence but may not actually do so. This is because the level of precision is in large part a function of how variable the sample is with respect to the thing being measured – in this case, free-ridership. If most projects in the sample have similar levels of free-ridership, then there is low variability and good precision; but if the level of free-ridership is highly variable, then precision is not as good. Since the actual level of variability cannot be known in advance, researchers must base the sample design on the assumed variability. If that assumption is incorrect, then the assumed levels of precision and confidence also are incorrect.

4.1.2. Evidence of Variability in Researched Free-Ridership

The above background should help to put the following research findings in context. A review of free-ridership estimates across nine program types across multiple jurisdictions in the northwestern United States revealed notable variation in estimates across programs, in particular with custom programs (Cadmus 2017). This review of 13 custom C&I programs – seven in California, four in Oregon, one in New York, and one in Wisconsin – revealed a wide range of free-ridership estimates, from 11% for Energy Trust of Oregon industrial program in 2010 to 74% for a California Public Utility Commission (CPUC) agricultural custom program.

One program administrator, the CPUC, calculated the range of free-ridership for its agriculture and custom programs in 2009 to 2011. The values for the custom programs ranged from a low of 15% to a high of 36% (Figure 1). While this could reflect year-to-year differences in the programs' project make-up, it also likely reflects lack of precision in the estimates. Unfortunately, the report citing these values did not include estimates of precision, and the reference to the original source is no longer a live link. In any case, making policy or program planning decisions based estimates with so much year-to-year variability could easily lead to conflicting decisions.

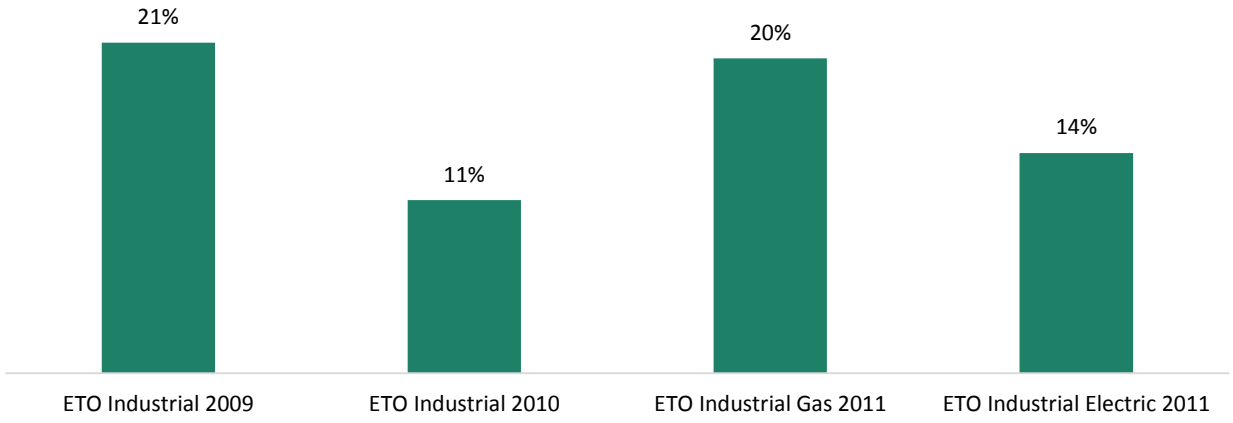
Figure 1: Free-ridership Estimate Range for the CPUC's Agricultural and Custom Programs



Examining a specific program's free-ridership values across multiple years sometimes shows variation that is difficult to interpret. For example, the free-ridership estimate for Energy Trust's Industrial program was 21% in 2009, dropped to 11% in 2010, and went back up in 2011 (Figure 2). Again, the

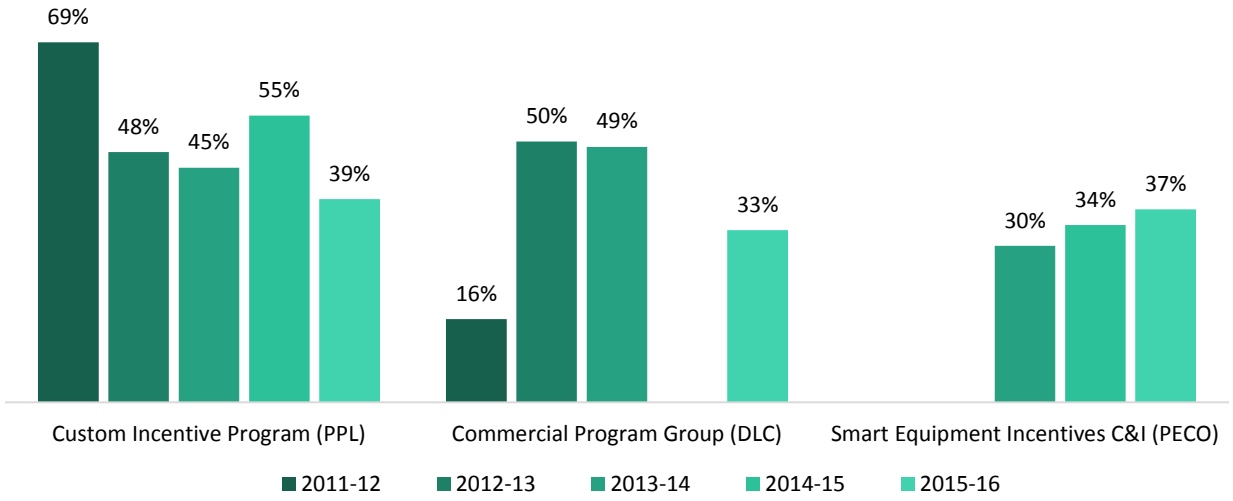
year-to-year variability underscores the risk in relying on any specific estimate in determining the "true" free-ridership value.

Figure 2: Free-ridership Estimate for Energy Trust's Industrial Program, 2009-2011



Variability also existed in free-ridership estimates for C&I programs in several Pennsylvania utilities (Figure 3). As with the Energy Trust values, there was no clear pattern across utilities and years. For one program, free-ridership estimates trended down with a seemingly aberrant spike in the fourth year. For another, free-ridership tripled after the first year before falling to twice the starting point. For the third program, it slowly increased across years.

Figure 3: Free-Ridership Estimates for Pennsylvania Programs, 2011/12 to 2013/14



Sources: GDS Associates et at. 2014, 2015, 2016, 2017.

4.1.3. Exacerbation of Imprecision from Considering Spillover

The above subsection addressed free-ridership, but the lack of precision applies to spillover as well. In fact, spillover estimates may be even less precise than free-ridership estimates, as self-reported energy efficiency actions outside of efficiency programs are relatively low-frequency events. As Haeri and Khawaja (2012) point out, this means that a small *absolute* increase in spillover reported in a sample may result in a large increase in the spillover *percentage*.

Moreover, what is usually not considered is that a NTG estimate that includes both a free-ridership and spillover estimate (estimated separately) is not as precise as either the free-ridership or spillover estimate alone. That is because there are separate sources of variability for the free-ridership and spillover estimates that are combined when they are put together to form the NTG estimate.

Again, a slight digression into statistics is needed here. The precision of an estimate is a function of the *standard error* of that estimate. It is not necessary here to go into great detail about how the *standard error* is calculated, except to note that it is related to the *variance*, which is a measure of the variability of the sample component constituents – in this case, the individual free-ridership or spillover values that make up the sample – and to the sample size. When two estimates are combined, as when the separately estimated free-ridership and spillover are combined to estimate NTG, the variance around the combined estimate (the NTG in this case) is the sum of the variances of the components of that estimate (the free-ridership and spillover estimates).

Suppose, for example, an evaluation estimated free-ridership and spillover. Assume that samples of 68 observations generated estimated mean free-ridership and spillover values with 10% precision at 90% confidence. In both cases, the *variance* of the estimate is about .25, and so the *variance* of the NTG estimate is about .50, resulting in a precision of about 14% instead of 10%.

4.2. Spillover Is Not Sufficiently Accounted For

It is important to include estimates of spillover when free-ridership adjustments are made to ensure a balanced NTG ratio. Some evaluators have argued, and some regulators have accepted, that spillover and market effects balance out free riders (e.g., PWP and Evergreen Economics 2017; Khawaja, Haeri, and Hedman 2014; Haeri and Khawaja 2012). While there is as yet little empirical evidence for this argument, there is good theoretical reason to expect it is true. As an energy efficiency program succeeds in increasing trade allies' promotion of efficient equipment and end-users' recognition of the value of energy efficient investments, both self-reported free-ridership and spillover likely will increase (e.g., see Saxonis 2007). Yet, as documented below, not all states report spillover when estimating net savings. At the same time, current methods to estimate spillover may underestimate spillover savings.

4.2.1. Spillover Is Not Always Measured or Reported

When commissions/programs adjust gross savings by subtracting savings from free-riders, spillover should also be evaluated to provide for a balanced estimation of program effects (PWP and Evergreen Economics 2017; Kushler et al. 2014; and many others). One of the principles NEEP (2006) developed for estimating net savings is to "apply the concept of symmetry" which accounts for both positive (spillover) and negative (free-ridership) influences. Measuring free-ridership without accounting for spillover is not fully accounting for net program influences. Hence, retrospectively punishing programs for high free-

ridership by reducing program-generated energy savings is considered "overly punitive" by some when the NTG ratio does not account for spillover (Khawaja, Haeri, and Hedman 2014, p.40).

Enbridge does not include spillover in its NTG analyses, which does not credit the program for the energy customers saved influenced by Enbridge programs (Synapse Energy Economics 2015). Participant and non-participant spillover is highly likely when programs have been in place for several years, as many prior participants are not still participating, yet were influenced to continue to pursue energy efficiency as a result (as in the case of Enbridge's programs).

A growing number of states are recognizing the importance of including spillover estimates in their NTG ratios. Kushler et al. (2012) found that while 26 of the 39 states (67%) adjusted for free-riders, only 17 (44%) always included spillover. In a subsequent iteration of their survey, Kushler et al.(2014) found that 25 of 43 states include spillover (58%) and five more reported planning to. Table 1 displays which states adjust for free-ridership or spillover in their net savings, as reported by representatives in a phone survey.

Table 1: Reported Net Savings Adjustments by State*

Free-riders	Spillover	Number of States	States
Yes	Yes	33	Arkansas, California, Connecticut, District of Columbia, Florida, Georgia, Hawaii, Idaho, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nevada, New York, North Carolina, Oklahoma, Oregon, Rhode Island, South Dakota, Tennessee, Utah, Vermont, Wisconsin, Wyoming, and portions of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia
Yes	No	4	Colorado, Illinois, Indiana, New Mexico
No	No	12	Arizona, Delaware, Iowa, Kansas, Minnesota, Nebraska, New Hampshire, New Jersey, Ohio, Pennsylvania, South Carolina, Texas
No data		2	

* Adapted from Kushler et al. (2014).

4.2.2. Spillover Is Easily Underestimated with Current Methods

In a report documenting the results of a recent literature review and expert interviews, PWP and Evergreen Economics (2017) note that estimated participant spillover usually falls below 5% of gross savings, while non-participant spillover estimates "vary widely."[7] It may be more likely that self-report methods underestimate spillover. Underestimations of spillover can derive from a reliance on the survey respondents' attribution of influence to the program. As discussed in Section 3, because of the tendency

[7] Although the authors report that some estimates of non-participant spillover exceed participant gross savings, such cases appear to be infrequent and may be limited to certain specific measure types, such as high-bay lighting (personal communication, Phil Degens, Evaluation Manager at Energy Trust of Oregon, August 15, 2017).

to rationalize past decisions, people tend to attribute energy efficiency decisions to themselves. This would be as likely lead to underestimation of spillover as overestimation of free-ridership.

Another reason is that self-report studies can identify only spillover activities done at the time of the survey. This is particularly problematic when a survey is conducted within the program year in which the respondent participated because it would not capture any spillover activities done after the survey but within the program year. To overcome this potential problem, a program might seek to conduct self-report surveys up to two years after program participation (Tetra Tech 2011). However, increasing the time that has elapsed between program participation and self-report surveys may lead to recall issues, with a resulting and greater tendency for the biases described in Section 3.

Bliss et al. (2017) argued that accurate survey-based spillover assessment must incorporate the perspectives of all parties involved in selling and installing energy efficient equipment – the equipment vendors, the installation contractors, and the end-users (program participants and non-participants). Specifically, in addition to assessing the program's direct influence on end-users, via marketing and outreach as well as learning the value of energy efficiency investments through program participation, accurate spillover assessment must assess the program's indirect influence on end-users via its influence on vendors and installation contractors. Accurate assessment of indirect influence must include assessment of: 1) the program's influence on the recommendations that equipment vendors and installation contractors make to their customers and on the recommendations that vendors make to contractors; 2) the equipment vendors' influence (through recommendations, stocking practices, and pricing) on installers; and 3) the vendors' and installers' influence (through recommendations, stocking practices, and pricing) on end users. Survey approaches that do not attempt to assess all those elements risk misestimating program influence.

Approaches that rely only on the end-users or the vendors and contractors, according to this view, cannot accurately estimate spillover because they cannot accurately assess both the direct and indirect pathways of program influence. While end-users are, at least nominally, able to identify program direct influence on their decisions (subject to the limitations identified in Section 3), they cannot report on the program's influence on vendors' and installers' practices, and so they cannot by themselves provide insights into program indirect influence. On the other hand, while vendors and installers can speak to the program's influence on their practices, they cannot report on the program's direct influence on end-users.

5. Policy Considerations and the Rationale for Negotiated NTG

This section discusses some of the policy considerations that proceed from, or are otherwise related to, the preceding discussion. First, some have concluded that the value of doing NTG research for a specific program year may not offset the cost. In addition, reliance on researched NTG, applied retroactively to gross savings, can generate conflict regarding the calculation and award of utility shareholder incentives. Following the discussion of the above issues, this section provides a summary of where negotiated or deemed NTG values have been used. Finally, this section addresses the related issue of how to attribute some portion of gas savings to parties other than the program in question and how that affects, if at all, the establishment of the NTG value.

5.1. The Value of Annual Primary Research May Not Justify the Cost

A primary reason for using NTG values is to accurately understand the amount of energy savings a program has generated so that policymakers can be sure ratepayer dollars are being spent in a cost-effective manner. However, conducting the studies uses a large portion of ratepayer dollars dedicated to EM&V (Messenger et al. 2010). Concerns over whether the funds spent on NTG self-report research justify the research costs, when deemed or negotiated values could be used instead, go back many years (e.g., Peters and McRae 2008; Messenger et al. 2010; SEEAction 2012) and continue to stimulate research and discussion (Violette et al. 2015; NEEP 2016).

Peters and McRae (2008) argued that funding self-report NTG research is not the most effective way of spending ratepayer dollars. Rather, research on motivations, behaviors, messaging, and intervention strategies may drive greater energy savings and would be a more cost-effective use of ratepayer funds. Two years later, though, this was still an open issue. In interviews with more than 80 energy efficiency experts, Messenger et al. (2010) found that those seeking more consistency in reporting impacts likely would encounter disagreement on using researched versus stipulated (deemed) NTG values.

SEEAction (2012) suggested that deemed NTG values are best used when "the expense of conducting NTG analyses and/or the uncertainty of the potential results are considered significant barriers." (p. 5-7) The authors caution that deemed NTG values are potentially less accurate than research-based approaches, but do not cite specific data to support that claim. A possible basis for that suggestion is the concern that deemed values should be based on comparison to "similar programs, *hopefully* applied to similar populations with a similar level of efficiency adoption and during a time period similar to that of the program being reviewed" (emphasis added). In other words, the potential for inaccuracy may come from basing the analysis on programs that do not have sufficiently similar populations, over a time period that is not sufficiently similar. Despite this note of caution, the authors suggest that conducting NTG research every few years and using those findings to stipulate NTG ratios for the intervening years is acceptable, "as long as the market influences and participants' behavior are relatively consistent" (SEEAction 2012, 5-7).

More recently, Violette and colleagues (Violette et al. 2015; NEEP 2016) have suggested that deemed or negotiated NTG values are sometimes close enough to the research-generated NTG value that policy decisions would be the same whether negotiated or original NTG values are used.

Violette et al. (2015) analyzed the costs and benefits of doing NTG research in Iowa compared to assuming a NTG value – in this case, a NTG value of 1.0. Specifically, the researchers compared the increased benefits of obtaining better NTG information to the cost of obtaining that information. The analytic model incorporated information on NTG values for similar programs in other jurisdictions to generate a distribution of probabilities for NTG values that differed from 1.0. The researchers then generated cost-benefit ratios under varying assumptions about research cost and rigor, research frequency, risk that true NTG departs from 1.0, and value of program design improvements resulting from NTG research. Under all scenarios, including ones with a low cost and high benefit of NTG research, the model indicated that the cost of annual NTG research outweighs the benefit for a custom C&I program, even compared to a deemed value of 1.0. Although the report does not consider the cost-benefits of NTG research compared to a deemed value of less than 1.0, it seems clear that it would weigh even more heavily in favor of the deemed value.

A guidance document on gross and net savings (NEEP 2016) expands on the earlier work by Violette et al. (2015). The authors of that document encourage utilities to consider the value of the information generated from NTG studies to determine whether the potential value/benefits of original NTG research outweigh the costs of conducting it. The authors recommend that policymakers consider the likelihood that original NTG research would produce information sufficiently different from current assumptions to result in program changes, and on that basis, consider whether updated gross savings and net savings information is needed to inform decision-making or whether spending ratepayer dollars on other types of research (e.g., market research) might be more valuable.

5.2. Reliance on Retroactive NTG Application Can Generate Conflict

Kushler et al. (2014) noted that conflict over net savings methods and results can arise – indeed, *has arisen* – when the results of net savings analyses have substantial financial impacts, such as on utility performance incentives or lost revenue recovery. Those authors noted:

> "Exacerbated by a policy of retroactively applying *ex post* estimates of free ridership, California degenerated into years of argument and litigation regarding the calculation and award of utility shareholder incentives." (p. 23)

Citing a study by the California Public Utility Commission (TecMarket 2010), Kushler et al. (2014) noted that the way in which NTG is calculated could mean the difference between nearly $400 million in earnings and a penalty of more than $100 million. Kushler et al. (2014) recognized that California's experience was an "extreme example," but even a less extreme experience can generate conflict. For those authors, avoidance of such conflict is one of the factors that has led to the "great proliferation" of deemed or negotiated NTG values in recent years.

5.3. Use of Negotiated NTG

Researchers observed strong trends among the US States in using deemed or negotiated NTG values for their programs or portfolios (Kushler et al.2012, 2014; SBW et al. 2013). In their review of 31 state's

policies for estimating net savings, Kushler et al. (2012) found that 19 states use deemed values for their NTG ratios. Several of these states are listed in Table 2, all of which use deemed NTG values for their non-residential custom programs. Reportedly, regulators in Iowa and Arizona deem their NTG ratio at 1.0 because they "have accepted the argument that spillover and market effects balance out free riders" (Khawaja, Haeri, and Hedman 2014, 40).

Table 2: Use of Deemed/Stipulated NTG Values

State	Program(s) or Portfolio	NTG Value
Minnesota[a]	Portfolio	1.0
Arizona[b]	All programs	1.0
Iowa[b]	All programs	1.0
New Hampshire[c]	All programs	1.0
New Jersey[c]	All programs	1.0
New York[a,b]	All programs	.90
Michigan[a]	For all EE programs besides pilot, low-income, and education programs	.90
Hawaii[b]	All programs	.70

[a] Research Into Action, New Horizon Technologies, and Ridge & Associates (2013).
[b] Violette et al. (2015). Note that the information for Hawaii is not consistent with information in the Hawaii Energy 2014 Annual Report (Leidos 2014), which shows program-specific NTG factors and a composite NTG ratio of .78.
[c] Kushler et al. (2014).

Stipulated NTG values of 1.0 are common because many research studies estimating NTG factors have found that free-ridership and spillover roughly cancel each other out (Haeri and Khawaja 2012; Nowak and Witte 2014). Low-income programs and pilot programs targeting emerging technologies generally assume a NTG value of 1.0 because the target audiences demonstrate little free-ridership, as they are unlikely to purchase the newer, more expensive, energy-efficient products on their own.

In addition to the jurisdictions that explicitly identify a deemed NTG value, there are other jurisdictions that may require or encourage NTG research to inform program planning but do not apply NTG to assessments of program savings. In other words, these jurisdictions pay attention only to gross savings, not net, which is logically equivalent to having a stipulated NTG value of 1.0. For example, the Pennsylvania Utility Commission bases compliance with energy and demand reduction targets on gross verified savings, but it nevertheless requires Pennsylvania electric distribution companies to conduct NTG research to inform program design and implementation (GDS, Research Into Action, and Apex 2017). Similarly, as noted elsewhere in this report, utilities in the Pacific Northwest use deemed savings values that take into the account market baseline conditions, which includes free-ridership and spillover. In this case, gross reported savings based on the deemed values are net of free-ridership and spillover. Yet many of those utilities continue to conduct NTG research to inform program planning and implementation (e.g., Roy et al. 2016).

5.4. Attribution of Savings to Other Parties

Finally, it is important to clarify how the above relates to the discussion of "attribution" in the Ontario Energy Board's *Filing Guidelines to the Demand Side Management Framework for Natural Gas Distributors (2015-2000)*. Section 7.2.2 of that document addresses "whether the effects observed after the implementation of a natural gas utility's DSM activity can be attributed to that activity, or at least partly results from the activities of others" (Ontario Energy Board 2014, 21).

The guidance presented in that section addresses two topics. The first – "attribution between rate-regulated natural gas utilities and rate-regulated electricity distributors" – is not relevant to this report, which is concerned only with the attribution of gas savings. Of concern to the present discussion is the second topic – "attribution between rate-regulated natural gas utilities and other parties (e.g., non-rate-regulated entities such as agencies and various levels of government, non-rate-regulated private companies, etc.)." Such other parties might include GreenOn, the Ministry of Environment and Climate Change, and any other large funding body that promotes energy efficiency in Ontario.

The *Filing Guidelines* state that natural gas utilities should establish partnership agreements with such other parties before program launch, specifying the shares (percentages) of natural gas savings to be allocated to the natural gas utilities and the other parties. If the percentage allocated to a given natural gas utility exceeds its percentage of total dollars spent by more than 20%, the utility should provide an explanation for the difference.[8]

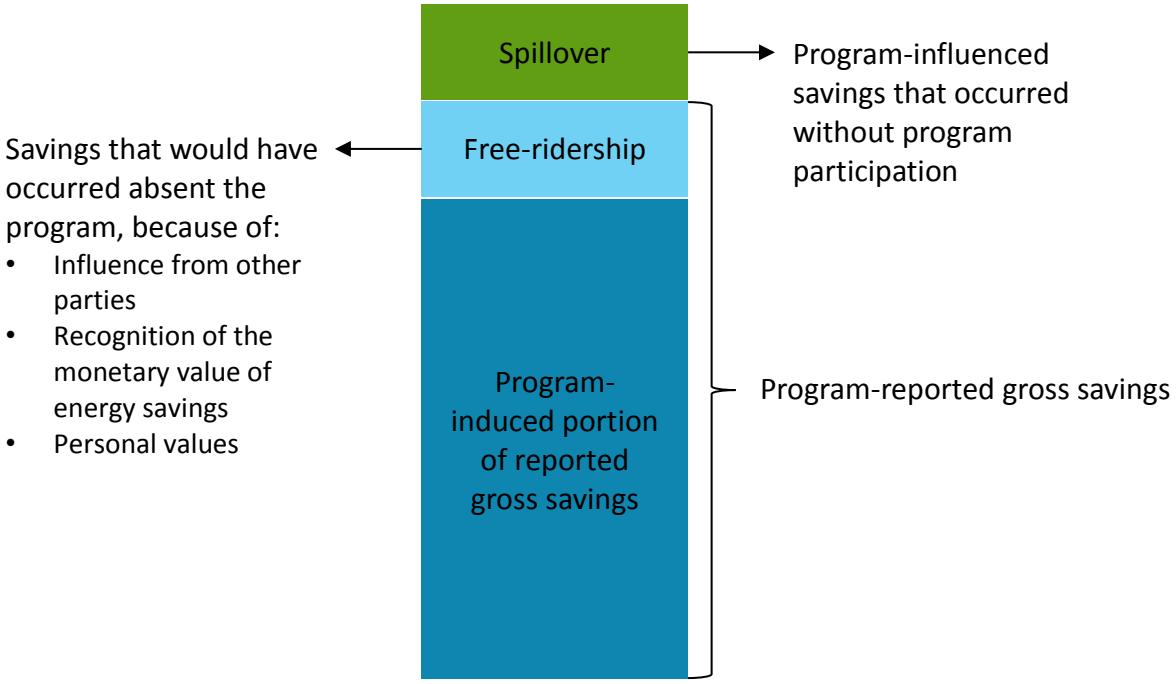
Some attention has been paid to the question of sharing credit for energy savings among multiple influences (e.g., Skumatz and Vine 2010), although we identified no reports detailing a methodology for doing so. The important consideration for this issue, however, is whether the above reference to the allocation of natural gas savings refers to *gross* or *net* savings. The discussion in the introductory paragraphs of section 7.2 of the *Filing Guidelines* suggests that it refers to the *net* savings, as defined in section 2 of this report. Specifically, those sections refer to applying "attribution" as an adjustment factor separate from free-ridership and spillover. This seems to imply that the "attribution" adjustment, as defined above, would occur after adjusting for free-ridership and spillover.

We believe that such an approach is inconsistent with the meaning of *gross* and *net* savings as universally used in the energy efficiency evaluation community. In particular, it is inconsistent with the definition of free-ridership as the program-claimed savings that would have occurred without program assistance – meaning that net savings are those that occurred *only because of the program's assistance*. Another way of stating this is that the counterfactual in freeridership assessment theoretically incorporates all other influences, including the influence of those "other parties" identified above. Figure 4 illustrates this point.

Thus, we believe that the allocation of natural gas savings, as established in partnership agreements with other parties before program launch, should apply to gross program savings. Specifically, it should *come out of* the assessed free-ridership portion of gross savings. If done after the application of free-ridership adjustments, then the utility is penalized twice for the effects of the same external influences.

[8] The *Filing Guidelines* actually state that an explanation is needed when the natural gas utilities' allocated share of natural gas savings in the partnership agreement is "more than 20% of" (i.e., more than one-fifth of) the "percentage of total dollars spent" (p. 22). We believe this is not consistent with the example provided in a footnote of the *Filing Guidelines*, but the interpretation in the text of the current document is consistent with that example.

Figure 4: Components of Program Gross and Net Savings, Including Attribution to Other Parties



6. Conclusions and Recommendations

Regulators are rightly concerned about ensuring that energy efficiency programs not receive credit for energy savings that they did not cause. If there are no checks in place to ensure accurate assessment of attribution of savings, then program designers and implementers may not get the feedback needed to adjust and fine-tune programs to deliver the most savings possible for the dollars spent.

Yet the preceding sections of this report identify many potential problems with the way that net savings assessment has been conducted. Particularly problematic are self-report methods, which are very common for their low cost and ease of administration. Respondent self-selection bias as well as several very well-documented psychological propensities can easily result in over-estimation of free-ridership. A lack of statistical precision can produce estimates that may change notably from year to year. Spillover often is not included in NTG ratios and, when it is, it may very likely be under-estimated. Moreover, while the inclusion of spillover generally would increase the accuracy of a NTG estimate, it *decreases* the *precision* of NTG estimates because the separate estimates of free-ridership and spillover each contribute to the variance of the combined estimate. On top of all of the above – or perhaps, largely as a result of it – applying variable and unpredictable NTG adjustments retroactively can lead to conflict and litigation from dissatisfied shareholders.

Even apart from the above considerations, some evaluators (e.g., Violette et al. 2015) have concluded that the value of annual NTG research may not justify the cost. This conclusion applies even to self-report methods, which are probably the least expensive primary research methods to implement.

What, then, is the alternative to conducting program-year-specific primary NTG research? Based on our foregoing review and analysis, we offer the following recommendations to OEB and the natural gas utilities:

- **Develop a negotiated (also called "deemed" and "stipulated") NTG value.** This value should be based on a range of inputs, including a review of researched NTG values from similar programs in comparable jurisdictions that account for free-ridership and spillover, at a minimum, but also market effects if possible. Assessment of applicable NTG values from multiple studies should not treat all inputs equally but should follow a meta-analytic approach, which includes reviewing the study quality, assessing study heterogeneity, and developing a pooled estimate of variability based on the variabilities reported in the studies. The pooled estimate is a better representation of what the true estimate is in the population and it can provide insight into variability around NTG that are important to consider when determining what the value should be. Part of reviewing study quality should include assessing efforts taken to reduce the self-report biases identified in section 3. Other inputs to the negotiated NTG value should include structured expert judgment and any available market data or macroeconomic analyses. In developing the negotiated value, it may be valuable to employ a "value of information" approach, such as described by Violette et al. (2015).

- **Allocate any savings to parties other than the program only from the free-ridership portion of gross savings.** By definition, free-ridership represents the program-claimed savings that would have occurred without program assistance, which must include savings attributable to other parties. Allocating savings net of free-ridership to other parties doubly penalizes the program.

As noted in the body of this report, establishing a negotiated NTG value does not preclude doing NTG research, as such research may be valuable for program planning and implementation as well as to inform periodic adjustments to the negotiated NTG value. We recommend that OEB and the natural gas utilities observe the following when NTG research is conducted:

- **Always include spillover and, if feasible, market effects assessments.** As documented in the body of this report, failure to account for these factors will underestimate NTG.
- **If using self-report, employ methods to reduce the bias toward high free-ridership.** Energy Trust of Oregon, with input from Research Into Action, Inc., developed an approach to free-ridership assessment that attempts to control for the high-free-ridership bias of other self-report methods in addition to reducing customer fatigue (see Bliss, McClaren, Folks, and Kociolek, 2015; Roy and Bliss 2012). This alternative approach balances the counterfactual assessment with a component that assesses the influence of the various program interventions, which typically produces a lower free-ridership estimate than the counterfactual (PWP and Evergreen Economics 2017).
- **Assess free-ridership as close as possible to project implementation.** The longer the time that has elapsed between the implementation of the project and the assessment of the decision-making that went into the project, the less salient the external influences (including the program influence) will be to the program participant and the more likely that participant will be affected by the biases toward free-ridership responses.
- **Use multiple methods and triangulate the NTG estimate.** The use of multiple methods, such as surveys of contractors as well as program participants, is now generally regarded as best practice among energy efficiency experts (Kushler et al. 2014; PWP and Evergreen Economics 2017).

Following the above recommendations may allow the natural gas utilities to continue offering large C&I customers in Ontario opportunities to generate high energy savings through custom programs that may not otherwise be achievable.

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