GEC Response to APPrO Interrogatory #1

Question:

Reference: L.GEC.1

i) Page 27, first bullet point[1]

> ***Continuing Union's large industrial program for T2/R100 customers.***
> *Experience from 2013 and 2014 suggests that would – by itself – roughly double Unions forecast savings for 2016 to 2020*

ii) Page 31

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 *While Union's estimate of free ridership is admittedly based on an outdated study, its implicit conclusion that there are substantial cost-effective savings that large customers would not pursue absent efficiency programs is consistent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

ii) Page 32

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

Preamble: Mr. Neme makes a statement about potentially doubling Union Gas Limited's (**Union**) savings 2016-2020 by continuing Union's large industrial program for T2/Rate 100 customers. This statement may rely on a free ridership estimate. APPrO would like understand the basis for this statement and whether the Navigant study is representative of Union's T2/Rate 100 customers.

a) Please confirm that the statement made in Reference i) was based on the free ridership rate of 54% that was established in 2008 by Summit Blue. If not confirmed, please explain.

b) Please confirm that the above-noted 2008 Summit Blue study was based on a study published using data that was collected pre-2008.

c) In Reference ii) Mr. Neme recognizes that the Union's free ridership study is out of date, and uses a Navigant report to support the contention that there are still significant savings in utility Custom Commercial and Industrial (**C&I**) programs based on an evaluation of 24 US jurisdictions.
   i. The link in footnote 69 of Mr. Neme's evidence was broken; please provide a correct link to the referenced Navigant Study.
   ii. Please indicate if Mr. Neme assisted Navigant in its research or preparation of the report in any way. If so, please provide details regarding the support that was provided.
   iii. Please provide a description of the methodology used by Navigant to obtain the information for its report.
   iv. Please list the major assumptions that Navigant used to collect and analyze the information.
   v. Please confirm that Union offers custom C&I programs to the following rate classes: M4, M5, M7, T1, and Rate 20 categories, in addition to T2 and Rate 100. If not confirmed, please explain.
   vi. Please confirm that Enbridge Gas Distribution Inc.'s (**EGD**) custom C&I programs are offered to rate classes 6, 110, 115, 135, 145, and 170. If not confirmed, please explain.

Witness: Chris Neme

vii. Please list each of the 24 jurisdictions that were used to come up with Navigant's conclusions noted in Reference ii). Please also provide the rationale why these 24 jurisdictions were selected vs a comprehensive review.
viii. Please confirm that the Navigant also expressed concern about the accuracy of their results. If not confirmed, please explain.
ix. Please provide the specific Navigant reference to support Mr. Neme's statement "*….the average free rider rate….was between 30% and 40%".*

d) Please confirm that if the customer were to complete energy efficiency measures independent of a mandatory rate payer funded DSM program, the energy savings could still occur. If so, please confirm that such independent measures would not be accounted for within the utility DSM program. If not confirmed, please explain.
e) Please confirm that if DSM budgets were to be reallocated to T2 and Rate 100 rate classes, the DSM budget for other rate classes would decline and the related energy savings in those rate classes would also decline. If not confirmed, please explain.
f) Please provide an estimate of the annual energy savings that would be lost from other rate classes if DSM budgets were to be reallocated to rate T2 and Rate 100.

Response:

a) It implicitly assumes a net-to-gross ratio that is consistent with the combination of a free rider rate in that ballpark and no spillover.
b) The 2008 Summit Blue study was not based on another study (regardless of vintage). Rather it collected its own data during the winter of 2007-2008.
c) Responses as follows:
    i. See attached.
    ii. He did not. The study was commissioned by the Technical Evaluation Committee (TEC). A subcommittee of the TEC was created to oversee the work. Once the subcommittee felt a draft report was ready for the full TEC to review, the full TEC review took place. Mr. Neme was a member of the TEC at the time the study was commissioned (and is still now), so he did have an opportunity to review and provide comments on the draft report. He was not a member of the TEC subcommittee overseeing the work.
    iii. Navigant provides an extensive description in its report.
    iv. See the attached Navigant report.
    v. Union Gas can confirm which rate classes are eligible for custom programs.
    vi. Correct, according to EB-2015-0049, Exh B/T2/S1 pages 8 and 11.
    vii. My understanding is that intention of the study was to be as broad and comprehensive as possible. As the report states, Navigant started by reviewing the net-to-gross (NTG) approaches used in 42 different jurisdictions. A portion of those do not do not adjust gross savings, so they were obviously not candidates for review of NTG studies. Ultimately, a short list of jurisdictions and programs that were deemed comparable to Union's and Enbridge's programs (in terms of customer segments and program design) was chosen. The results cover nine jurisdictions, nineteen different studies

and thirty-eight different programs. The list of jurisdictions whose studies were reviewed is provided in Navigant's report.

viii. Not confirmed. A search of the document suggests that Navigant did not use the word accuracy even once. The word "concern" arises only once, in a sentence in which Navigant notes that there is a slight trend in recent years to higher net-of-free rider estimates, but that the trend isn't so significant that the TEC should have concern about using Navigant's estimated average values (see p. 20 of the report).

ix. See the following quote from the Executive Summary of the report regarding gas C&I programs:

> *The average net-of-free ridership value is 68%. As expected, NTG values are larger when considering spillover. Average net-of-free ridership & PSO value is 86% and average net-of-free ridership & spillover value is 87%...* (p. iv)

Also, see the Figure 9 on p. 24 which graphs values separately for custom C&I programs and prescriptive C&I programs. It appears to suggest that the average NTG when considering only free ridership is in the 60% to 70% range. If one also accounts for spillover effects, the values increase. In fact, there is not a single study that estimated NTG less than about 55% for custom C&I programs when including both free ridership and spillover effects, and the average appears to be on the order of 80% to 85%.

d) Confirmed.

e) Not confirmed. That statement would only be true if one presumed that Union was not permitted to increase its budget to account for spending on T2/R100 customers. As noted in my testimony, the Board's DSM guidelines are just guidelines, not binding regulatory constraints. Moreover, the budget suggested for Union in the guidelines was presumably established while the Board was cognizant of the fact that it was simultaneously suggesting not offering programs to those rate classes. It is not clear whether the same budget guideline would have been put in place by the Board if it has not suggested terminating Union's self-direct program.

f) A precise answer would require careful consideration of which program and/or budget categories in Union's proposed 2016-2020 plan would be most appropriate to reduce. However, a rough estimate can be developed as follows:

- Union spent approximately $4.1 million on its large industrial program in 2014; approximately 80% of that – or $3.25 million – could be said to be associated with just the T2 and R100 customers. That is roughly equal to 5.7% of Union's proposed average annual 2016-2020 DSM budget.
- Union forecasts in its plan that it will achieve an average of 1.23 billion lifetime m^3 savings per year from its 2016 to 2020 programs.
- If Union reduced its budget equally for all other programs by 5.7% of its annual budget, it would reduce savings from non-T2/R100 customers by approximately 70 million lifetime m^3 each year.

Note that Union estimates that the level of budget shift contemplated above produced roughly billion lifetime m^3 savings from T2/R100 customers in 2014 – even after adjusting for an assumed 54% free rider rate.

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Custom Free Ridership and Participant Spillover Jurisdictional Review

Prepared for:
Sub-Committee of the Ontario
Technical Evaluation Committee

May 29, 2013

Prepared by:
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Executive Summary

Union Gas Limited (Union) and Enbridge Gas Distribution (Enbridge) have delivered Demand Side Management (DSM) initiatives since 1997 and 1995, respectively, including programs that involve custom projects in the commercial and industrial (C&I) sectors. In 2007-2008, Summit Blue Consulting (now part of Navigant's Energy Practice) conducted the first attribution study of Union and Enbridge's custom C&I programs to evaluate free ridership (FR) and spillover effects. After the study, the Ontario Energy Board (OEB) approved the FR adjustment, but did not approve the spillover factor. Since that time, there have been a host of program environment changes, including economic conditions, energy prices, advances in technology, as well as changes in the design and delivery of the custom programs. As a result, Ontario's Technical Evaluation Committee (TEC) is prioritizing updates to FR and spillover adjustment factors as part of its mandate.

This report provides information to support a sub-committee of Ontario's TEC in its deliberations on the appropriate approach to Net-to-Gross (NTG) values in Ontario. Through a jurisdictional review of the approach to net savings, and a review of researched NTG values for programs comparable to Union and Enbridge's custom C&I gas programs, Navigant provides an assessment of the various approaches to NTG.

ES 1. Report Objectives

There are a range of options for NTG that could be adopted for natural gas DSM programs in Ontario, from transferring NTG values from similar jurisdictions and programs to conducting research to estimate a NTG value.

The objective of this report is to provide information to assist the TEC sub-committee in their determination on the appropriate approach to NTG for DSM programs in Ontario, and not to provide a specific recommendation. While this report is not comprehensive in addressing all potential considerations, such as other benefits of accurate (costs of inaccurate) NTG values, it provides important information relevant to the discussion. In addition to summarizing the regulatory and methodological approach taken by other jurisdictions, and summarizing NTG values for programs with characteristics similar to Union and Enbridge's custom C&I programs, Navigant provides insight into the risks associated with inaccurate NTG values and the approximate cost of mitigating those risks.

ES 2. Key Findings

To achieve the objective of this report, Navigant (1) reviewed the approach to net savings across a wide array of jurisdictions in the United States and Canada to identify trends in the regulatory and methodological approach to net savings, (2) conducted a review of researched NTG values of non-residential gas programs in selected jurisdictions, and (3) conducted a decision analysis to assess the options for NTG. Key findings are presented for each of these.

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Approach to Net Savings

Navigant conducted research to provide a summary of the regulatory and methodological approach to net savings adopted by jurisdictions across North America. In total, Navigant reviewed the approach to net savings taken by 42 jurisdictions across North America, representing the vast majority of jurisdictions with ratepayer-funded energy efficiency programs.

The majority of jurisdictions with ratepayer funded energy efficiency programs conduct NTG research, though only half adjust gross savings based on research. While there appears to be a trend towards considering participant and non-participant spillover in NTG research in recent years, the majority of research only includes FR adjustments. Both FR and spillover are most commonly estimated through a self-report (participant survey) approach, though econometric methods (e.g., billing analysis) and market share modeling approaches are occasionally used.

Navigant also researched whether jurisdictions offer utility performance incentives for meeting their savings goals. U.S. states that provide a performance incentive mechanism for utilities or program administrators are more likely to make deemed or researched NTG adjustments.

Researched NTG Values in Selected Jurisdictions

Navigant reviewed a total of 19 documents that conducted NTG research of non-residential gas programs covering nine jurisdictions in North America, including: California, Colorado, Massachusetts, Minnesota, New Jersey, New Mexico, Oregon, Washington, and Wisconsin. Within these 19 documents, 38 distinct NTG values were reported.

Different formulations of NTG values are presented, with each including or excluding different NTG factors. In particular, the following NTG values are presented:

- Net-of-free ridership = 1- FR,
- Net-of-free ridership and participant spillover = 1 – FR + PSO, and
- Net-of-free ridership and all spillover = 1- FR + PSO + NPSO
  (Note: NPSO is non-participant spillover)

This approach conveys information on NTG values based on the common definitions across the studies, and avoids inappropriate comparisons that could result from comparing the studies' reported NTG values when they include different components.

A review of researched net-of-free ridership values for non-residential gas programs exhibits a wide dispersion (21% to 100%) with a slight "clustering" of values between 40% and 90%, as shown in Figure ES-1. The average net-of-free ridership value is 68%. As expected, NTG values are larger when considering spillover. Average net-of-free ridership & PSO value is 86% and average net-of-free ridership & spillover value is 87%, suggesting that NPSO is small for non-residential gas programs.

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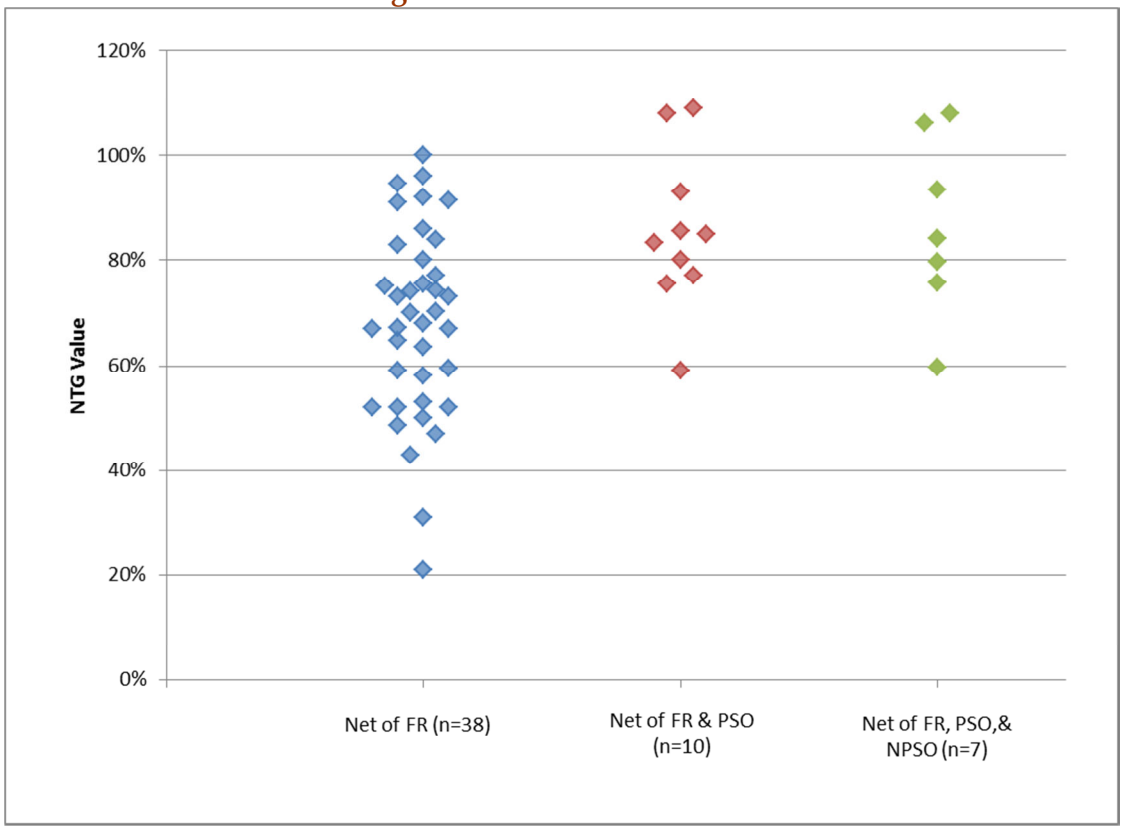
Figure ES-1. NTG Values



Source: Navigant analysis. Note that the sample size (n) represents the number of unique NTG values (program-utility-year combinations) reported in the 19 studies.

To provide additional context Navigant reviewed NTG values by study, program year and region and found that the variation in NTG values did not appear to be driven by the program evaluator, program year, or region. Navigant also examined whether variation in NTG values resulted from differences in the analytic rigor of the methodology (all used self-reports), using enhanced self-report methods in the form of trade ally feedback as a proxy. Free ridership values appeared lower with the inclusion of trade ally feedback. Finally, Navigant compared electric NTG values to gas NTG values for studies that reported both values and found that gas NTG values exhibited a wider dispersion.

Navigant also reviewed researched NTG values based on specific program characteristics: program type, customer segment, utility-type, program maturity, and program marketing strategy. Trends in NTG values are less defined and should be interpreted with caution due to the small sample sizes. Nevertheless, some trends emerged: NTG values for custom programs exhibited a wider dispersion than programs offer prescriptive incentives or both, programs offered by gas-only utilities appear to have lower FR than programs offered by combination utilities, and FR appears to be greater with program maturity.

Figure ES-2 presents the net-of-free ridership values for program characteristics that are most similar to Union and Enbridge's custom C&I programs. In addition, Union and Enbridge's

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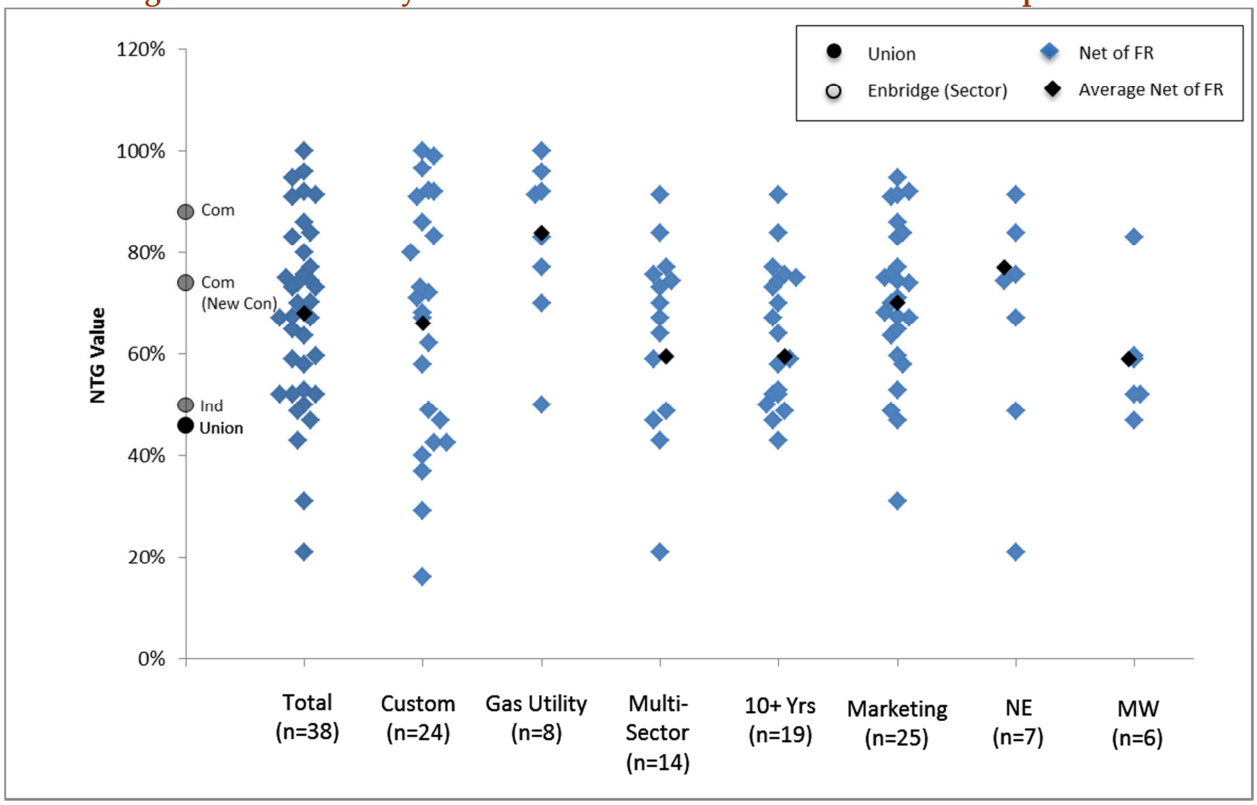
current NTG values, based on the 2007-2008 research conducted by Navigant (formerly Summit Blue Consulting) are presented. Note that Union currently uses one NTG value for C&I custom programs while Enbridge uses sector-specific NTG values.

Figure ES-2. Summary of Relevant Researched Net-of-Free Ridership Values



Source: Navigant analysis. Note that the sample size (n) represents the number of unique NTG values (program-utility-year combinations).

Both Union and Enbridge's current NTG values are within the range of researched values. Union's NTG value is below the average value. Enbridge's NTG value for the commercial sector is above the average value while the NTG value for the industrial sector is below the average value.

Assessing Options for NTG

Gross savings can usually be estimated quite accurately, however, estimating net savings poses greater challenges. Given the uncertainty around any NTG value, Navigant applied a Decision Analysis approach for organizing information around alternative approaches to setting NTG values.

There are a number of benefits resulting from more precise NTG values, including the ability to improve program design and implementation, more accurate utility incentive payments, and the ability to consider energy savings as a resource. Navigant conducted a value of information

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(VIF) analysis on the second benefit, incentive payments, as the benefit/cost of improved information can be easily quantified.

To support the VIF analysis, Union and Enbridge conducted a sensitivity analysis of utility incentive payments resulting from their custom programs, using a +/- 10 percentage point margin of error on the custom programs NTG values. This analysis revealed that improving the precision of custom NTG values has a sizable impact on incentive payments. Table ES-1 and Table ES-2 present a value of information analysis for Union and Enbridge respectively at targeted net savings.

Table ES-1. Value of Information Assessment for Union

	NTG Value for Custom Programs		Incentives	Change in Incentives
Base Case:	**Current NTG** NTG = 0.46	→	Incentives = $2.73 M	
Scenario 1:	**Higher True NTG** NTG = 0.56	→	Incentives = $5.63 M	**(+$2.90 M)**
Scenario 2:	**Lower True NTG** NTG = 0.36	→	Incentives = $0.8 M	**(-$1.93 M)**

Source: Sensitivity analysis provided by Union.

Table ES-2. Value of Information Assessment for Enbridge

	NTG Value for Custom Programs		Incentives	Change in Incentives
Base Case:	**Current NTG by Program** Commercial = 0.80 Commercial New Construction = 0.74 Industrial = 0.50	→	Incentives = $2.58 M	
Scenario 1:	**Higher True NTG** Commercial = 0.90 Commercial New Construction = 0.84 Industrial = 0.60	→	Incentives = $4.26 M	**(+$1.68 M)**
Scenario 2:	**Lower True NTG** Commercial = 0.70 Commercial New Construction = 0.64 Industrial = 0.40	→	Incentives = $1.45 M	**(-$1.13 M)**

Source: Sensitivity analysis provided by Enbridge.

The penalty for assuming a NTG value that is +/- 10 percentage points different from the actual NTG value is roughly $1 to $3 million in utility incentive payments, as shown in Figure ES-3. If the cost of revising the NTG values is less than $0.5 million then revising the values *could be judged to be warranted* assuming NTG research could reduce the margin of error by one-half (i.e., the range of the likely true NTG values).

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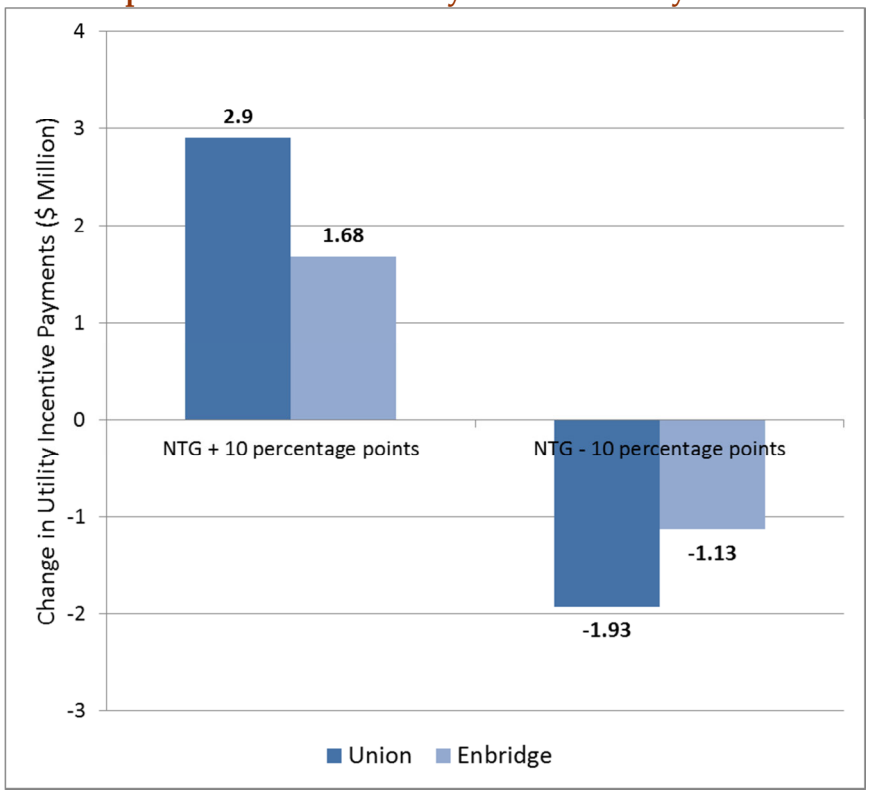
Figure ES-3. Comparison of the Sensitivity of Incentive Payments to NTG Values



Source: Sensitivity analyses provided by Union and Enbridge.

Navigant provides a brief review of five general approaches to NTG, providing an estimate of the improved precision of the NTG value and the approximate cost per utility (Table ES-3). Alternate NTG approaches could improve the precision of NTG values by approximately 50% at an approximate cost of $0.25 - $0.50 million per utility.

Table ES-3. Ability of NTG Approaches to Produce More Precise NTG Values

General NTG Approach	Estimated Improved Precision (or Reduced Range) of NTG Value	Cost of NTG Approach per Utility (approximate)
Transfer NTG Values from Other Research	Little change	$3 – 5k
Adjust NTG Values based on Program Factors	Little change	$5 – 10k
Align NTG Values using Limited Primary Data	3 percentage points	$100 – 200k
Full NTG Research Study – After Program Year	5 percentage points	$250 – 500k
Integrated/Fast Feedback NTG Estimation	5 percentage points	$250 – 500k

Source: Navigant analysis.

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1. Introduction

This report provides information to support the sub-committee of Ontario's TEC in its deliberations on the appropriate approach to NTG values in Ontario. Through a jurisdictional review of the approach to net savings, and a review of researched NTG values for programs comparable to Union and Enbridge custom C&I gas programs, Navigant provides an assessment of the various approaches to NTG.

1.1 Background

Union and Enbridge have delivered Demand Side Management (DSM) initiatives since 1997 and 1995, respectively, including programs that involve custom projects in the C&I sectors. Custom projects cover opportunities where savings are linked to unique end uses and technologies. The DSM portfolio for both utilities includes several hundred custom projects annually. Union and Enbridge DSM activities are regulated by the OEB.

In June, 2011, Union and Enbridge entered into a new DSM regulatory framework. In addition to filing comprehensive, multiyear program plans, Union and Enbridge established Terms of Reference (ToR) for engaging stakeholders. The ToR established engagement processes, and included the creation of a common TEC for both gas utilities. The goal of the TEC is to "establish DSM technical and evaluation standards for measuring the impact of natural gas DSM programs in Ontario."[1]

In 2007-2008, Navigant (formerly Summit Blue Consulting) conducted the first attribution study of Union and Enbridge's custom C&I programs to evaluate FR and spillover effects.[2] The OEB approved the FR adjustment, but did not approve the spillover factor. Since that time, there have been a host of program environment changes, including economic conditions, energy prices, advances in technology, as well as changes in the design and delivery of the custom programs. As a result, the TEC is prioritizing updates to FR and spillover adjustment factors as part of its mandate.

1.2 Report Objective

There are a range of options for addressing net savings that could be adopted for natural gas DSM programs in Ontario, from deeming a NTG value to conducting research to estimate a NTG value. The objective of this report is to provide information to assist the TEC sub-committee in their deliberations on appropriate approaches for developing an NTG value for these programs. This report is not meant to provide a specific recommendation, but rather to

[1] *2012 Custom Free Ridership and Participant Spillover Jurisdictional Review Request for Proposal,* Ontario Natural Gas Technical Evaluation Committee, October 29, 2012.

[2] *Source:* Summit Blue Consulting. 2008. *Custom Projects Attribution Study.* Union Gas Limited and Enbridge Gas Distribution, October 27, 2008.

provide information on the range of approaches to assist the TEC sub-committee in making their determination.

The steps taken to achieve this objective include the following:

- Understand the portfolio of Union and Enbridge's custom C&I gas programs (Section 3)
- Review the approach to net savings across a wide array of jurisdictions in the United States and Canada to identify trends in the regulatory and methodological approach to net savings (Section 4)
- Conduct a review of researched NTG values of non-residential gas programs in selected jurisdictions (Section 5)
- Conduct a decision analysis to assess the options for NTG (Section 0)

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2. Methodology

This section describes the methodology Navigant employed to provide information to assist the TEC sub-committee in their deliberations on the appropriate approach to NTG for custom natural gas DSM programs in Ontario. The sub-sections that follow discuss the four distinct tasks conducted by Navigant:

- Reviews of the custom C&I natural gas programs,
- Summary of research methods and regulatory approaches to net savings,
- Review of researched NTG values in selected jurisdictions, and
- Assessing options for updating NTG values for these programs.

2.1 *Union and Enbridge Programs*

To develop an understanding of the portfolio of Union and Enbridge's custom C&I gas programs, Navigant conducted a review of the following:

- Description of programs included in the *2012 Custom Free Ridership and Participant Spillover Jurisdictional Review* request for proposal, and
- Union and Enbridge program websites.

Union and Enbridge also provided additional information on features of program design and implementation as requested by Navigant.

2.2 *Approach to Net Savings*

Navigant conducted research to provide a summary of the regulatory and methodological approach to net savings adopted by jurisdictions across North America, as well as whether jurisdictions offer utility performance incentives for meeting their savings goals. The research methodology included a review of:

- Utility websites,
- Regulatory agency websites,
- Websites of research/advocacy groups such as the Regulatory Assistance Project (RAP), American Council for an Energy-Efficiency Economy (ACEEE), Consortium for Energy Efficiency (CEE), and the Edison Foundation, and
- Studies that previously surveyed the approach to net savings.[3]

In total, Navigant reviewed the approach to net savings taken by 42 jurisdictions across North America, representing the vast majority of jurisdictions with ratepayer-funded energy efficiency programs. In addition, a review of the approach to net savings in nine selected jurisdictions is discussed in the following section.

[3] Refer to 7.Appendix A for a list of references for methodological resources.

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2.3 *Researched NTG Values in Selected Jurisdictions*

To provide the TEC sub-committee with a comprehensive review of researched NTG values Navigant worked with the TEC sub-committee in an iterative process to identify relevant jurisdictions/ programs and accompanying evaluation studies. The research methodology included:

- Review of program evaluations conducted by Navigant and Summit Blue Consulting (acquired by Navigant in 2010),
- Review of program evaluations identified by Navigant staff,
- Review of the Northeast Energy Efficiency Partnerships' Repository of State and Topical EM&V Studies,
- Search of the California Measurement Advisory Council searchable database,
- Search of the Consortium for Energy Efficiency searchable database,
- Review of State and Utility websites for program evaluations and filings,
- General internet searches for program evaluations, and
- Outreach to industry professionals.

This list was revised to develop a shortlist of programs comparable to Union and Enbridge's programs, accounting for factors such as customer segment and program design. Additional studies were excluded due to the methodology employed and/or the applicability of the reported NTG values.[4]

NTG values for programs targeting natural gas savings is the focus of this report due to the greater than expected availability of gas utility studies, as well as combination utility studies where natural gas NTG values were reported separately.

A total of 19 documents[5] were selected covering nine jurisdictions in North America, including: California, Colorado, Massachusetts, Minnesota, New Jersey, New Mexico, Oregon, Washington, and Wisconsin. In some cases, one document reported NTG values for multiple programs, multiple utilities, or multiple program years. In total, 38 distinct NTG values were reported. Table 1 presents the number of distinct values reported across the 19 documents.

[4] Refer to Appendix B for an example of two notable studies/jurisdictions excluded from the analysis.
[5] Refer to Appendix C for an annotated bibliography of these documents.

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Table 1. Documents Reviewed and Distinct NTG Values Reported

Document Number and Title	Number of Distinct Values Reported	Reason for Including Multiple Values
1. 2004/2005 Statewide Express Efficiency and Upstream HVAC Program Impact Evaluation	4	NTG values reported for 4 utilities: PG&E, SDG&E, SCE, and SCG.
2. 2004-2005 Statewide Nonresidential Standard Performance Contract Program Measurement and Evaluation Study	2	NTG values reported for 2 investor-owned utilities: PG&E and SDG&E.
3. 2006-2008 Retro-Commissioning Impact Evaluation	4	NTG values reported for 4 utilities: PG&E, SDG&E, SCE, and SCG.
4. 2011 Commercial and Industrial Natural Gas Programs Free-Ridership and Spillover Study	6	NTG values reported for 6 utilities: NSTAR, Unitil, New England Gas, National Grid, Columbia Gas, and Berkshire Gas.
5. Evaluation of 2011 DSM Portfolio	2	NTG values reported for 2 programs: Commercial Solutions and SCORE pilot.
6. Fast Feedback Results	3	NTG values reported for 3 programs: Existing Multifamily, Existing Buildings, and Industrial Production Efficiency.
7. Impact and Process Evaluation of the 2006-2007 Building Efficiency Program	2	NTG values reported for 2 program-years: 2006 and 2007.
8. Evaluation of Building Efficiency Program 2004 & 2005	2	NTG values reported for 2 program-years: 2004 and 2005.
9. Impact and Process Evaluation of the 2006-2007 New Building Efficiency Program	2	NTG values reported for 2 program-years: 2006 and 2007.
10. Focus on Energy Evaluation: Business Programs Impact Evaluation Report – Last Quarter of Calendar Year 2009 and First Two Quarters of Calendar Year 2010	2	NTG values reported for 2 program-years: 2009 and 2010.
11. 2006-2008 Evaluation Report for PG&E Fabrication, Process and Manufacturing Contract Group	1	N/A
12. Evaluation of the Southern California Gas Company 2004-2005 Non-Residential Financial Incentives Program	1	N/A
13. Comprehensive Process and Impact Evaluation of the Business Heating Efficiency Program - Colorado	1	N/A

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Document Number and Title	Number of Distinct Values Reported	Reason for Including Multiple Values
14. New Jersey's Clean Energy Program Energy Impact Evaluation: SmartStart Program Impact Evaluation	1	N/A
15. Commercial and Industrial Energy Efficiency Retrofit Custom Programs Portfolio Evaluation	1	N/A
16. Focus on Energy Evaluation: Business Programs – Additional Looks at Attribution	1	N/A
17. Focus on Energy Evaluation: Semiannual Report (Second Half of 2009)	1	N/A
18. Focus on Energy Evaluation: Semiannual Report (First Half of 2009)	1	N/A
19. Achieving Natural Gas Savings Goals: Commercial Heating Programs Heat It Up	1	N/A
Total: 19 Documents Reviewed, 38 Distinct Values Reported		

Source: Navigant analysis.

Navigant reviewed these selected documents to summarize methods used to assess NTG values across these jurisdictions. The following estimates from these studies are reported:

- Net-of-free ridership = 1- FR,
- Net-of-free ridership and participant spillover = 1 – FR + PSO, and
- Net-of-free ridership and all spillover = 1- FR + PSO + NPSO
  (Note: NPSO is non-participant spillover)

This approach conveys information on NTG values based on the common definitions across these studies, and avoids inappropriate comparisons that could result from comparing the studies' reported NTG values when they include different components. Table 2 presents the distribution of the different NTG factors reported across the 38 distinct values.

Table 2. NTG Values Reported

	NTG Values Reported by Adjustment Factor Included	Net-of-NTG Factors
FR	28	38
FR & PSO	3	10
FR, PSO & NPSO	7	7

Source: Navigant analysis.

A total of 28 NTG values reported adjust for FR only, 3 adjust for FR and PSO, and 7 adjust for FR, PSO, and NPSO. The last column shows the information gained from presenting net-of-NTG component values. For example, all 38 of the NTG values reported include values for FR.

Rather than just present the NTG values that adjust for FR only (n=28), the net-of-NTG component values are presented. In this case, (1 – FR) (n=38).[6]

In addition to these studies, Navigant also reviewed the 2008 evaluation of Union and Enbridge's custom projects program conducted by Summit Blue Consulting.[7]

2.4 *Assessing Options for NTG*

Given the uncertainty around NTG values, Navigant applied Decision Analysis methods to illustrate the risks faced by utilities and ratepayers when NTG values are uncertain and provide information on the benefits and costs of choosing one approach to net savings over another.

Navigant took the following steps to conduct the Decision Analysis:

1. Define the benefits of accurate (and costs of inaccurate) NTG values in a general context.
2. Narrow the focus the analysis on the benefits/costs for which Navigant had access to data; specifically, the incentives paid to utilities based on the estimated net savings (m^3) achieved by custom programs.
3. Establish a baseline against which a sensitivity analysis can be conducted where a selected NTG value is assumed to be correct, but in fact is incorrect by some margin of error.[8] The sensitivity analyses were conducted independently by Union and Enbridge and were not verified by Navigant.
4. Conduct a "value of information" analysis by examining the change in incentive payments resulting from better information on NTG values compared to the cost of obtaining the information (e.g., through NTG research).

In addition, Navigant organized the results of the Decision Analysis to provide insight into the tradeoffs from using different approaches to setting an NTG value, ranging from transferring values based on the jurisdictional review to conducting NTG research.

The next section (Section 3) presents an overview of the Union and Enbridge C&I programs to provide context. Following this program overview, Section 4 discusses the regulatory approach and methodological approach to NTG used by different jurisdictions followed by a review of researched NTG values in selected jurisdictions (Section 5). Finally, Section 0 presents the decision analysis for assessing alternate approaches to NTG.

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[6] Because the documents reviewed contain varying degrees of detail and explanation, the Navigant team applied its best interpretation of these documents to synthesize the available information in a consistent manner.

[7] Summit Blue Consulting. 2008. *Custom Projects Attribution Study.* Union Gas Limited and Enbridge Gas Distribution, October 27, 2008.

[8] These first three steps are part of a "loss function" analysis which identifies the costs of selecting one NTG value when another value is the actual value.

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3. Overview of Union and Enbridge Custom Programs

Union and Enbridge have been delivering natural gas DSM programs for over 10 years, including custom programs for the C&I sectors. This section provides an overview of these programs.

3.1 Union Custom Programs

Union offers the Custom Savings Program to C&I customers. Within the custom program umbrella there are numerous program offerings providing a combination of technical assistance and financial incentives:

- **Engineering Feasibility Study.** These comprehensive engineering analyses and assessments include both whole facility and end-use focused studies. Example projects include thermal surveys, HVAC audits, energy audits, and energy benchmarking.
- **Steam Trap Survey.** These studies focus exclusively on the use and efficiency of steam traps, and seek efficiencies in the discharge of condensation, air, and other non-condensable gases without losing steam.
- **Process Improvement Study.** This offering targets industrial facilities through comprehensive process improvement studies conducted by industry-specific production and energy utilization experts. Example projects include steam plant audits, process integration analyses, heating integration studies, and process operation improvement studies.
- **Integrated Energy Management Systems.** This program offering provides technical assistance and financial incentives to industrial customers for the installation of an integrated management system.
- **Customer Education.** This program provides education, training, and technical assistance to C&I customers.
- **New Equipment.** Technical assistance and financial incentives are provided to C&I customers to support the installation of new energy efficient equipment and processes. Examples of measures include furnaces, HVAC, heat recovery, controls, insulation, and building envelope.
- **Runsmart Building Optimization.** Technical assistance and financial incentives are provided to commercial customers (e.g., education, healthcare, offices, multi-unit residential, and entertainment) for building optimization. Examples of projects include verifying dampers and valves on air handling units, calibrating sensors and instrumentation, and insulation.

- **Operation and Maintenance.** This program offering provides technical assistance and financial incentives to C&I customers for operation and maintenance of existing measures. Typical projects include repairs to HVAC systems, hot water systems, insulation repairs, and steam system repairs.
- **Boiler Tune-Up.** Technical assistance and financial incentives are provided to industrial customers for a boiler tune-up. Boilers must have output of less than 25,000 pounds per hour or 800 BHP.
- **Meters.** Technical assistance and financial incentives are provided to industrial customers for the installation of natural gas, steam, or hot-water meters.
- **Infrared Anti-Condensate Plastic.** This program offering provides technical assistance and financial incentives to industrial customers for the installation of infrared anti-condensate plastic for a greenhouse.
- **Demonstration of New Technologies.** Technical assistance and financial incentives are provided to C&I customers for adopting new technologies that save natural gas.

3.2 Enbridge Custom Programs

Enbridge offers two custom C&I programs:

- **Commercial Custom Savings Program** provides both technical assistance and financial incentives to medium to large-sized new and existing commercial customers for energy efficient custom gas projects. Examples of custom measures include boilers, building automation systems, variable frequency drives, and demand control ventilation.
    1. The *Existing Buildings* program offering primarily focuses on projects with multiple technologies and requires technical assistance throughout the development of the project.
    2. Two new initiatives, launched in 2012, (*Energy Compass and Run It Right*) encourage a continuous improvement strategy for large commercial customers. These program offerings provide technical assistance by offering an energy efficiency diagnostic service and assisting with the implementation of low and no-cost operational improvements.
- **Industrial Continuous Energy Improvement Program** aims to reduce the natural gas use of medium to large-sized industrial customers through a continuous improvement approach. This approach includes five steps, providing both technical assistance and financial incentives for the implementation of energy efficiency projects:
    1. *Knowledge Development* involves educating customers through workshops and publications.
    2. *Opportunity Identification* involves providing technical assistance to customers in identifying energy efficiency opportunities.

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3. *Measurement* provides technical assistance to identify and measure the information needed to make a decision regarding energy efficiency opportunities. Financial incentives are available for measurement equipment.
4. *Engineering Analysis* provides technical assistance to customers in quantifying the benefits and costs associated with an energy efficiency opportunity. Financial incentives are available if a third party consultation is required.
5. *Action and Implementation* provides technical assistance and financial incentives for energy efficiency projects.

Examples of projects include industrial process heat systems, steam systems, and heating and ventilation.

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4. Approach to Net Savings

This section presents the findings from the jurisdictional review of the approach taken to net savings, as well as the availability of performance incentives. This section begins with a review of 42 jurisdictions in the United States and Canada, representing the vast majority of jurisdictions with ratepayer-funded energy efficiency programs. This is followed by a closer look at the nine jurisdictions selected for further review. The final section summarizes the findings that are most relevant to Union and Enbridge.

4.1 Jurisdictional Review

Table 3 presents a summary of the approach to net savings used in the 42 jurisdictions, including the treatment of a FR adjustment and whether spillover is considered.[9] The table also presents information on whether jurisdictions offer utility performance incentives for meeting their savings goals, though, as indicated below, these goals are linked to either *gross* or *net savings*. Following is a summary of key findings:

- One-third (33%) of the jurisdictions reviewed **do not adjust gross savings** for either FR or spillover; however, some of those states may conduct some NTG research to inform future program design. Half of the U.S. states that do not adjust gross savings provide performance incentives for utilities to achieve energy efficiency program goals or have a performance incentive pending.

- Relatively few (14%) of the jurisdictions reviewed use a **deemed approach** to NTG; the deemed NTG values may be determined at a portfolio level (ranging from 0.7 to 0.9) or on a measure-by-measure basis (as in California, Vermont, and Nevada). These deemed NTG values are typically developed after NTG research has been conducted through program impact evaluations, and are revised on a regular basis through negotiations between utilities and regulators (often informed by additional NTG research). Over three-quarters (83%) of the U.S. states that use a deemed NTG approach provide performance incentives for utilities to achieve energy efficiency program goals.

- Nearly half of all jurisdictions reviewed take a **research-based approach** to NTG analysis. The vast majority of those jurisdictions consider spillover in some capacity, at least for some program types, though spillover is still quantified much less often than FR. Both FR and spillover are most commonly estimated through a self-report (participant survey) approach, though econometric methods (e.g., billing analysis) and market share modeling approaches are occasionally used. Nearly three-quarters of the U.S. states that take a research-based NTG approach provide performance incentives for

[9] Note that within a given jurisdiction, the treatment of spillover may vary by program type (including whether participant, non-participant, or both types of spillover is researched), and evaluators may investigate the possibility of spillover but find that no spillover is occurring or that it cannot be quantified with enough precision to obtain regulatory approval. Thus, this column reflects jurisdictions which consider the possibility of spillover but have not necessarily quantified and received regulatory approval for spillover savings estimates.

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utilities to achieve energy efficiency program goals or have a performance incentive pending.

Table 3. NTG Approaches, Treatment of Free Ridership and Spillover, and Availability of Performance Incentives by Jurisdiction

Jurisdiction	NTG Approach*	Free-Ridership Adjustment	Spillover Considered?	Performance Incentives?	Notes
Hawaii	Deemed (0.7)			Yes	
Arkansas	Deemed (0.8)			Yes	
Michigan	Deemed (0.9)			Yes	Some NTG research conducted but not currently required by regulators.
California	Deemed (varies by measure, 0.5 for custom gas measures)			Yes	Research conducted to inform deemed NTG values.
Nevada	Deemed (varies by measure)				Some NTG research conducted.
Vermont	Deemed (varies by measure)			Yes	
British Columbia	Researched	Yes	Yes		Deemed NTG of 1.0 used until researched.
Nova Scotia	Researched	Yes	Yes		
Colorado	Researched	Yes	Yes	Yes	
Connecticut	Researched	Yes	Yes	Yes	Gross savings are used to evaluate whether goals have been met.
Florida	Researched	Yes	Yes	Pending	
Georgia	Researched	Yes	Yes	Yes	
Illinois	Researched	Yes	Yes		
Indiana	Researched	Yes	Yes	Yes	
Kansas	Researched	Yes		Pending	
Maine	Researched	Yes	Yes		
Massachusetts	Researched	Yes	Yes	Yes	
Missouri	Researched	Yes	Yes	Pending	
New Hampshire	Researched		Yes	Yes	
New Mexico	Researched	Yes		Yes	

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Jurisdiction	NTG Approach*	Free-Ridership Adjustment	Spillover Considered?	Performance Incentives?	Notes
New York	Researched	Yes	Yes	Yes	Deemed NTG of 0.9 used for programs without recent evaluations.
Oregon	Researched	Yes	Yes		
Pennsylvania	Researched	Yes	Yes		Gross savings are used to evaluate whether goals have been met.
Rhode Island	Researched		Yes	Yes	
Utah	Researched	Yes	Yes	Pending	
Wisconsin	Researched	Yes	Yes	Yes	
Wyoming	Researched	Yes	Yes		
Arizona	No NTG adjustment			Yes	
Delaware	No NTG adjustment				
District of Columbia	No NTG adjustment				
Idaho	No NTG adjustment			Pending	Some NTG research conducted but not required by regulators.
Iowa	No NTG adjustment				
Kentucky	No NTG adjustment			Yes	
Maryland	No NTG adjustment				
Minnesota	No NTG adjustment			Yes	
Nebraska	No NTG adjustment				
New Jersey	No NTG adjustment				
North Carolina	No NTG adjustment			Yes	
Ohio	No NTG adjustment			Yes	
Texas	No NTG adjustment			Yes	

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Jurisdiction	NTG Approach*	Free-Ridership Adjustment	Spillover Considered?	Performance Incentives?	Notes
Washington	No NTG adjustment				Some NTG research conducted but not required by regulators.
South Dakota	Varies by utility	Yes	Yes		

* Deemed NTG values are pre-determined values typically developed after NTG research has been conducted through program impact evaluations. Researched NG values are most commonly estimated through a self-report (participant survey) approach, though econometric methods (e.g., billing analysis) and market share modeling approaches are occasionally used. *Source:* Navigant analysis of various resources including utility websites, regulatory agency websites, websites of research/advocacy groups, and studies that previously surveyed the approach to net savings (Appendix A).

4.2 *Selected Jurisdictions*

As noted in the Methodology section, Navigant reviewed a total of 19 documents that researched NTG. These documents represent nine jurisdictions, including: California, Colorado, Massachusetts, Minnesota, New Jersey, New Mexico, Oregon, Washington, and Wisconsin.

While documents that research NTG were identified, the approach to net savings in these selected jurisdictions varies as shown in Table 4. Most notably, three of the jurisdictions make no NTG adjustment and one jurisdiction deems NTG even though NTG research is being conducted. Also note that three of the nine jurisdictions do not have performance incentives.

Table 4 . Approach to Net Savings in Selected Jurisdictions

Deemed	Researched Adjusts for Free Ridership and Spillover is Considered	No NTG Adjustment
California (0.5 for custom gas measures)	Colorado, Massachusetts, New Mexico (FR only), *Oregon*, and Wisconsin	Minnesota, *New Jersey*, and *Washington*

**Italics* indicate that the jurisdiction does not have performance incentives. *Source:* Navigant analysis.

Regional or temporal trends in whether participant and NPSO were also considered. Figure 1 presents the number of studies that include free-ridership, PSO, and NPSO by the year of study publication. Based on the sample of studies conducted in the selected jurisdictions, there is a clear trend towards including participant and NPSO in calculating NTG in recent years.

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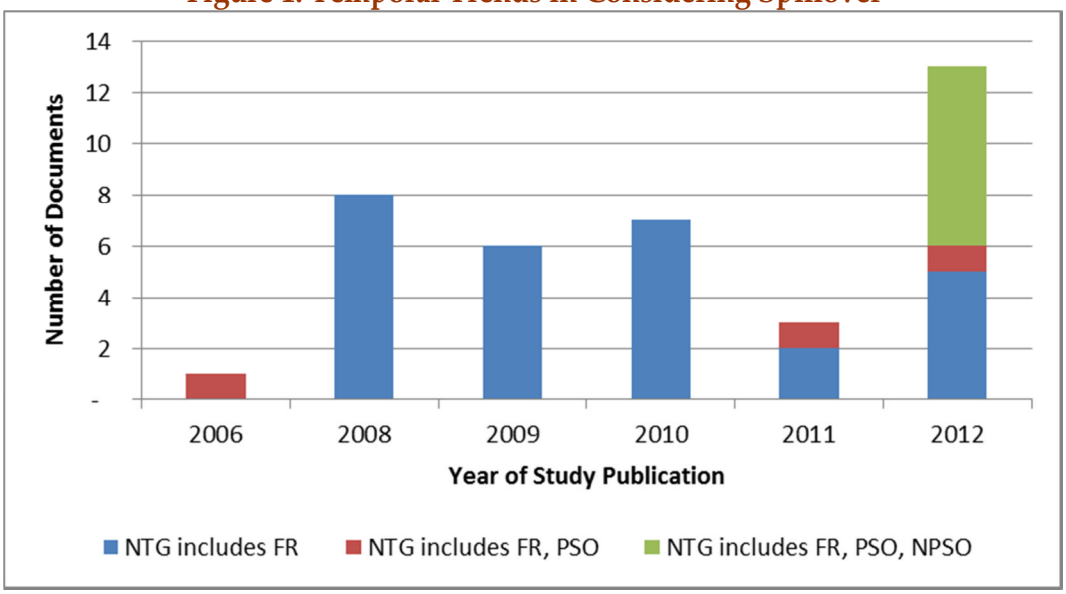
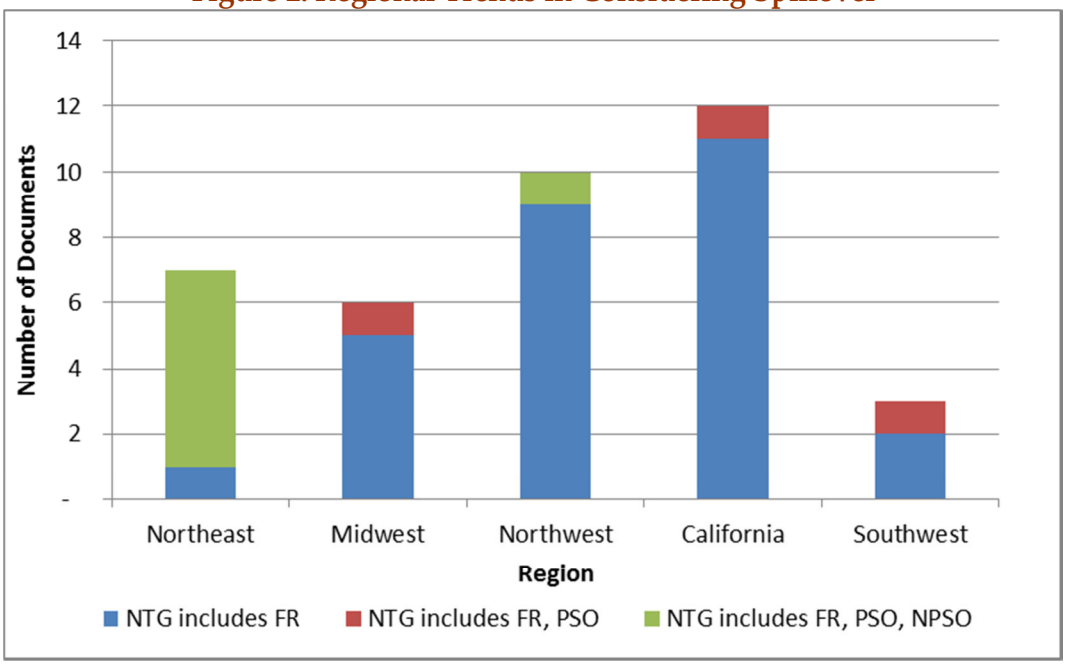
Figure 1. Temporal Trends in Considering Spillover



Source: Navigant analysis.

Figure 2 presents the number of studies that include free-ridership, PSO, and NPSO by region of the United States. Based on the sample of studies conducted in the selected jurisdictions, it appears that all regions consider PSO in calculating NTG values.

Figure 2. Regional Trends in Considering Spillover



Source: Navigant analysis.

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4.3 Application to Union and Enbridge

Based on the jurisdictional review nearly half of the jurisdictions with rate-payer funded energy efficiency program conduct NTG research. Among the 33% that do not adjust gross savings some research is being conducted. For example, three of the nine jurisdictions selected for further review do not adjust gross savings while another one deems – yet NTG research is being conducted.

Trends in the included NTG factors are also identified. Among the nine selected jurisdictions there is a clear trend towards including both participant and NPSO in recent years, and that it is not a regional phenomenon. The next section of this report summarizes the researched NTG values resulting from the review of research conducted in the nine selected jurisdictions.

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5. Researched NTG Values in Selected Jurisdictions

In this section Navigant summarizes the 38 NTG values reviewed in the nine selected jurisdictions. As described in Section 2.3, the NTG values presented are net-of-NTG factors. All values represent gas values, unless specified otherwise.

A summary of the studies' findings across the following categories are presented:

- First, a high level summary of the NTG values for non-residential natural gas programs is provided. To provide context for these values we examine how these values vary with the document number, region, program year, and the analytic rigor of the methodology used. We also provide a comparison of the natural gas NTG values to the electric NTG values reported in the same documents.
- Next, the NTG values based on a variety of program characteristics, including program type, customer segment, utility-type, region, approach to program marketing, and program maturity are summarized.[10]
- The final section summarizes the findings that are most relevant to Union and Enbridge.

Definitions

NTG values presented in this section represent "Net-of-NTG Factors."

- NTG value including free ridership, NTG = (1-FR),
- NTG value including free ridership and participant spillover, NTG = (1-FR+PSO), or
- NTG value including free ridership and spillover, NTG = (1-FR+PSO+NSPO), where NPSO represents non-participant spillover.

It is important to keep in mind that the NTG values presented in this section are the result of research conducted for different programs, in different program environments, and using different methodologies. As a result, interpretation of trends should be made with caution - differences in NTG values may reflect true differences in FR and spillover, or may simply reflect differences in evaluation methodologies, even among similar programs (Saxonis 2007).

5.1 Summary of NTG Values

Figure 3 summarizes net of NTG component values.[11] Some key patterns are evident in this Figure:

[10] Summarizing NTG values by various categories limits the sample sizes. As a result, caution should be used in interpreting NTG values.

[11] By presenting net-of-NTG component values, a distinct result reported in a document may be represented by multiple data points in the figures below. For example, if free ridership, PSO, and NPSO are considered, three data points will appear in the figure: the net-of-FR value, the net-of-FR & PSO value, and the net-of-FR, PSO & NPSO value.

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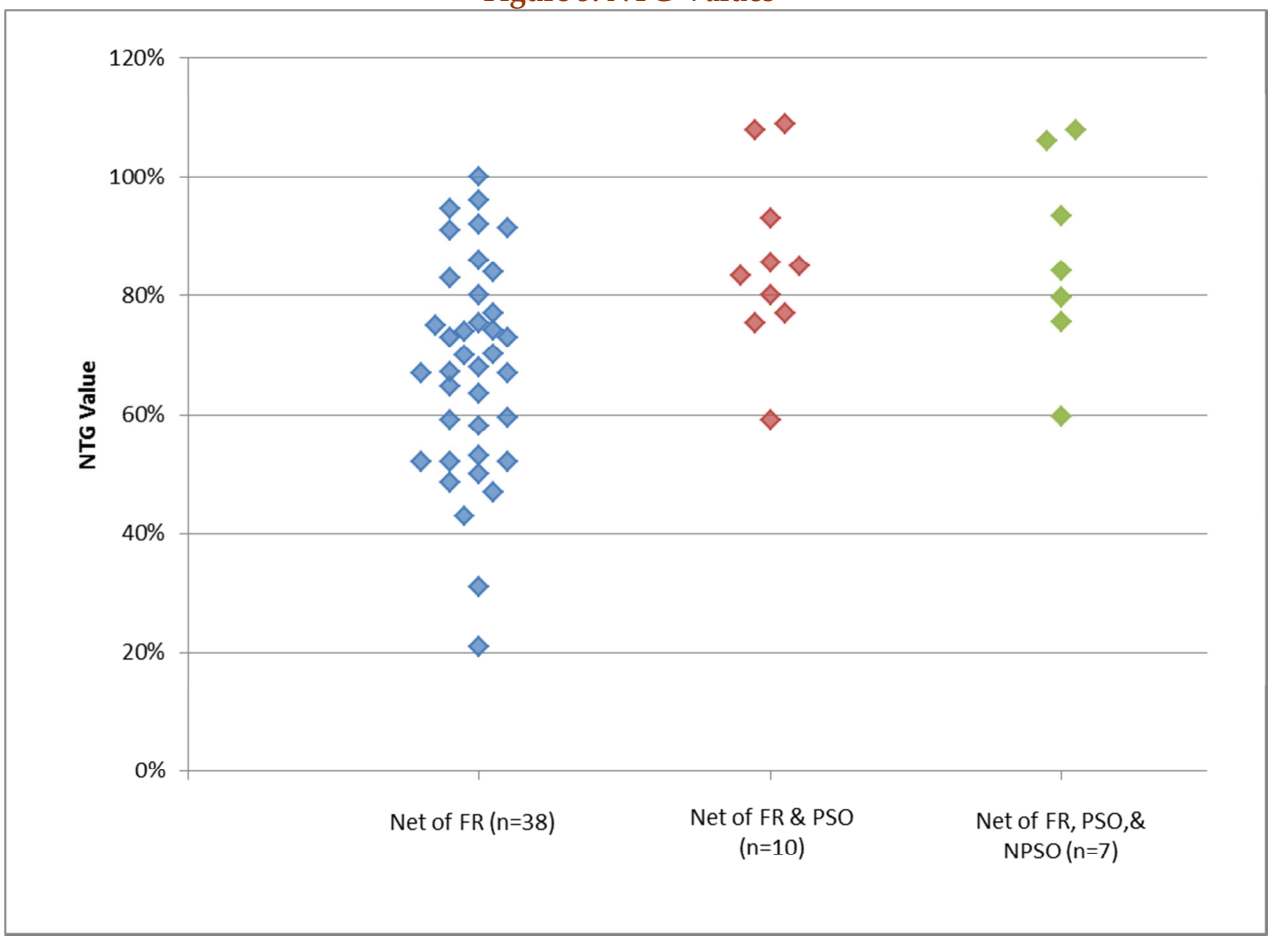
- While the dispersion of net-of-free ridership values is quite large, ranging from 21% to 100%, the majority of values appear to "cluster" between 40% and 90%.
- There are only a few studies at the extremes of the range of net-of-free ridership values. One result reports high levels of free-ridership (79%) with another reporting zero free-ridership.[12]
- The average net-of-free ridership value is 68%.
- As expected, NTG values are larger when considering spillover. Average net-of-free ridership & PSO value is 86% and average net-of-free ridership & spillover value is 87%, suggesting that NPSO is small for non-residential gas programs.[13]

Figure 3. NTG Values



Source: Navigant analysis. Note that the sample size (n) represents the number of unique NTG values (program-utility-year combinations) reported in the 19 studies.

[12] Zero free-ridership was reported for a small pilot program (n=30) offering custom and prescriptive incentives targeted at K-12 school districts. 79% free-ridership was reported for a retrofit program in its third program year. The sample size (n=18) represents 75% of participants with natural gas measures and 10% of total program participants. Both studies relied on self-report methods.

[13] 5 of the 7 data points for NPSO report values of less than 1% with another reporting 2.6% (all values reported by the same study). The remaining data point reports NPSO of 21% with a corresponding PSO value of 13%).

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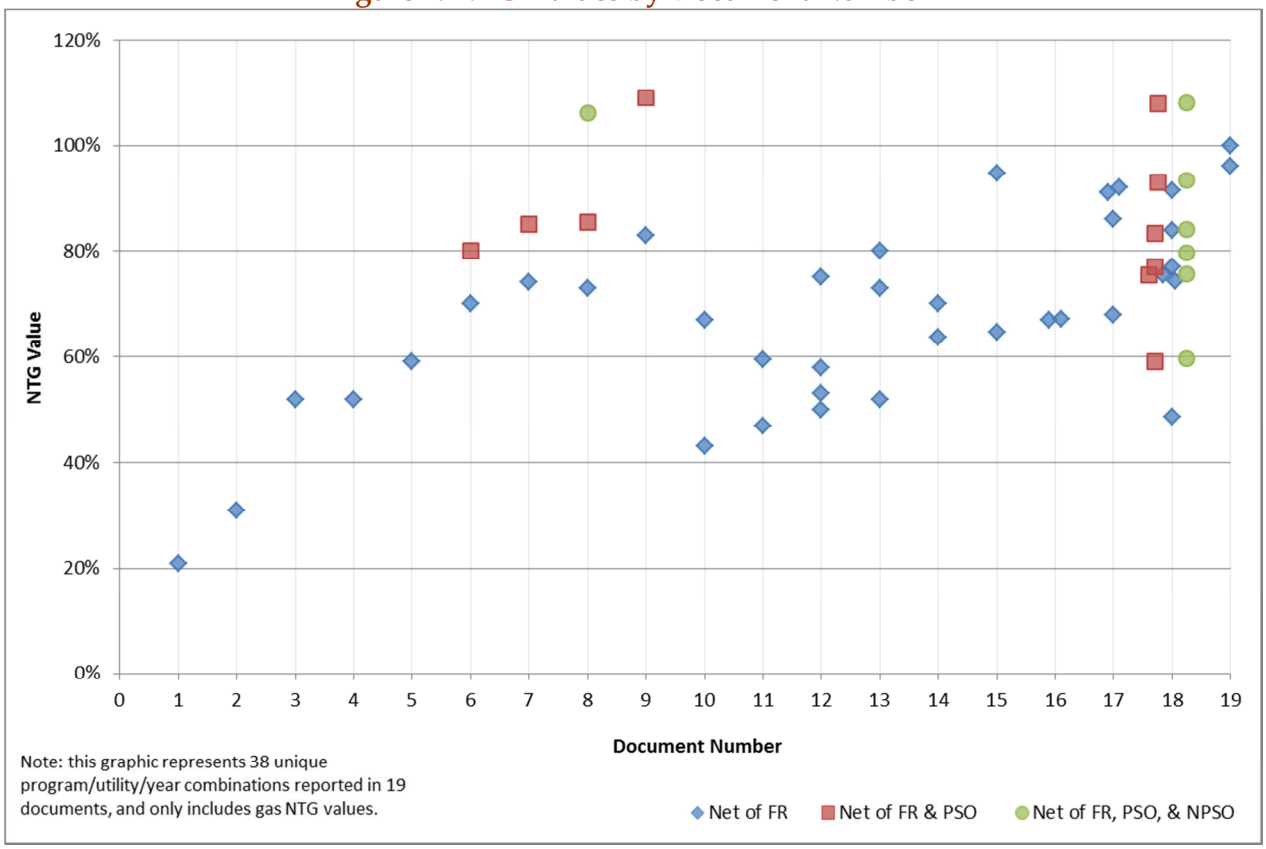
To further examine trends in NTG values, Figure 4 summarizes the distinct NTG values reported by each document. There are two key findings:

- Only two documents report net-of-FR values below 40%.
- Net-of-FR values that exceed 90% are reported by just four documents and generally exhibit a clustering of multiple values. For example, document number 19 reports two distinct NTG values, both of which are larger than 90%.

Figure 4. NTG Values by Document Number



Source: Navigant analysis.

Figure 5 summarizes NTG values by region. No clear regional trends emerge except it appears there is a clustering of net-of-FR values in the Northwest around 70%. These values represent evaluations of multiple program-years of two programs, with evaluations conducted by multiple evaluators.

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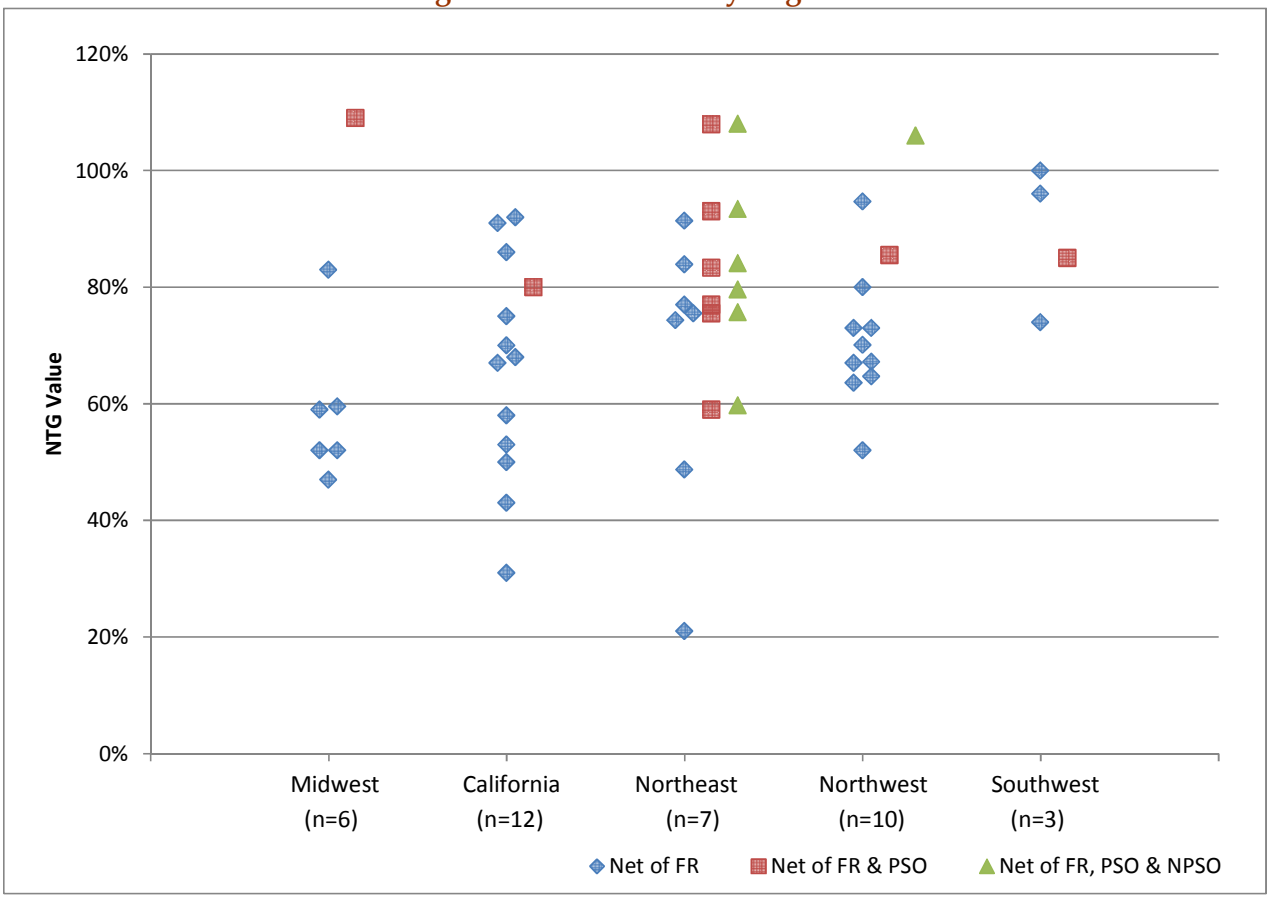
Figure 5. NTG Values by Region



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) in each region; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable).

Economic conditions may influence NTG values though few longitudinal studies have been conducted to reveal with certainty how FR and spillover are influenced. Saxonis (2007) identifies research conducted in the 1990's that suggest FR is lower during economic downturns. To ensure that trends in NTG values are not driven by specific economic conditions, Navigant explored whether NTG values vary by program year in Figure 6.[14] While there is a slight upward trend in the net-of-FR estimates, it is not large enough to cause concern about using average values if the TEC decides to do so.

[14] When two program years were evaluated, the first program year is used. For example, if a study evaluates program years 2004-2005, the NTG value is recorded for 2004.When three program years were evaluated, the middle program year is used. For example, if a study evaluates program years 2006-2008, the NTG value is recorded for 2007.

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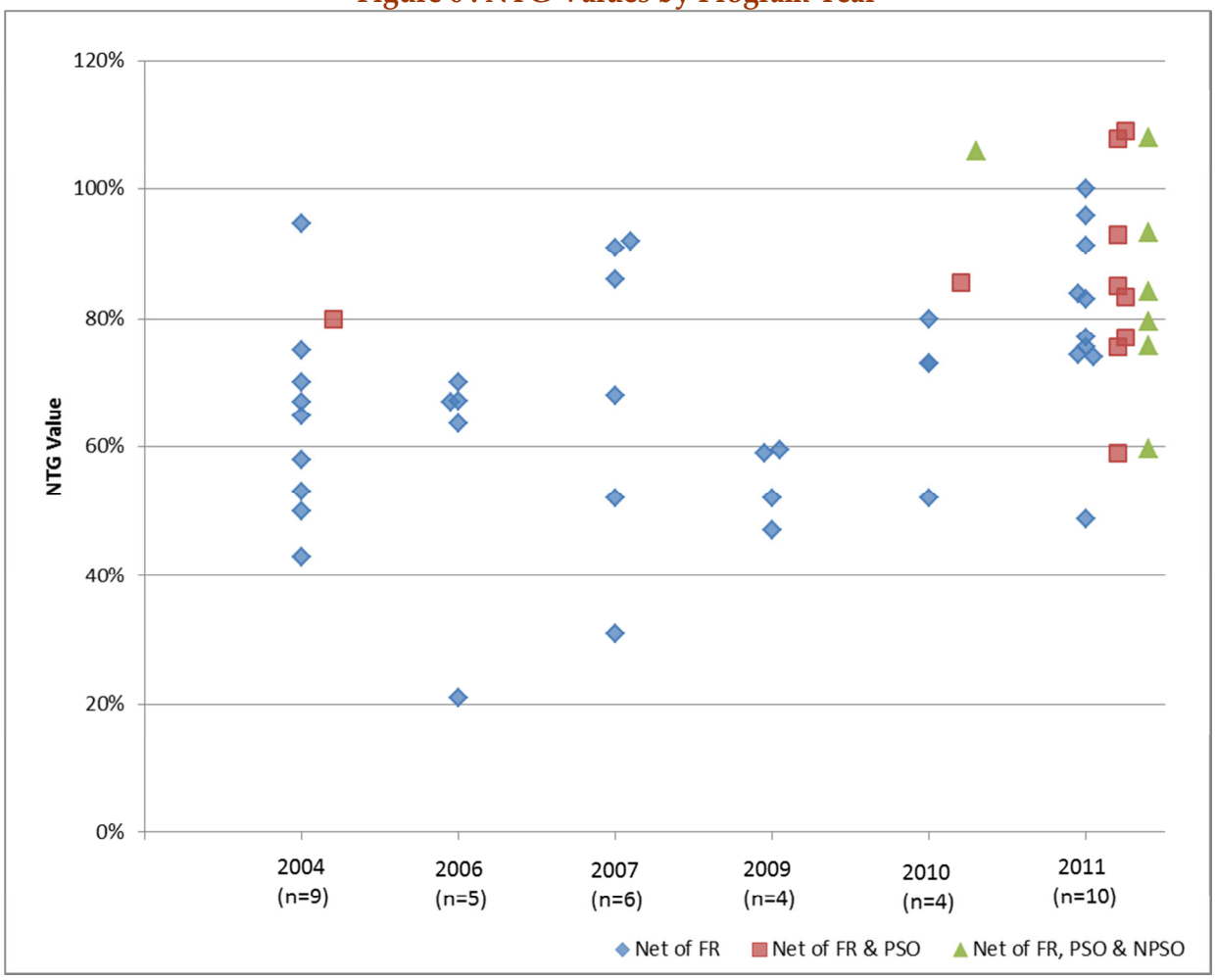
Figure 6 . NTG Values by Program Year



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) by program year; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable).

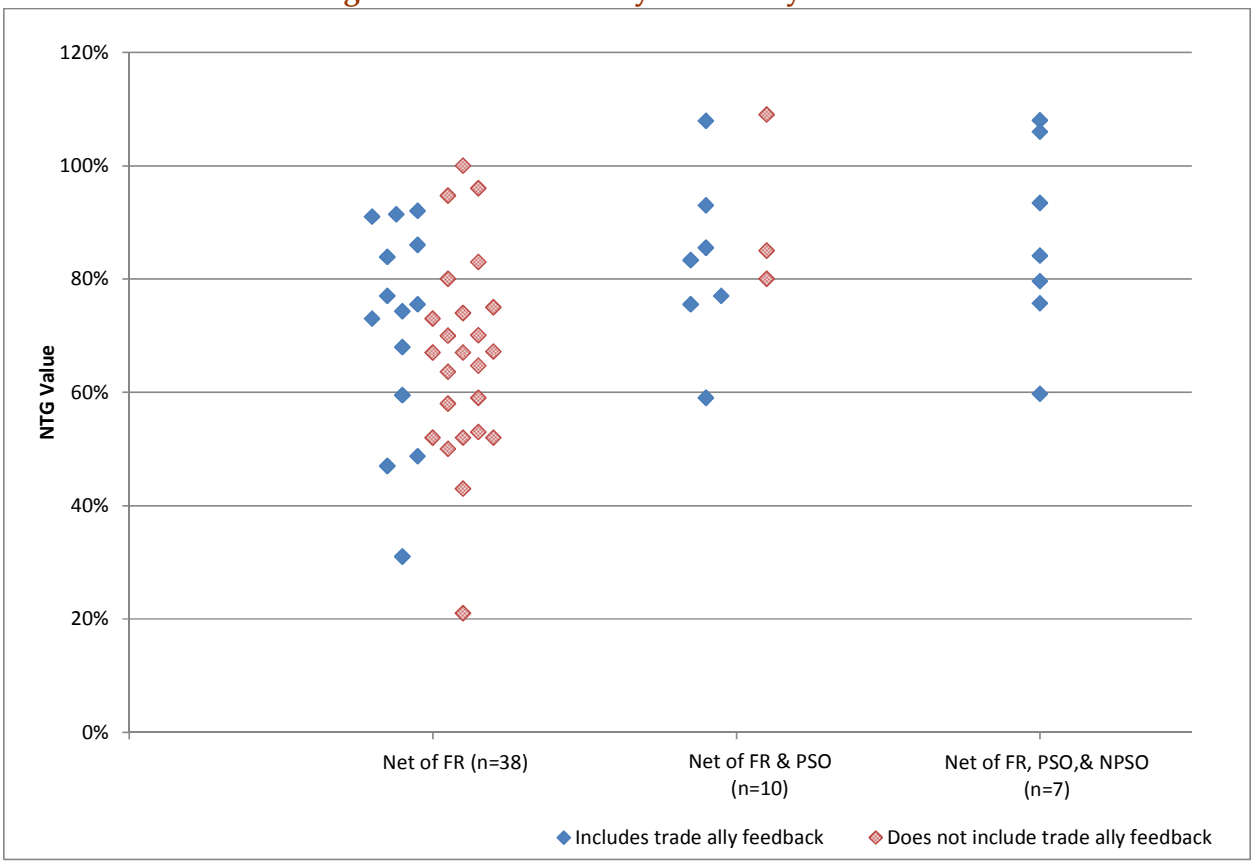
To provide further context to this summary of NTG values Navigant explored whether there are trends in NTG values based on the analytic rigor of the methodology, but were limited in our efforts due to a lack of data. For example, the sample size for most of the results was identified, but the documents did not report population size or the fraction of energy savings that the sample size represents. Without context for the sample size, information on how NTG values vary with sample size provides little insight.[15]

Instead, Navigant uses a proxy for the analytic rigor of the methodology based on data that is available, namely, whether the evaluators used enhanced self-report methods in the form of trade ally feedback. Figure 7 summarizes NTG values differentiating between whether trade ally feedback was incorporated in the NTG calculation. Net-of-free ridership values appear to

[15] Refer to Appendix D for information on sample size.

cluster at slightly larger values when incorporating trade ally feedback. This is not unexpected as trade ally feedback often decreases FR because trade allies have more insight about the full extent of the program's influence on the market.

Figure 7. NTG Values by Trade Ally Feedback



Source: Navigant analysis. Note that the sample size (n) represents the number of unique NTG values (program-utility-year combinations) reported in the 19 studies.

Comparing gas NTG values to electric NTG values may also provide additional insight. Many of the documents reviewed target both electric and gas measures, but report NTG values for electric and gas measures separately. Figure 8 compares electric NTG values to gas NTG values for those documents that report both electric and gas NTG values. Net of FR values appear to cluster for both gas and electric, but the clustering of gas values is slightly wider than electric. Average net-of-free ridership values are similar, 69% for electric and 65% for gas.

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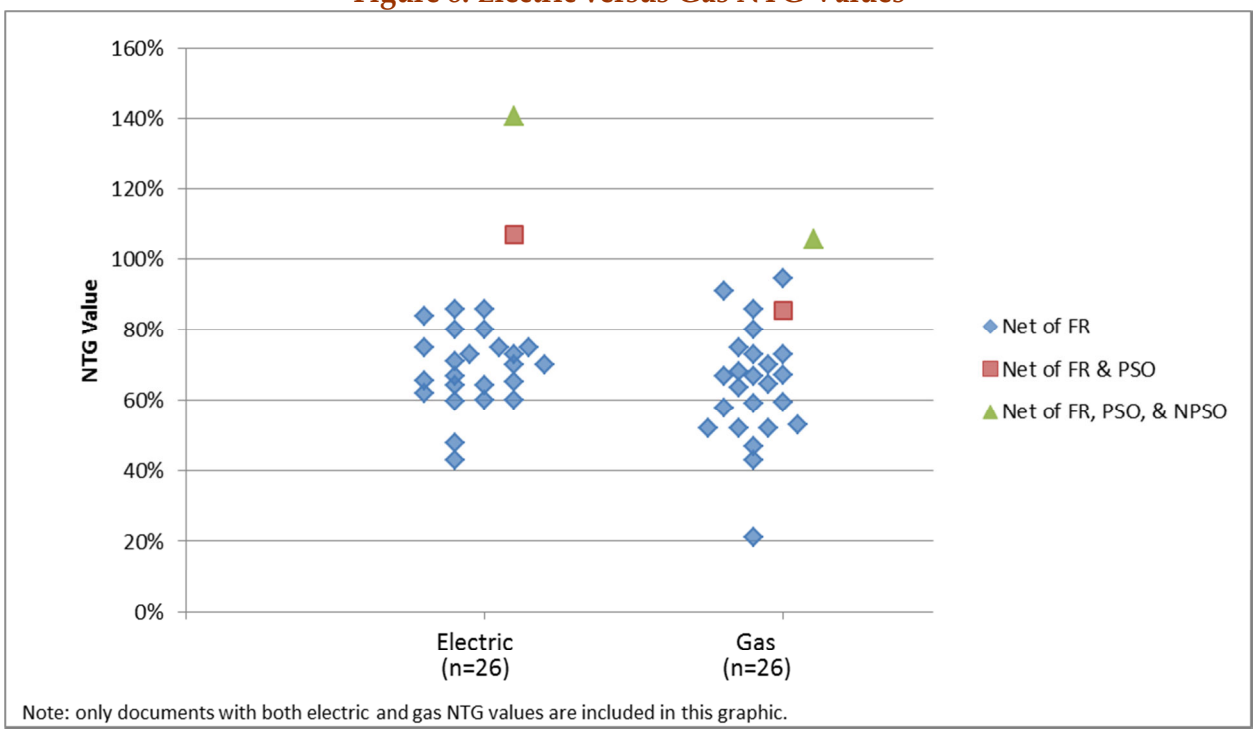
Figure 8. Electric versus Gas NTG Values



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) for each fuel type; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable).

The following section examines whether NTG values vary by features of program design and delivery.

5.2 *Summary Based on Program Characteristics*

In this section, Navigant summarizes NTG values based on various characteristics of program design and delivery. In particular, variation in NTG values is examined based on:[16]

1. **Program-type**, differentiating between custom, prescriptive, and both.
2. **Customer segment**, differentiating between commercial, industrial, agricultural, institutional, and multi-sector.
3. **Utility-type,** differentiating between utilities/organizations that offer electric and gas versus those that offer gas-only.
4. **Program maturity,** differentiating by the number of years since program inception.

[16] Navigant explored other characteristics of program design, such as incentives as a percent of incremental cost, extent of design assistance throughout the program, program objectives, and more, however, because most studies did not provide this level of detail on the programs they were not included in the analysis.

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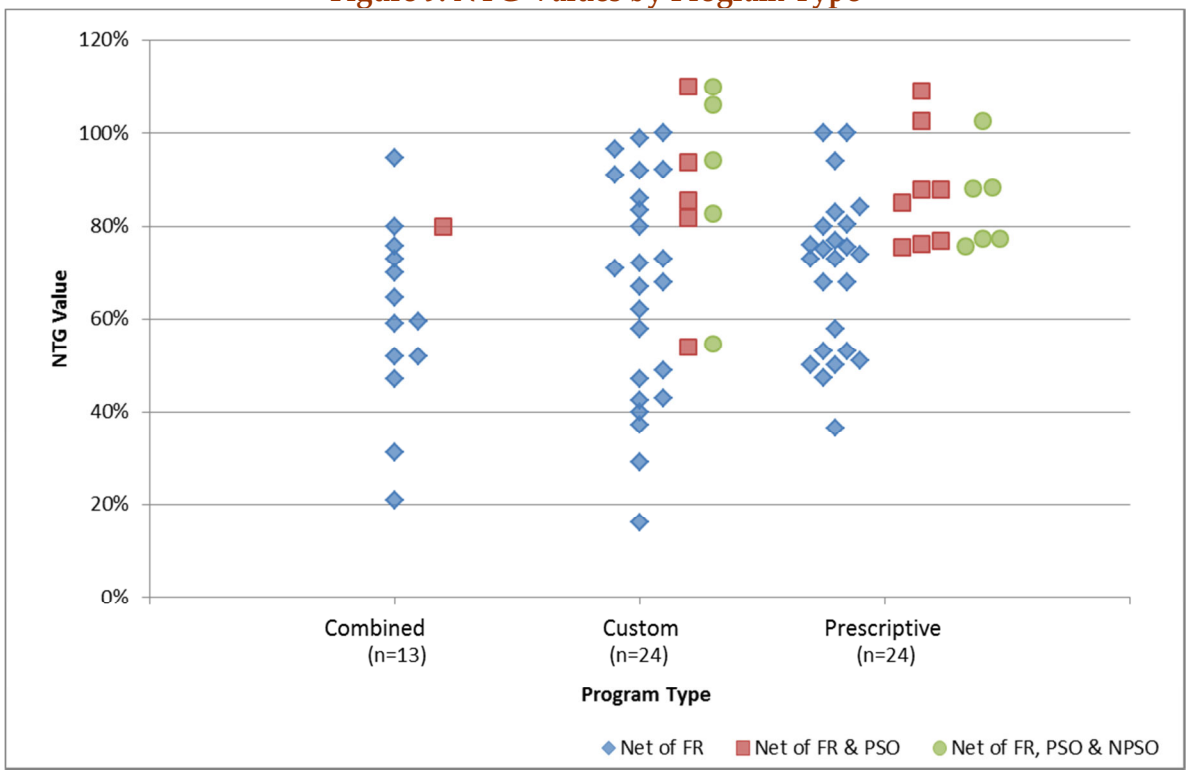
5. **Program marketing strategy**, differentiating between a direct marketing/outreach, channel/partners, and both.

Figure 9 summarizes NTG values by program type (custom, prescriptive, or both).[17] Custom net-of-FR values exhibit a wider dispersion relative to prescriptive values. Excluding some outlier custom values, the ranges are fairly similar but the prescriptive values exhibit more clustering between 50% and 85%, whereas custom values do not appear to cluster in any particular range of values.

Figure 9. NTG Values by Program Type



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) for each program type; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable).

Figure 10 summarizes NTG values by customer segment.[18] Most of the programs included in this review are targeted at the commercial sector or are classified as multi-sector programs. While there is a wide dispersion of NTG values, the majority of values are found within the 60% and 80% range.

[17] In an effort to identify whether there are trends in NTG values by program type, when a NTG value was disaggregated into custom and prescriptive categories, these NTG values were included separately, resulting in a total of 61 data points for this analysis.

[18] In an effort to identify whether there are trends in NTG values by customer segment, when a NTG value was disaggregated into customer segments, these NTG values were included separately, resulting in a total of 44 data points for this analysis.

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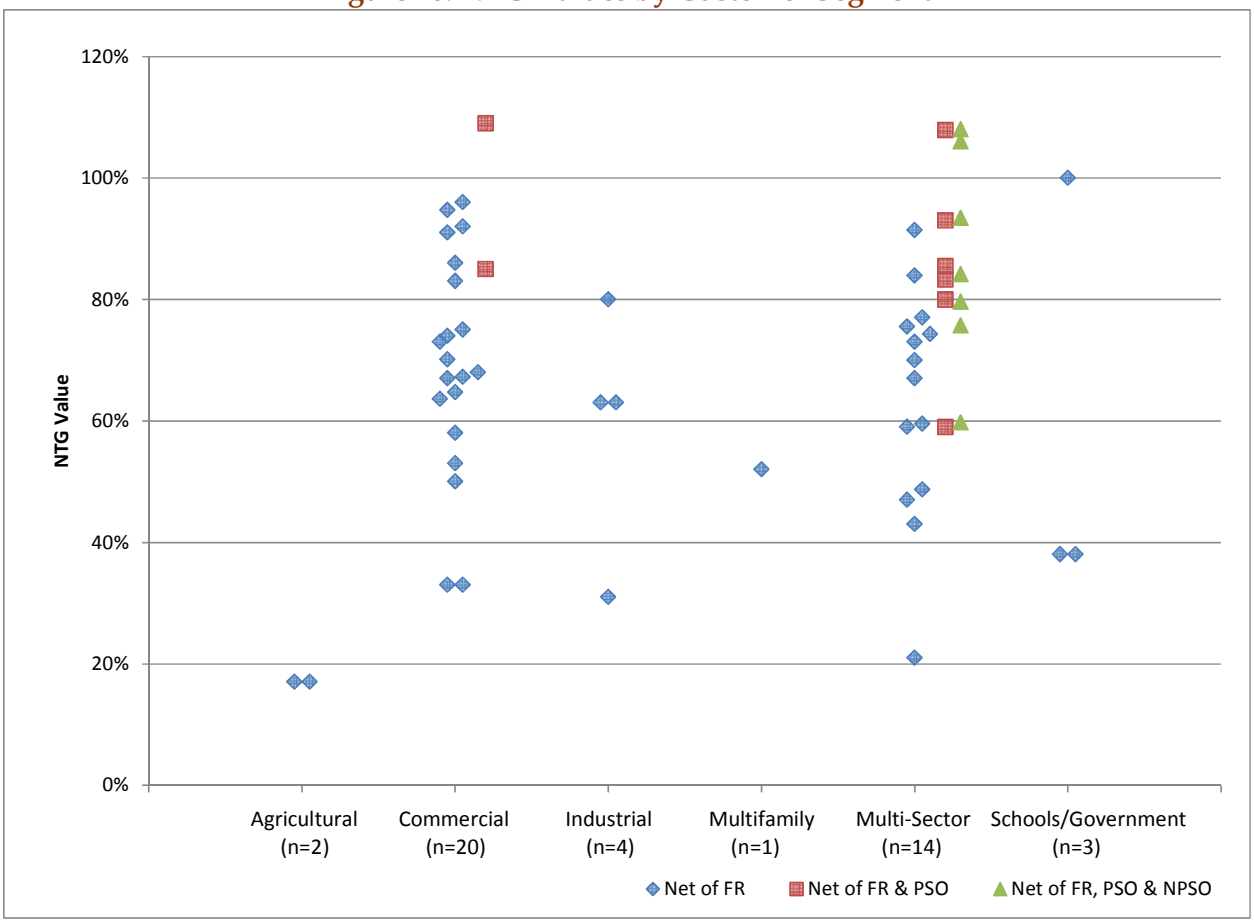
Figure 10. NTG Values by Customer Segment



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) for each segment; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable).

Figure 11 summarizes NTG values by utility-type (e.g., gas only, electric and gas).[19] Of the documents reviewed, more programs are offered by electric and gas utilities relative to gas-only. With only a few distinct net-of-FR values for gas-only utilities, comparisons across utility-types should be made with caution. Nevertheless, there appears to be a trend of lower FR and higher NTG values for programs offered by gas-only utilities.

[19] Note that the values presented are gas NTG values.

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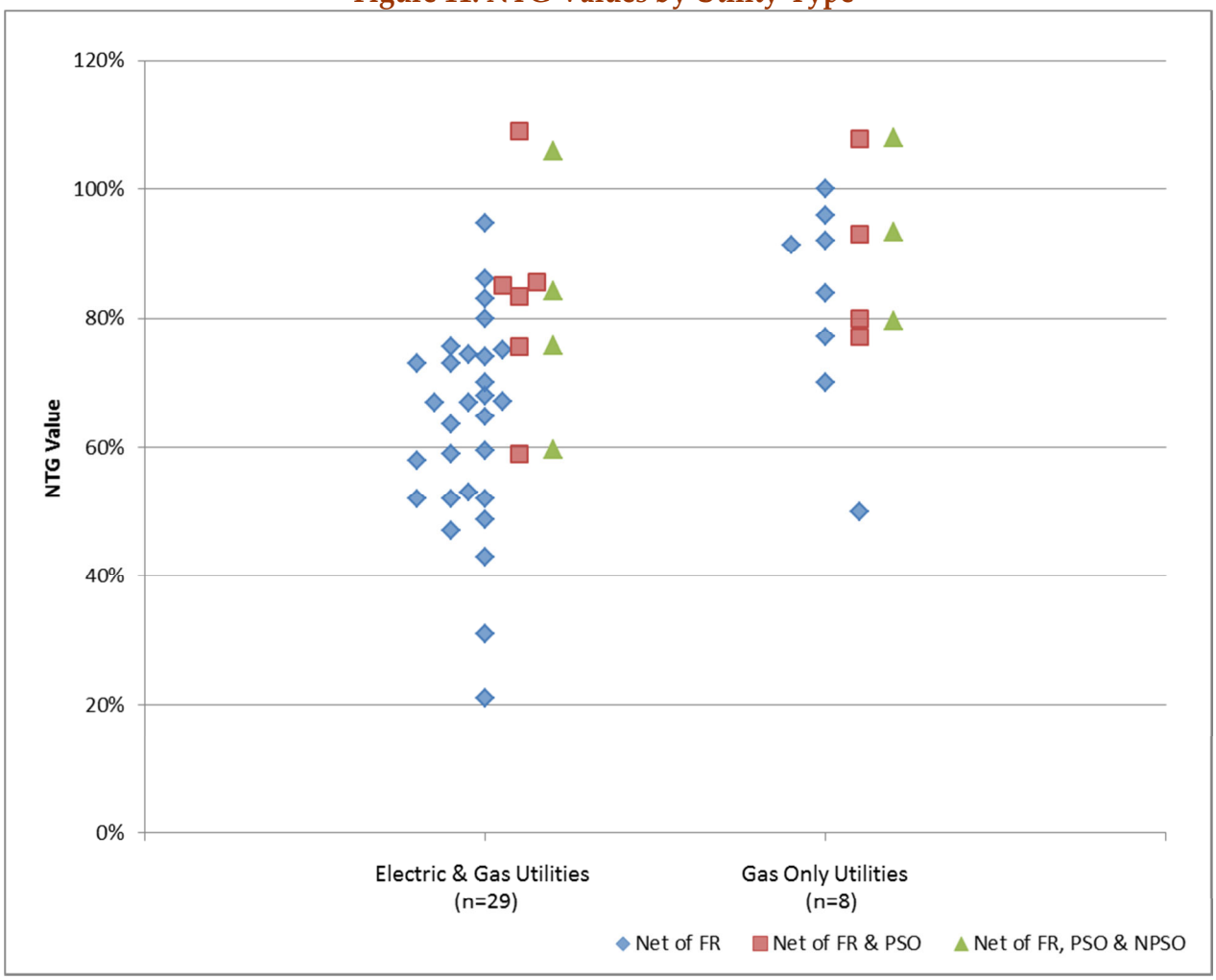
Figure 11. NTG Values by Utility-Type



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) for each utility-type; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable). Total sample size is 37 instead of 38 because one utility is electric only but reported NTG values for gas savings from electric programs, specifically a retrofit program.

Navigant also explored whether NTG values varied with program maturity and program marketing strategy. Figure 12 summarizes NTG values by program maturity. The majority of programs are in at least their fifth program year, and while the sample size of programs with less than 5 years' experience is limited, there appears to be a trend of lower NTG values (and higher FR) as program experience increases. This finding is not unexpected as markets transform over time raising awareness and knowledge of the benefits of energy efficiency among potential resulting in higher degrees of FR. Jurisdictions which only adjust for FR can be especially prone to declining NTG values over time because what appears like FR in a program's later years may actually be evidence of spillover or market transformation from the program's earlier market interventions.

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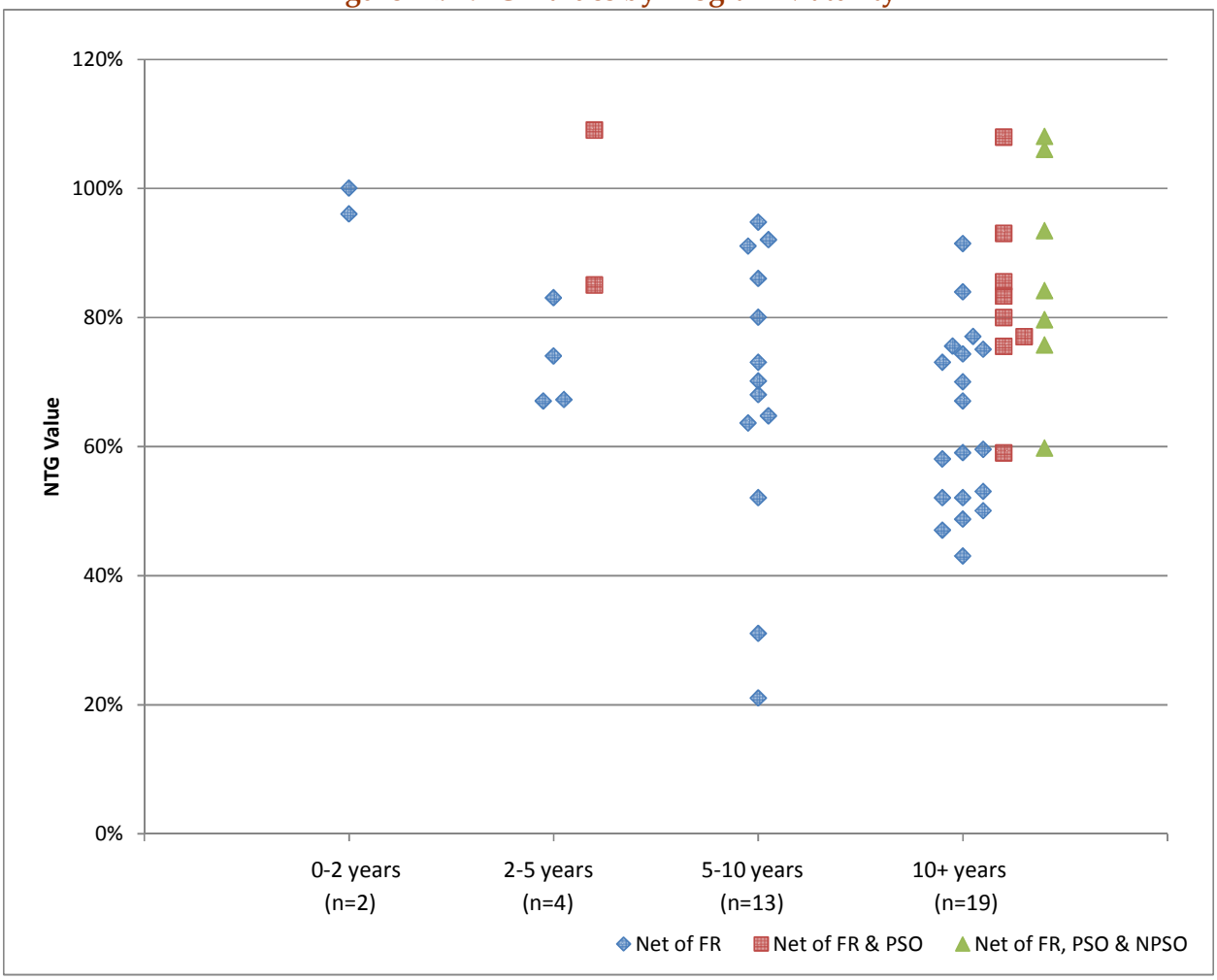
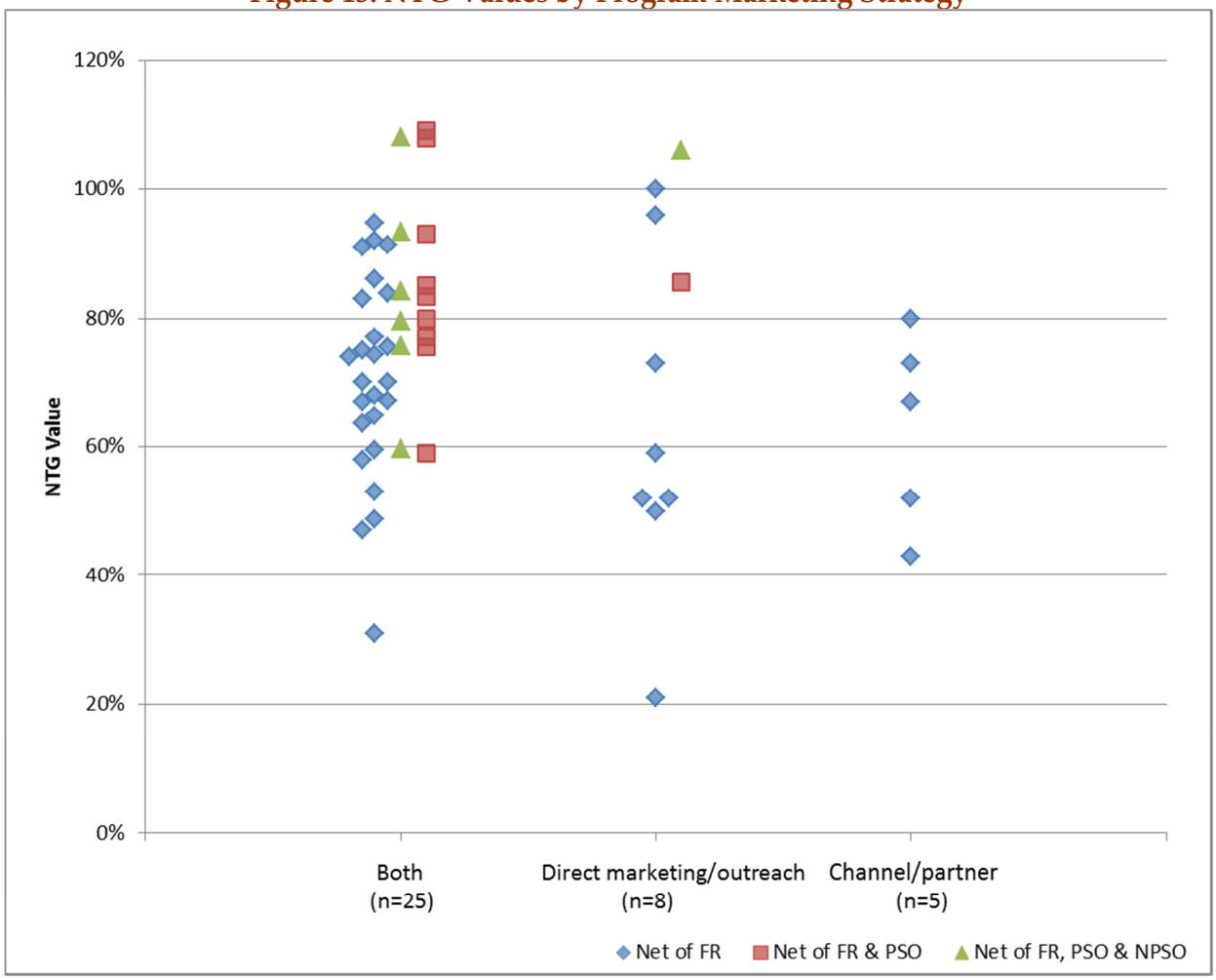
Figure 12. NTG Values by Program Maturity



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) by program maturity; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable).

Figure 13 summarizes NTG values by program marketing strategy. The majority of programs adopted both a direct marketing/outreach strategy and a channel/partner strategy. As a result, the distribution of NTG values is similar to the high-level summary depicted in Figure 3. Note that the extreme net-of-FR values of 100% and 21% are for programs with a direct marketing/outreach strategy.

Figure 13. NTG Values by Program Marketing Strategy



Source: Navigant analysis. Note that the sample size (n) represent the number of unique NTG values (program-utility-year combinations) by program marketing strategy; the number of data points in the figure exceed the sample sizes because NTG findings are presented as net-of-free ridership, net-of-free ridership & PSO (if applicable), *and* net-of-free ridership, PSO & NPSO (if applicable).

5.3 *Application to Union and Enbridge*

In 2007-2008 Navigant (formerly Summit Blue Consulting) conducted the first attribution study of Union and Enbridge's custom C&I programs to evaluate FR and spillover effects. Table 5 presents the NTG values as well as the values of the individual NTG components.[20]

[20] Non-PSO was also researched but was not factored into the NTG ratio because the energy savings could not be calculated accurately.

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Table 5. Summary of Attribution Analysis

Utility	Sector	NTG	Free Ridership	Participant Spillover
Union	**Total**	**56%**	**54%**	**10%**
	Agriculture		0%	
	Commercial Retrofit		59%	
	Industrial		56%	
	Multifamily		42%	
	New Construction		33%	
Enbridge	**Total***	**79%**	**41%**	**21%**
	Agriculture		40%	
	Commercial Retrofit		12%	
	Industrial		50%	
	Multifamily		20%	
	New Construction		26%	

*Free ridership and spillover values include rounding error.
Source: Summit Blue Consulting. 2008. *Custom Projects Attribution Study.* Union Gas Limited and Enbridge Gas Distribution, October 27, 2008.

Following the study, the OEB approved the FR adjustment, but did not approve a spillover value. Currently, Union uses one NTG value for all C&I custom programs, the researched net-of-free ridership value calculated across all sectors (i.e., a FR of 54% and a net-of-free ridership value of 46%). Enbridge, on the other hand, currently uses the researched sector-specific net-of-free ridership values.

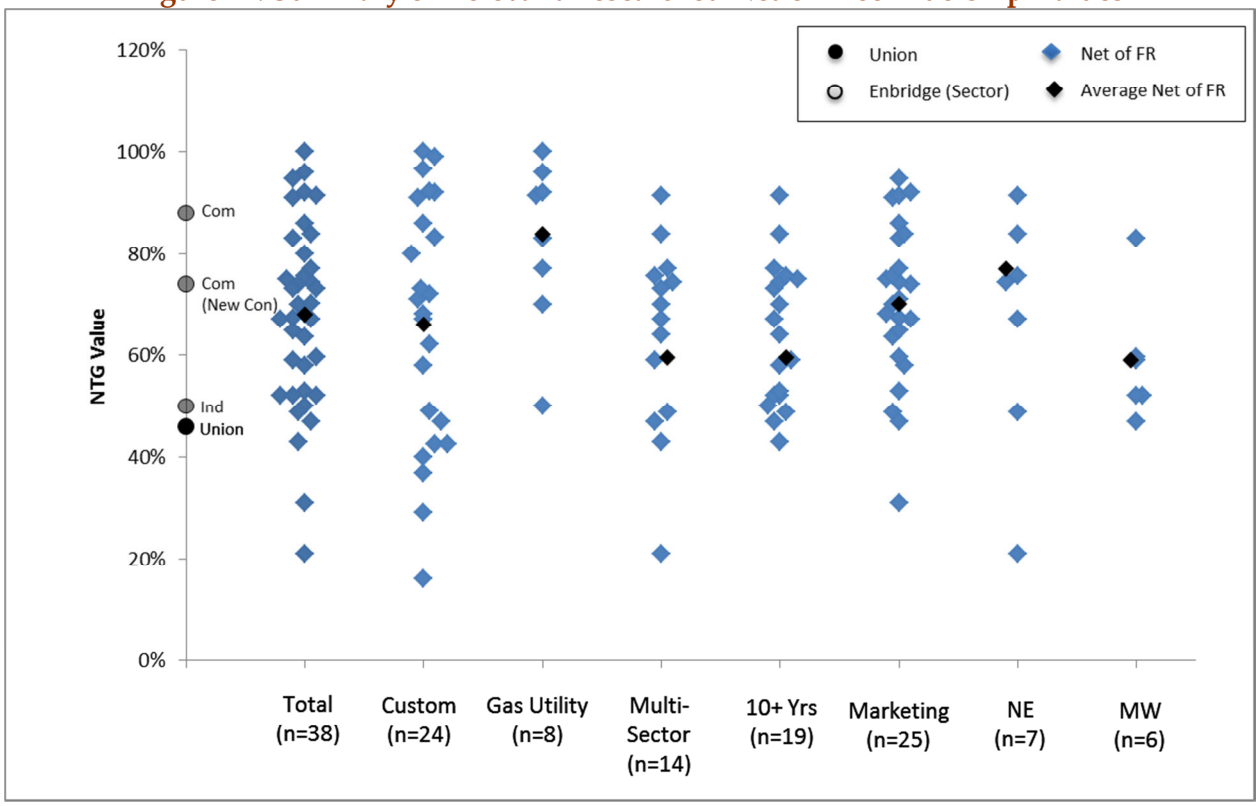
Comparing the current net-of-free ridership values for C&I custom programs (i.e., the researched net-of-free ridership values from the 2007-2008 Union and Enbridge study) to the range of researched values from the jurisdictional review provides context for the current net-of-free ridership values and insight into whether information available from other jurisdictions can be used to estimate NTG values in Ontario. Figure 14 summarizes findings from the review of researched NTG values in selected jurisdictions that are most relevant to Union and Enbridge.[21]

Union and Enbridge are gas-utilities that have been offering custom programs to commercial, industrial, or multi-sector customers for more than 10 years using both a direct marketing and channel/partner marketing strategy. As a result, Figure 14 presents the researched net-of-free ridership values for the following categories: custom program, gas utility, multi-sector, 10+

[21] We only summarize net-of-free ridership values as this summary provides the most information due to the largest sample sizes. Summaries of net of FR and spillover values are presented in Appendix E. Trends resulting from the jurisdictional review of NTG values that consider spillover should be interpreted with caution due to the small sample sizes.

years since program inception, a combination of direct and channel/partner marketing strategy, and northern regions (Northeast and Midwest).[22]

Figure 14. Summary of Relevant Researched Net-of-Free Ridership Values



Source: Navigant analysis. Note that the sample size (n) represents the number of unique NTG values (program-utility-year combinations).

The main findings resulting from the review of researched NTG values include the following:

- The NTG values calculated for Union and Enbridge are within the range of NTG values summarized in the review.
- When considering non-residential natural gas programs, NTG values appear to "cluster" between 40% and 90%. Union's NTG value is below the average. Enbridge's NTG value for the commercial sector is above the average while the NTG value for the industrial sector is below the average.

This "clustering" of values becomes less defined when considering other features of program design or implementation that make the NTG values more comparable to Union and Enbridge. For example, the clustering of NTG values for non-residential *custom* gas programs exhibits a wider dispersion without distinct clustering patterns.[23]

[22] All programs evaluated in the Midwest were offered in Wisconsin.

[23] Recall that when a NTG value was disaggregated into custom and prescriptive categories, these NTG values were included separately, resulting in more data points.

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6. Assessing Options for NTG

Gross savings can usually be estimated quite accurately, however, estimating net savings poses greater challenges. Given the uncertainty around any NTG value, in this section Navigant applies a Decision Analysis approach for organizing information around alternative approaches to setting NTG values.

Navigant took the following steps to conduct the Decision Analysis:

1. Define the benefits of accurate (and costs of inaccurate) NTG values in a general context.
2. Narrow the focus the analysis on one of the benefits/cost for which Navigant had access to data; specifically, the incentives paid to utilities based on the estimated net savings (m^3) achieved.
3. Establish a baseline against which a sensitivity analysis can be conducted where a selected NTG value is assumed to be correct, but in fact is incorrect by some margin of error.[24]
4. Conduct a "value of information" analysis by examining the change in incentive payments resulting from better information on NTG values compared to the cost of obtaining the information (e.g., through NTG research).

This section concludes by organizing the results of the Decision Analysis to provide insight into the tradeoffs from using different approaches to setting an NTG value.

6.1 Decision Analysis

The first step in conducting the Decision Analysis is to identify the benefits resulting from more precise NTG values. Three of the primary benefits are described.

- **Program Design and Implementation.** NTG research can be leveraged to improve program design and implementation, ultimately providing greater gross and net savings. For example, FR research can inform decisions to discontinue incenting certain measures and boost the incentives for others. More generally, NTG research will identify what influences the customers' decisions regarding investments in energy efficiency, existing customer knowledge of energy efficiency and equipment operations, and identify aspects of the program that have the greatest influence on the customer's decision to participate in the program. NTG research can also provide insights into how the program is motivating distributors, contractors and other trade allies, and how their

[24] These first three steps are part of a "loss function" analysis which identifies the costs of selecting one NTG value when another value is the actual value. While a traditional loss function analysis focuses on deviations in both the mean value and the precision of the value, for simplicity, this analysis focuses only on precision or range of the values. Navigant did not conduct a more complex analysis because this simple approach provided insight into the value of more precise NTG values, i.e., a reduction in the range of NTG values.

actions might be leading to program spillover. All of this information helps in the design of improved programs.

- **Utility Incentive Payments.** Utilities, and utility shareholders, receive incentive payments for achieving performance goals. NTG values influence the incentive payments that are paid, or not paid, to utilities. More precise estimates of NTG values mitigate the risk that utilities face of receiving incentive payments that are too small, as well as the risk that ratepayers face of making incentive payments that are too large.[25]

- **Energy Savings as a Resource.** Regardless of the NTG value, the gross savings that result from the program are unchanged. (1) From a resource planning perspective, the net effects of the energy efficiency program must be known (i.e., the impacts attributable to the program must not have occurred in the absence of the program). (2) An accurate NTG estimate is important for understanding the equity implications of a program. I.e., participants that receive payments for taking actions that they would have taken even if the program had not existed transfers wealth from ratepayers to the participant. There are policy actions that can be taken to reduce equity issues, such as expanding the program to ensure all ratepayers have access to the program. However, a first step to considering the equity implications of a program is to accurately estimate the level of FR and spillover.

In the Decision Analysis that follows, Navigant focuses on the one benefit/cost for which data was available and for which there is little debate about how to formulate the benefit/cost: utility incentive payments. Union and Enbridge conducted an analysis of the sensitivity of utility incentive payments to changes in the NTG value of custom C&I programs.[26] The sensitivity analysis data was provided by the utilities and was not verified by Navigant.

6.1.1 Union

This section presents an assessment of the value of improved information on NTG values for Union Gas. Table 6 summarizes the impact on utility incentive payments if the custom NTG value is 10 percentage points higher or lower than the current custom NTG value of 0.46 used by Union.[27]

[25] While this report highlights the impact of improved precision of NTG values on the incentive payments received by the utilities, one can easily interpret the impact on ratepayers as it is a zero-sum game (i.e., the gain in incentive payments by utilities is a cost to ratepayers and vice versa).
[26] All other data inputs in the incentive payment calculations were held constant.
[27] This analysis assumes Union meets the targeted level of net savings.

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Table 6. Value of Information Assessment for Union

	NTG Value for Custom Programs		Incentives	Change in Incentives
Base Case:	**Current NTG** NTG = 0.46	→	Incentives = $2.73 M	
Scenario 1:	**Higher True NTG** NTG = 0.56	→	Incentives = $5.63 M	**(+$2.90 M)**
Scenario 2:	**Lower True NTG** NTG = 0.36	→	Incentives = $0.8 M	**(-$1.93 M)**

Source: Sensitivity Analysis provided by Union.

At the net savings target under current assumptions, if the true custom program NTG value is 10 percentage points higher (Scenario 1) Union should receive an additional $2.9 million in incentive payments for savings achieved. If, instead, the true NTG value is 10 percentage points lower (Scenario 2), Union is receiving $1.93 million in incentives for savings that are not achieved.

A swing of +/- 10 percentage points (i.e., error bounds of +/- 22%) in the custom NTG value causes a swing in incentive payments by almost $3 million on the high side and $2 million on the low side. Assuming a revised custom program NTG value (e.g., by conducting NTG research) would reduce this margin of error by one-half, the error bounds would reduce to +/- 5 percentage points (i.e., +/- 11%) in the NTG value. The swing in incentive payments at the new error bounds would be approximately $1.5 million on the high side and $1 million on the low side. If the cost of revising the NTG values are less than $1 million given these assumed error bounds; then, revising the NTG values *could be judged to be warranted*.

6.1.2 Enbridge

This section presents an assessment of the value of improved information on NTG values for Enbridge. Table 7 summarizes the impact on utility incentive payments if the custom program NTG values are 10 percentage points higher or lower than the current custom NTG values used by Enbridge.[28]

[28] This analysis assumes Enbridge meets the targeted level of net savings.

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Table 7. Value of Information Assessment for Enbridge

	NTG Value for Custom Programs		Incentives	Change in Incentives
Base Case:	**Current NTG by Program** Commercial = 0.80 Commercial New Construction = 0.74 Industrial = 0.50	→	Incentives = $2.58 M	
Scenario 1:	**Higher True NTG** Commercial = 0.90 Commercial New Construction = 0.84 Industrial = 0.60	→	Incentives = $4.26 M	**(+$1.68 M)**
Scenario 2:	**Lower True NTG** Commercial = 0.70 Commercial New Construction = 0.64 Industrial = 0.40	→	Incentives = $1.45 M	**(-$1.13 M)**

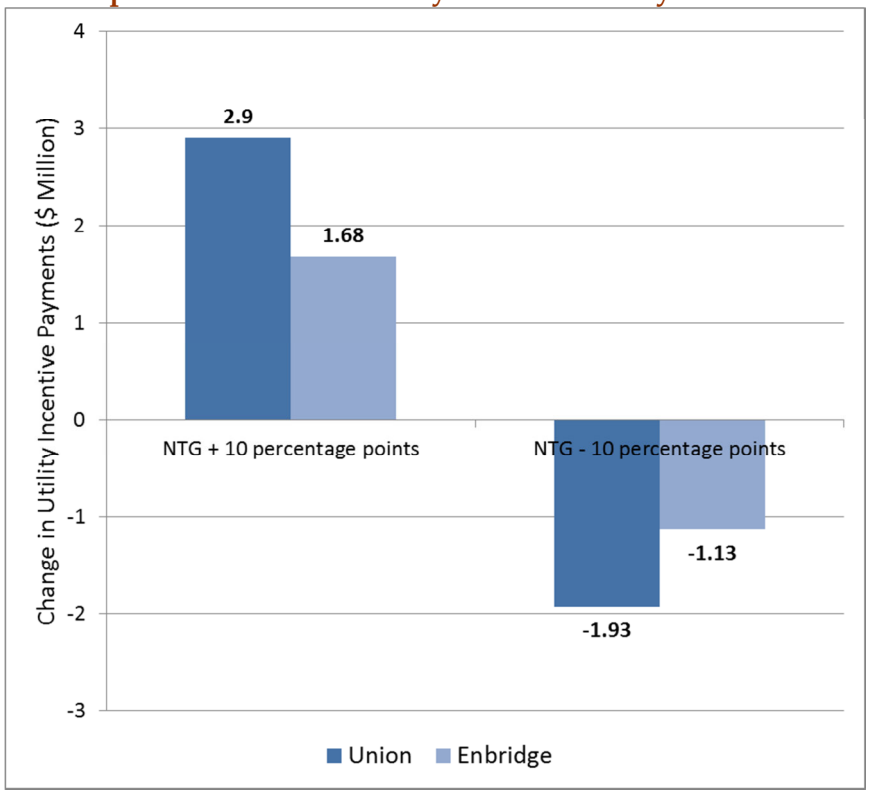
Source: Sensitivity Analysis provided by Enbridge.

At the net savings target under current assumptions, if the true custom program NTG values are 10 percentage points higher (Scenario 1) Enbridge should receive an additional $1.68 million in incentive payments for savings achieved. If, instead, the true custom program NTG values are 10 percentage points lower (Scenario 2), Enbridge is receiving $1.13 million in incentives for savings that are not achieved.

A swing of +/- 10 percentage points in custom program NTG values (i.e., error bounds of +/- 12.5% for commercial, +/- 13.5% for commercial new construction, and +/- 20% for industrial)) causes a swing in incentive payments by almost $2 million on the high side and $1 million on the low side. Assuming revised NTG values (e.g., by conducting NTG research) would reduce this uncertainty by one-half, the error bounds on the NTG values would reduce to +/- 5 percentage points in the NTG values. The swing in incentive payments at the new error bounds would be approximately $1 million on the high side and $0.5 million on the low side. If the cost of revising the NTG values are less than $0.5 million given these assumed error bounds; then, revising the NTG values *could be judged to be warranted*.

Figure 15 illustrates that the sensitivity in incentive payments to changes in custom program NTG values is greater for Union relative to Enbridge. This can be attributed to the fact that custom programs represent a larger share of Union's portfolio of programs, and consequently incentive payments, relative to Enbridge. Nevertheless, for both utilities changes in NTG values have a considerable impact on incentive payments.

Figure 15. Comparison of the Sensitivity of Incentive Payments to NTG Values



Source: Sensitivity analyses provided by Union and Enbridge.

6.2 *General Approaches to NTG*

In this section Navigant describes five general approaches to NTG representing the range of options for addressing net savings, from deeming a NTG value to conducting research to estimate a NTG value. The estimated increased precision of NTG values for each approach is identified as well as the approximate cost of the approach.

Option 1. Transfer NTG Values from Other Research

This approach transfers NTG values from the jurisdictional review. While the jurisdictional review revealed a wide range of NTG values, there is some clustering of values which could be used to inform a deemed value. If this approach is selected, the TEC sub-committee could select a NTG value from this clustering and apply it uniformly to Union and Enbridge's non-residential custom gas programs.

Advantages: The advantage of this approach is that it is simple, straightforward, uniform, and inexpensive.

Disadvantages: The disadvantage of this approach is that it does not recognize differences in the performance of different programs, designs, implementation, or program environments (such as economic conditions, energy prices, technology, and attitudes

about climate change); consequently, the transferred values may provide inaccurate estimates of net savings.

Option 2. Adjusted or Scaled NTG Values based on Program Factors

This approach uses a simple scaled or adjusted NTG value from the jurisdictional review to better represent Union and Enbridge programs. A principal objective of the detailed review of researched NTG values was to summarize NTG values based on program factors comparable to Union and Enbridge programs. In particular, Navigant characterized researched NTG values by utility-type, program-type, targeted sector, program maturity, program marketing, and region. If this approach is selected, the TEC sub-committee could select a NTG value accounting for comparable program factors and adjusting appropriately for Union and Enbridge's non-residential custom gas programs. For example, a NTG value that includes spillover should be adjusted to reflect the fact that the majority of studies that consider spillover were conducted in recent years.

Advantages: The advantage of this approach is that it is straightforward, uniform, and inexpensive. In addition, it recognizes differences in the performance of different program factors. Despite the disadvantages outlined below, the additional cost of adjusting or scaling the NTG value is so low that Option 2 is preferred in a pairwise comparison with Option 1.

Disadvantages: The disadvantage of this approach is that due to the small number of researched NTG values with comparable program factors, the credibility of the scaled or adjusted NTG values may come into question, particularly if considering spillover.

Option 3. Align NTG Values using Limited Primary Data Collection

This approach augments comparative NTG values with a small set of selected primary data gathered during the course of program implementation and/or evaluation to enhance the precision of the NTG values. The detailed review revealed that in situations where program design remains consistent, NTG values can vary substantively from one program year to the next, likely due to changes in program implementation or program environment. Interviews with participating and non-participating trade allies, for example, can provide insight into FR and spillover, informing NTG values and requiring relatively limited data collection. If this approach is selected, the TEC sub-committee could select a comparable NTG value using limited primary data collection to adjust NTG values for Union and Enbridge's programs.

Advantages: The advantage of this approach is that it recognizes differences in the performance of different programs, designs, implementation, and program environments while leveraging findings from the detailed review. NTG values will more accurately reflect actual net savings of the program.

Disadvantages: One disadvantage may be the difficulty of developing the appropriate data to collect that represents actual changes in the NTG values. Another disadvantage

of this approach is that data collection, even if limited, can be costly; however, if it is incorporated within a program process, e.g., a short survey with the payment of incentives, the costs may be limited.

Option 4. Full NTG Research Study (After Program Year)

This approach conducts full-scale evaluations specific to Union and Enbridge programs at the end of the program-year cycle. There various methods for estimating net savings, including, for example, survey-based methods and econometric modeling. The enhanced self-report approach would likely be the most appropriate approach given Union and Enbridge's programs are custom C&I and that identifying the magnitude of individual NTG components is desired.

Advantages: The advantage of this approach is that it recognizes differences in the performance of different programs, designs, implementation, and program environments. Given a full-scale evaluation, NTG values will more accurately reflect actual net savings of the program relative to the limited data collection approach.

Disadvantages: The disadvantage of this approach is that full-scale evaluations are costly. In addition, if not designed properly, NTG research estimates may be biased. Appropriate NTG research contends with a variety of potential biases including, for example, non-response bias, recall bias, reaching the appropriate person, as well as biases related to respondents providing socially desirable responses or legitimizing past behavior.

Option 5. Integrated/Fast Feedback NTG Estimation

This approach relies on Integrated Data Collection, or rolling data collection processes, to estimate NTG values specific to Union and Enbridge programs using fast-feedback. Fast-feedback approaches reduce bias associated with NTG estimates, such as recall bias, by surveying participants closer to when the decision-making actually occurs (Energy Trust of Oregon 2012). Collecting data frequently over time assures that less biased estimates of FR are calculated.

Advantages: The advantage of this approach is that it recognizes differences in the performance of different programs, designs, implementation, and program environments. Integrated or Fast Feedback NTG estimation has received a lot of attention due to its ability to help address several key estimation issues – it is easier to target the appropriate people and recall bias is reduced by reducing the time cycle between project completion and data collection.[29] Another possible advantage of this approach is that program implementation staff can see what the NTG is as the program

[29] A number of recent studies estimating NTG make sure that they at least reach appropriate participating customers within 90 days after participating, and conduct surveys on a quarterly cycle. E.g., Summit Blue Consulting, LLC., Skumatz Economic Research Associates, Inc., and Quantec, LLC. 2005. *Commercial/Industrial Performance Program (CIPP) – Market Characterization, Market Assessment and Causality Evaluation.* NYSERDA, March 2005.

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is implemented through the year. As a result, there are unlikely to be surprises in the NTG value at the end of a program year. Finally, this approach can actually be less costly than the traditional full research study presented above as Option 4 if data collection leverages existing program implementation efforts. For example, NTG surveys could be linked to the incentive payment process, e.g., one to two weeks after the incentives are paid a short free rider survey could be conducted (usually by phone). This approach is similar to Option 3 with more extensive data collection.

Disadvantages: The primary disadvantage of this approach are issues that may make integration difficult, e.g., appropriate timing of data collection, appropriate survey instruments, appropriate personnel leading the data collection all done along a timeline that is based on the implementation process. In addition, conducting research closer to program participation limits the amount of spillover that can be attributed to the program.

Table 8 provides a summary of the ability of the various approaches to improve the precision of the NTG value and provides an approximate cost of each NTG approach. Though an approximation, Navigant believe a 50% improvement in the precision of custom NTG values at a cost of $0.25 – 0.5 million is a reasonable estimate.[30]

Table 8. Ability of NTG Approaches to Produce More Precise NTG Values

General NTG Approach	Estimated Improved Precision (or Reduced Range) of NTG Value	Cost of NTG Approach per Utility (approximate)
Transfer NTG Values from Other Research	Little change	$3 – 5k
Adjust NTG Values based on Program Factors	Little change	$5 – 10k
Align NTG Values using Limited Primary Data	3 percentage points	$100 – 200k
Full NTG Research Study – After Program Year	5 percentage points	$250 – 500k
Integrated/Fast Feedback NTG Estimation	5 percentage points	$250 – 500k

Source: Navigant analysis.

[30] The cost estimates only reflect the contractor's program evaluation costs and do not include costs incurred by the utility and the TEC. These estimates assume primary data collection on program participants, a set of trade allies, and a sample of non-participants. Actual costs may vary depending on sub-strata and/or sector differentiation (e.g., commercial, commercial new construction, industrial).

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7. Summary

The net savings of Union and Enbridge's custom C&I programs were first evaluated by Navigant (formerly Summit Blue Consulting) in 2007-2008. Following the study, the OEB approved the FR adjustment, but did not approve a spillover value. Since that time, there have been a host of program environment changes, including economic conditions, energy prices, advances in technology, as well as changes in the design and delivery of the custom programs. As a result, a key priority for Ontario's TEC sub-committee is to update the FR adjustment factor and reconsider the spillover adjustment.

As an initial step, the TEC sub-committee contracted Navigant to provide information to assist the TEC sub-committee in their deliberations on the appropriate approach to NTG for natural gas DSM programs in Ontario. Through a jurisdictional review of the approach to net savings, and a review of researched NTG values for programs comparable to Union and Enbridge's custom C&I gas programs, Navigant provides an assessment of the various approaches to NTG. Following is a summary of key findings:

Approach to Net Savings

- The majority of jurisdictions with ratepayer funded energy efficiency programs conduct NTG research, though only half adjust gross savings based on research.
- U.S. states that provide a performance incentive mechanism for utilities or program administrators are more likely to make deemed or researched NTG adjustments.
- There appears to be a trend towards considering participant and NPSO in NTG research in recent years.

Researched NTG Values in Selected Jurisdictions

- Navigant identified a total of 19 documents that conducted NTG research of non-residential gas programs that calculated 38 distinct results.
- Researched net-of-free ridership values for non-residential gas programs exhibit a wide dispersion (21% to 100%) with a slight "clustering" of values between 40% and 90%.
- Trends in researched NTG values that consider spillover, as well as trends when considering specific program characteristics, should be interpreted with caution due to the small sample sizes.
- Union and Enbridge's current NTG values are within the range of researched values. Union's NTG value is below the average value. Enbridge's NTG value for the commercial sector is above the average value while the NTG value for the industrial sector is below the average value.

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Assessing Options for NTG

- There are a variety of benefits of accurate (costs of inaccurate) NTG values that could be considered; utility incentive payments are just one.
- Improving the precision of NTG values has a sizable impact on incentive payments.
- NTG values with a margin of error of +/- 10 percentage points have roughly a $1 - $3 million impact on utility incentive payments.
- Alternate NTG approaches could improve the precision of NTG values by approximately 50% at an approximate cost of $0.25 - $0.50 million per utility.

The objective of this report is to provide information to assist the TEC sub-committee in their determination on the appropriate approach to NTG for DSM programs in Ontario, and not to provide a specific recommendation. While this report is not comprehensive in addressing all potential considerations, such as other benefits of accurate (costs of inaccurate) NTG values, it provides important information relevant to the discussion. In addition to summarizing the regulatory and methodological approach taken by other jurisdictions, and summarizing NTG values for programs with characteristics similar to Union and Enbridge's custom C&I programs, Navigant provides insight into the risks associated with inaccurate NTG values and the approximate cost of mitigating those risks.

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Appendix A. General and Methodological References

Kushler, Martin, Nowak, Seth, and Patti White. 2012. *A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs.* American Council for an Energy-Efficient Economy. Available from: http://www.aceee.org/sites/default/files/publications/researchreports/u122.pdf.

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Saxonis, W. 2007. *Free Ridership and Spillover: A Regulatory Dilemma.* Energy Program Evaluation Conference, Chicago, IL.

The Cadmus Group. 2012. *Assessment of Energy and Capacity Savings Potential in Iowa.* Iowa Utility Association, February 28, 2012.

The Cadmus Group. 2011. *Net-to-Gross: Updating Research.* Salt River Project, December 20, 2011.

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Appendix B. Summary of NTG Values for Excluded Programs

There are two jurisdictions/programs that were excluded from the detailed review but provide additional information to the TEC sub-committee on NTG values in other jurisdictions.

California's **Savings by Design** program is a custom C&I program that has been offered for more than 10 years. This program was excluded from our review because the methodology used to calculate net savings was different from the approach used by the remaining documents reviewed. In particular, responses to a FR survey were used to adjust the baseline of an engineering model. The NTG ratio was then calculated as the ratio of gross to net savings, as estimated by the engineering model. This approach accounts for interactive effects between measures and resulted in NTG values greater than 100%, even though only a FR adjustment was made. The table below summarizes the NTG values for Savings by Design.

NTG Values for Savings by Design

Category	NTG Value
Combined	87%
PG&E	66%
SDG&E	109%
SCE	101%
SCG	25%

Source: RLW Analytics. 2008. *An Evaluation of the 2004-2005 Savings by Design Program.* California Public Utilities Commission, October 2008.

NYSERDA has implemented a number of C&I programs with custom components, and include both electric and gas measures. Relevant programs include: **Industrial and Process Efficiency, Flexible Technical Assistance, C&I Performance, and New Construction Program.** Recent research estimates NTG values using a rigorous methodology, but were excluded from our review because the values were not reported separately for electric and gas measures. The Table below summarizes NTG values for these programs, where NTG = 1 – Free Ridership + Participant Spillover + Non-Participant Spillover.

NTG Values for NYSERDA Programs

Program	NTG Value
Industrial and Process Efficiency	104%
Flexible Technical Assistance	117%
New Construction Program	116%
C&I Performance	123%

Sources: Megdal & Associates. 2012. *NYSERDA 2009-2010 Industrial and Process Efficiency Program Impact Evaluation Report; Impact Evaluation: NYSERDA 2007-2009 FlexTech Program; New Construction Program (NCP) Impact Evaluation Report for Program Years 2007-2008;*
Summit Blue Consulting. 2007. *Commercial and Industrial Performance Program (CIPP): Market Characterization, Market Assessment and Causality Evaluation.* NYSERDA, May 2007.

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Appendix C. Annotated Bibliography of Documents Reviewed

2004/2005 Statewide Express Efficiency and Upstream HVAC Program Impact Evaluation	
Author and Date	Itron and KEMA. December 31, 2008.
Jurisdiction	California
Utilities	Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, and Southern California Gas Company
Program Name	Express Efficiency Program
Program Summary	The Express Efficiency program targets small and medium-sized commercial customers (electricity demand less than 500 kW; annual gas consumption less than 250,000 therms) providing financial incentives to end-users for the installation of selected energy efficient electric and gas technologies (e.g., lighting, refrigeration, air conditioning, food service, agricultural, and gas technologies). The program implements a marketing strategy directly with the end-user and through upstream partners (e.g., vendors).
Program Year	2004-2005
NTG	0.51
Free-Ridership	NTG=1-FR; 0.49
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Self-report. Participant surveys were completed by end-users. The free-ridership score was the average of scores from two methodologies using participant survey data. One methodology adjusts for timing.

Note that this evaluation study also addresses the Upstream HVAC/Motors; however, no gas savings were reported under this program in 2004-2005.

NAVIGANT

2004-2005 Statewide Nonresidential Standard Performance Contract Program Measurement and Evaluation Study	
Author and Date	Itron. September 30, 2008.
Jurisdiction	California
Utilities	Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison
Program Name	Nonresidential Standard Performance Contract Program
Program Summary	This program provides financial incentives for custom cost effective energy saving retrofits of existing facilities. While targeted at large and medium-sized businesses, small businesses can participate if they are ineligible for incentives through California's Express Efficiency program. Major measure types include: lighting and lighting controls, variable speed-drive for motors, HVAC, and industrial processes. Pacific Gas & Electric and San Diego Gas & Electric offer incentives for energy efficiency gas measures, with incentives of $1.00 per therm.
Program Year	2004-2005
NTG	0.57
Free-Ridership	0.43
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Self-report. Participant surveys were completed by end-users. The sample used for gross impact analysis was also used for net impact analysis. The free-ridership score was the average of scores from two methodologies using participant survey data, in which one methodology adjusted for timing.

NAVIGANT

2006-2008 Retro-Commissioning Impact Evaluation	
Author and Date	SBW Consulting. February 8, 2010.
Jurisdiction	California
Utilities	Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, and Southern California Gas
Program Name	More than two dozen Retro-Commissioning programs.
Program Summary	This report presents evaluation, measurement and verification activities for over two dozen commercial retro-commissioning programs that target high impact measures (i.e. contribute more than 1% of utilities' savings portfolio). Given the number of programs, program design varies and may include technical assistance and/or financial incentives.
Program Year	2006-2008
NTG	PG&E: 0.86 SCE: 0.91 SCG: 0.92 SDG&E: 0.68
Free-Ridership	PG&E: 0.14 SCE: 0.09 SCG: 0.08 SDG&E: 0.32
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Enhanced self-report. Includes participant surveys, vendor surveys, program staff interviews, and file reviews. In some cases supplemental questions were asked of participant decision-makers. Free-ridership estimate is based on survey questions about timing and selection, program influence, and likelihood. Timing adjustments are included. When multiple elements feed into one score, the maximum (representing highest program influence) is used.

NAVIGANT

2006-2008 Evaluation Report for PG&E Fabrication, Process and Manufacturing Contract Group	
Author and Date	Itron. February 3, 2010.
Jurisdiction	California
Utilities	Pacific Gas & Electric
Program Name	Program administered by PG&E: • Fabrication, Process and Manufacturing Programs administered by a third-party: • Heavy Industry Energy Efficiency Program • California Wastewater Process Optimization Program • Energy Efficiency Services for Oil Production • Wastewater Process Efficiency Initiative • Refinery Energy Efficiency Program • Assessment, Implementation and Monitoring • Value and Energy Stream Mapping Advantage Plus • Energy Efficiency of Compressed Systems • C&I Boiler Efficiency Program
Program Summary	The Pacific Gas & Electric Fabrication, Process and Manufacturing contract group is comprised of one PG&E program and nine third-party programs. These programs provide technical assistance and financial incentives for the installation of custom and prescriptive electric and gas measures in industrial facilities. Eligible sectors include industrial and manufacturing, water supply and treatment, wastewater, oil and gas extraction, refining, and production. Major measure types include: boiler upgrades and controls, boiler heat recovery, pipe and duct insulation, HVAC, process improvements, as well as various electric measures.
Program Year	2006-2008
NTG	0.31
Free-Ridership	0.69
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Enhanced self-report. Includes participant surveys, vendor surveys, program staff interviews, and file reviews. In some cases supplemental questions were asked of participant decision-makers. Free-ridership estimate is based on survey questions about timing and selection, program influence, and likelihood. Timing adjustments are included. When multiple elements feed into one score, the maximum (representing highest program influence) is used.

NAVIGANT

Evaluation of the Southern California Gas Company 2004-2005 Non-Residential Financial Incentives Program	
Author and Date	ECONorthwest. June 6, 2006.
Jurisdiction	California
Utilities	Southern California Gas Company
Program Name	Nonresidential Financial Incentives Program
Program Summary	This program provides technical assistance, education, and financial incentives for prescriptive and custom energy efficiency gas measures. This program is targeted at small and medium-sized customers, spanning the commercial, industrial and agricultural sectors. There are three program offerings: • The Commercial Food Service Equipment Rebate program offering provides financial incentives for prescriptive measures. Examples include ovens, broilers, griddles, and fryers. • The Nonresidential Equipment Replacement program offering provides financial incentives for the replacement of existing gas technologies with energy efficient alternative. Examples include industrial furnaces, ovens, dryers, washers, and more. • The Nonresidential Energy Conservation program offering provides financial incentives for energy efficiency retrofits and energy efficiency improvements to industrial processes. Examples include heat-recovery, process steam improvements, and high-efficiency burner replacements.
Program Year	2004-2005
NTG	0.70
Free-Ridership	0.30
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Self-report. Participant surveys were completed by end-users. Three methodologies were implemented though a preferred methodology is identified. This methodology calculates a probability of influence based on the influence of the financial incentive, program representatives, and adjusts for timing.

NAVIGANT

Comprehensive Process and Impact Evaluation of the Business Heating Efficiency Program - Colorado	
Author and Date	TetraTech. December 14, 2011.
Jurisdiction	Colorado
Utilities	Xcel Energy
Program Name	Business Heating Efficiency Program
Program Summary	This program provides financial incentives to commercial customers for prescriptive energy efficient gas measures. Major measure types include: new high efficiency hot water boilers and furnaces, improvements to existing boilers and hot water heaters, or boiler tune-ups to maintain peak operating efficiency.
Program Year	2011
NTG	0.85
Free-Ridership	0.26
Participant Spillover	0.11 (Like)
Non-Participant Spillover	N/A – Conducted interviews with HVAC trade allies but were unable to quantify NPSO.
Research Method	Self-report. Surveys include questions about the timing and selection of program measures, the influence of the program (whether rebate, recommendation, or other program intervention), and the likelihood of various actions now and in the future had the program not been available. Methodology adjusts free-ridership score if past program participation in any Xcel Energy program influences the decision to install a measure. Spillover is considered if it occurs within 4 years.

NAVIGANT

2011 C&I Natural Gas Programs Free-Ridership and Spillover Study	
Author and Date	TetraTech. June 26, 2012.
Jurisdiction	Massachusetts
Utilities	National Grid, NSTAR, Unitil, Berkshire Gas, Columbia Gas, and New England Gas
Program Names	All C&I custom and prescriptive gas programs were included in this evaluation. • National Grid programs include: New Construction (custom and prescriptive), Retrofit (custom and prescriptive), Direct Install (prescriptive) • NSTAR programs include: Business Solutions (custom), Construction Solutions (custom), Small Business Solutions (custom and prescriptive) • Columbia Gas programs include: Large Custom, Small Custom, Prescriptive • Unitil programs include: Large Retrofit (custom and prescriptive), Gas Networks (prescriptive), Small Direct Install (prescriptive) • New England Gas programs include: Retrofit (custom), Lost Opportunity (prescriptive), Direct Install (prescriptive) • Berkshire Gas programs include: Custom, Prescriptive
Program Summary	These programs provide financial incentives for installing custom and prescriptive energy efficient gas measures.
Program Year	2011
NTG	0.79
Free-Ridership	0.305
Participant Spillover	0.085 (Like)
Non-Participant Spillover	0.007
Research Method	Enhanced self-report. Combination of participant (decision-makers) and trade ally surveys. Surveys include questions about likelihood of equivalent efficiency and quantity of program measures, as well as the timing. Questions were also included about the influence of program and various features of the program, as well as the influence of participating in past programs. Free-ridership and spillover estimates are weighted by therm savings and the probability of being surveyed. Surveys with design professionals and equipment vendors were used to calculate free-ridership in cases where the decision was heavily influenced by the design professional/equipment vendor, as well as to calculate NPSO.

NAVIGANT

Achieving Natural Gas Savings Goals: Commercial Heating Programs Heat It Up	
Author and Date	TetraTech and Xcel Energy. 2012 ACEEE Summer Study on Energy Efficiency in Buildings.
Jurisdiction	Minnesota
Utilities	Xcel Energy
Program Name	Business Heating Efficiency Program
Program Summary	This program provides financial incentives to commercial customers for prescriptive energy efficient gas measures. Major measure types include: new high efficiency hot water boilers and furnaces, improvements to existing boilers and hot water heaters, or boiler tune-ups to maintain peak operating efficiency.
Program Year	2011
NTG	1.09
Free-Ridership	0.17
Participant Spillover	0.26 (Like)
Non-Participant Spillover	N/A – Conducted interviews with HVAC trade allies but were unable to quantify NPSO.
Research Method	Self-report. Surveys include questions about the timing and selection of program measures, the influence of the program (whether rebate, recommendation, or other program intervention), and the likelihood of various actions now and in the future had the program not been available. Methodology adjusts free-ridership score if past program participation in any Xcel Energy program influences the decision to install a measure. Spillover is considered if it occurs within 4 years.

Note: Research method is the method employed by TetraTech in the evaluation of Colorado's Xcel Energy Business Heating Efficiency Program which is the same method employed in Minnesota. This paper relies on TetraTech's evaluation to report NTG values, though the report itself is not publicly available.

NAVIGANT

New Jersey's Clean Energy Program Energy Impact Evaluation: SmartStart Program Impact Evaluation	
Author and Date	KEMA. September 17, 2009.
Jurisdiction	New Jersey
Utilities	New Jersey's Clean Energy Program
Program Name	SmartStart Buildings Program (New Construction, Schools, and Retrofit program)
Program Summary	This program provides financial incentives and technical assistance for energy efficient measures in new construction, retrofits of existing buildings, and schools.
Program Year	2006
NTG	0.21
Free-Ridership	0.79
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Self-report. Surveys include questions about likelihood of equivalent efficiency and quantity of program measures, as well as the timing. Free-ridership measures for timing, efficiency, and quantity are multiplied to determine free-ridership. Adjustments to free-ridership score based on timing is made. The sample size for Schools and New Construction programs is small.

NAVIGANT

Evaluation of 2011 DSM Portfolio	
Author and Date	ADM Associates. June 29, 2012.
Jurisdiction	New Mexico
Utilities	New Mexico Gas Company
Program Names	Commercial Solutions, Commercial High Efficiency Water Heater, Commercial Energy Star Food Service, and SCORE Pilot
Program Summary	These programs provide financial incentives for custom and prescriptive measures installed by commercial customers. • The Commercial Solutions program includes two program offerings: direct install of low flow faucet aerators and pre-rinse spray valves, and custom incentives of up to $0.75 per therm for custom measures, such as: water heating, HVAC, building envelope, and industrial processes. The SCORE Pilot is similar to the Commercial Solutions program but is targeted at K-12 school districts. • The Commercial Energy Star Food Services program provides prescriptive rebates for commercial kitchen measures, such as fryers, dishwashers, convection ovens, and commercial griddles. • The Commercial High Efficiency Water Heater program provides financial incentives for storage tank and tankless water heaters.
Program Year	2011
NTG	Commercial Solutions: 0.96 Commercial High Efficiency Water Heater: 1.00 Commercial Energy Star Food Service: 1.00 SCORE Pilot: 1.00
Free-Ridership	Commercial Solutions: 0.04
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Self-report. Surveys include questions about the financial ability to purchase measures without the program, the importance of the financial incentive, prior planning to purchase measures, and demonstrated behavior in purchasing similar measures without a financial incentive.

NAVIGANT

Fast Feedback Results	
Author and Date	Energy Trust of Oregon. April 25, 2012.
Jurisdiction	Oregon
Utilities	Energy Trust of Oregon
Program Names	Existing Buildings Program, Production Efficiency Program
Program Summary	Descriptions of programs not included in study. Information that follows is from the Energy Trust of Oregon's website (http://energytrust.org) Existing Buildings program provides custom and prescriptive financial incentives to existing commercial facilities. Major gas measure types include: HVAC, furnace, radiant heater, hot water tanks, tankless water heaters, boilers, and steam traps. Production Efficiency program provides technical assistance and financial incentives for energy efficiency improvements for industrial processes, including manufacturing, agriculture, and water/wastewater treatment. Major measure types include: motors, compressed air, variable speed drives, refrigeration, pumps, fans, and lighting.
Program Year	Q2 2010
NTG	Existing Buildings: 0.73 Existing Multifamily: 0.52 Production Efficiency: 0.80
Free-Ridership	Existing Buildings: 0.27 Existing Multifamily: 0.48 Production Efficiency: 0.20
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Self-report. Surveys are conducted with participants that received a financial incentive within the previous month. The survey is designed to be completed in no more than 5 minutes and consists of 10 questions or less. Free-ridership is calculated as the sum of a project change score and an influence score. The project change score is based on survey questions about the actions the customer would have taken if the program was not available. Influence questions ask about the influence of the program, trade ally influence, etc.

NAVIGANT

Impact and Process Evaluation of the 2006-2007 Building Efficiency Program	
Author and Date	Research Into Action and the Cadmus Group. August 3, 2009.
Jurisdiction	Oregon
Utilities	Energy Trust of Oregon
Program Name	Building Efficiency Program
Program Summary	This program provides technical assistance and financial incentives for electric and gas energy-saving measures installed by commercial and institutional customers. Financial incentives are provided for both prescriptive and custom measures. Major measure types include: lighting, motors, HVAC, gas space and water heaters, restaurant equipment, and insulation.
Program Year	2006-2007
NTG	0.70
Free-Ridership	0.30
Participant Spillover	Qualitative assessment.
Non-Participant Spillover	N/A
Research Method	Self-report. Survey questions consider program influence, intentions for the project without the program, and budget.

Evaluation of Building Efficiency Program 2004 &2005	
Author and Date	ADM Associates. February 2009.
Jurisdiction	Oregon
Utilities	Energy Trust of Oregon
Program Name	Building Efficiency Program
Program Summary	This program provides technical assistance and financial incentives for electric and gas energy-saving measures installed in existing commercial, institutional, and agricultural facilities. Financial incentives are provided for both prescriptive and custom measures. Major measure types include: lighting, motors, HVAC, gas space and water heaters, restaurant equipment, and insulation.
Program Year	2004-2005
NTG	2004: 0.65 2005: 0.95
Free-Ridership	2004: 0.35 2005: 0.05
Participant Spillover	Qualitative assessment.
Non-Participant Spillover	N/A
Research Method	Self-report. Survey questions consider program influence, intentions for the project without the program/prior planning, and previous experience with the measure. Each question is binary (i.e. yes/no). Partial free-ridership is explored through questions about efficiency level, quantity and timing.

NAVIGANT

Impact and Process Evaluation of the 2006-2007 New Building Efficiency Program	
Author and Date	ADM Associates. June 2009.
Jurisdiction	Oregon
Utilities	Energy Trust of Oregon
Program Name	New Building Efficiency Program
Program Summary	This program provides technical assistance and financial incentives for electric and gas energy-saving measures installed in new commercial facilities or commercial facilities undergoing major renovation. Major measure types include: lighting, HVAC, motors, energy management systems, and washer/dryers.
Program Year	2006-2007
NTG	0.67
Free-Ridership	0.33
Participant Spillover	Qualitative assessment.
Non-Participant Spillover	N/A
Research Method	Self-report. Participant surveys were conducted. Free-ridership estimates are based on survey questions that ask about the influence of the program, the participants' intentions for the project if the program were not available, and their financial ability to install the measures if the program were not available.

C&I Energy Efficiency Retrofit Custom Programs Portfolio Evaluation	
Author and Date	Navigant Consulting. February 3, 2012.
Jurisdiction	Washington
Utilities	Puget Sound Energy
Program Name	Custom Grant Program
Program Summary	This program provides financial incentives for the installation of custom energy efficient measures as part of a retrofit, new construction, or expansion of existing facilities project. Major measure types include: lighting, boilers, HVAC, variable speed drives, and process improvements.
Program Year	2010-2011
NTG	1.02-1.1
Free-Ridership	0.27
Participant Spillover	0.07-0.09 (inside like); 0.04-0.05 (outside like)
Non-Participant Spillover	0.18-0.23
Research Method	Self-report. Surveys of participants and non-participants were conducted. Free-ridership was estimated based on survey questions about timing, efficiency, quantity, and program importance. Spillover calculated as a factor of savings derived from spillover project based on program influence. Savings were assumed equal to savings by in-program projects (by measure-type). Similar calculations were conducted for NPSO.

NAVIGANT

Focus on Energy Evaluation: Business Programs – Additional Looks at Attribution	
Author and Date	PA Consulting Group and KEMA. February 26, 2010.
Jurisdiction	Wisconsin
Utilities	Focus on Energy
Program Name	The names of specific program offerings are not reported.
Program Summary	Various programs provide technical assistance and financial incentives for implementing cost effective energy efficiency measures. Both prescriptive and custom incentives are available. Targeted sectors include commercial, industrial, agricultural, and institutional. Major measure types include: boilers, HVAC, refrigeration, water heater, expanded processes, and lighting.
Program Year	July 1, 2007 through September 30, 2008
NTG	0.52
Free-Ridership	0.48
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Enhanced self-report. Surveys of participants and trade allies were conducted. Free-ridership survey questions ask about timing, efficiency, and the quantity of measures installed if the program were not available. These free-ridership estimates are multiplied (e.g., NTG=1-FqFeFt). Surveys include consistency checks. NTG estimates based on participant survey data is compared to estimates based on trade ally survey data. The maximum value is selected.

NAVIGANT

Focus on Energy Evaluation: Business Programs Impact Evaluation Report – Last Quarter of Calendar Year 2009 and First Two Quarters of Calendar Year 2010	
Author and Date	TetraTech and KEMA. January 27, 2011.
Jurisdiction	Wisconsin
Utilities	Focus on Energy
Program Name	The names of specific program offerings are not reported.
Program Summary	Various programs provide technical assistance and financial incentives for implementing cost effective energy efficiency measures. Both prescriptive and custom incentives are available. Targeted sectors include commercial, industrial, agricultural, and institutional. Major measure types include: boilers, HVAC, refrigeration, water heater, expanded processes, and lighting.
Program Year	October 1, 2009 through June 30, 2010
NTG	2009: 0.60 2010: 0.47
Free-Ridership	2009: 0.40 2010: 0.53
Participant Spillover	(Identified in a separate study as 0.002%)
Non-Participant Spillover	N/A
Research Method	Enhanced self-report. Surveys of participants and trade allies were conducted. Free-ridership survey questions ask about timing, efficiency, and the quantity of measures installed if the program were not available. These free-ridership estimates are multiplied (e.g., NTG=1-FqFeFt). Surveys include consistency checks. NTG estimates based on participant survey data is compared to estimates based on trade ally survey data. The maximum value is selected.

NAVIGANT

Focus on Energy Evaluation: Semiannual Report (Second Half of 2009)	
Author and Date	PA Consulting Group. April 23, 2010.
Jurisdiction	Wisconsin
Utilities	Focus on Energy
Program Name	The names of specific program offerings are not reported.
Program Summary	Various programs provide technical assistance and financial incentives for implementing cost effective energy efficiency measures. Both prescriptive and custom incentives are available. Targeted sectors include commercial, industrial, agricultural, and institutional. Major measure types include: boilers, HVAC, refrigeration, water heater, expanded processes, and lighting.
Program Year	Q3 and Q4 2009
NTG	0.59
Free-Ridership	0.41
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Enhanced self-report. Participant surveys and surveys with trade allies were conducted. Free-ridership survey questions ask about timing, efficiency, and the quantity of measures installed if the program were not available. Conducted a sensitivity analysis on treatment of timing using methodologies adopted in other jurisdictions finding little variation.

NAVIGANT

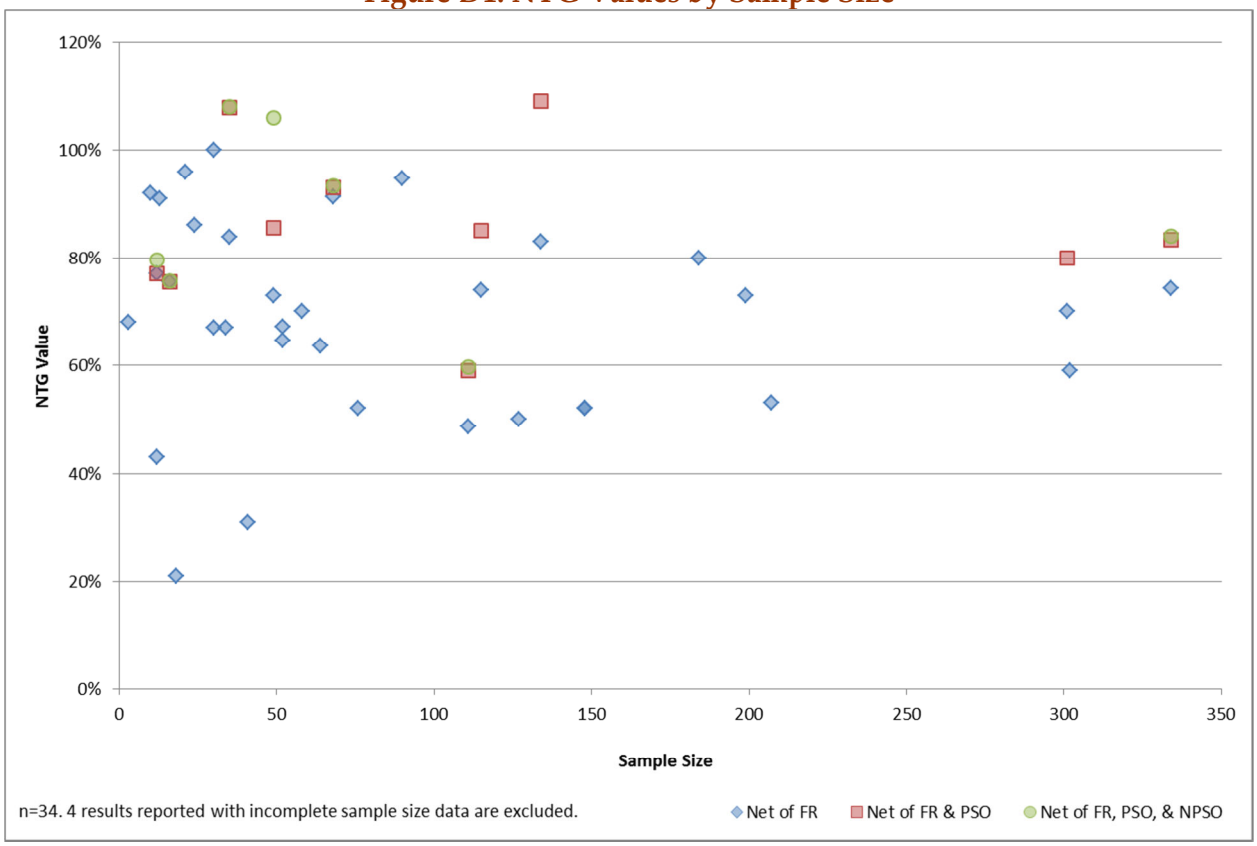
Focus on Energy Evaluation: Semiannual Report (First Half of 2009)	
Author and Date	PA Consulting Group. October 19, 2009.
Jurisdiction	Wisconsin
Utilities	Focus on Energy
Program Name	The names of specific program offerings are not reported.
Program Summary	Various programs provide technical assistance and financial incentives for implementing cost effective energy efficiency measures. Both prescriptive and custom incentives are available. Targeted sectors include commercial, industrial, agricultural, and institutional. Major measure types include: boilers, HVAC, refrigeration, water heater, expanded processes, and lighting.
Program Year	A1 and A2 2009
NTG	0.52
Free-Ridership	0.48
Participant Spillover	N/A
Non-Participant Spillover	N/A
Research Method	Enhanced self-report. Participant surveys and surveys with trade allies were conducted. Free-ridership survey questions ask about timing, efficiency, and the quantity of measures installed if the program were not available.

NAVIGANT

Appendix D. NTG Values by Sample Size

The figure below summarizes NTG values by sample size. Sample sizes are reported in raw form and do not reflect the percent of participants or percent of energy savings. Consequently, this Figure should be interpreted with caution.

Figure D1. NTG Values by Sample Size



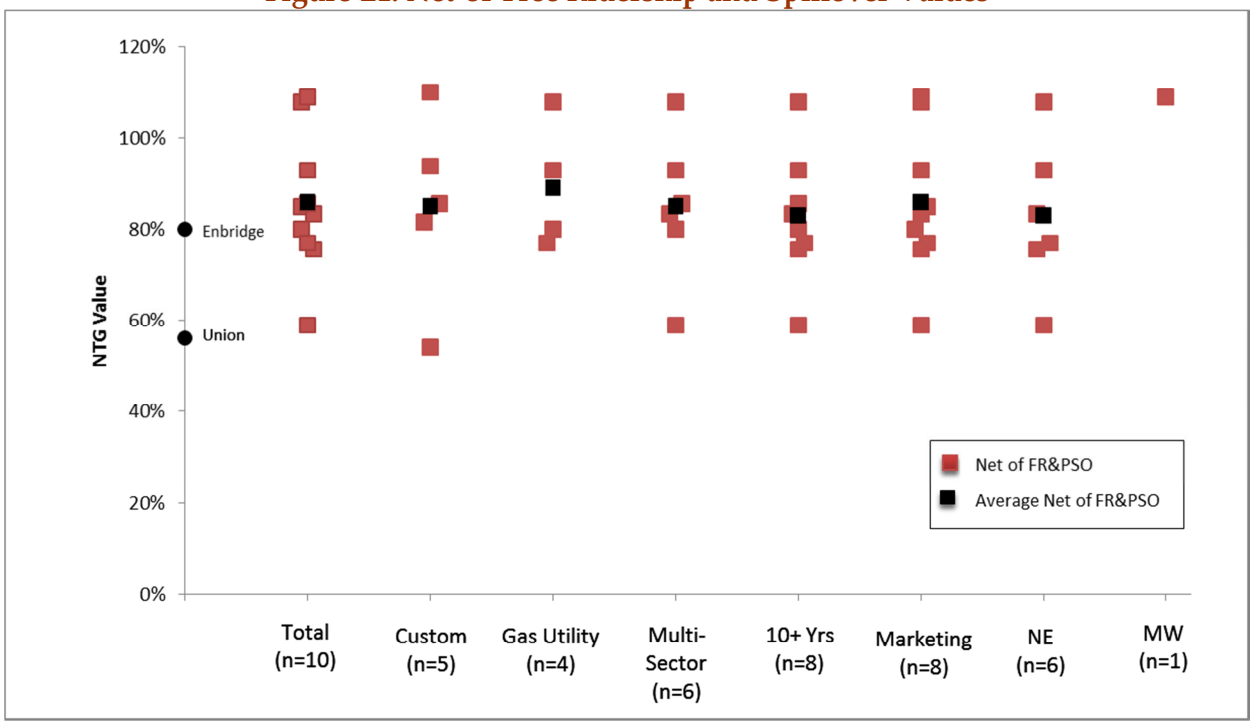
Source: Navigant analysis. Note that the sample size (n) represents the number of unique NTG results (program-utility-year combinations) reported in the 19 studies.

NAVIGANT

Appendix E. Researched Net-of-Free Ridership and Spillover Values

The figure below summarizes net-of-free ridership and PSO values that are most relevant to Union and Enbridge programs. In particular, values are presented for the following categories: custom program, gas utility, multi-sector, 10+ years since program inception, a combination of direct and channel/partner marketing strategy, and northern regions (Northeast and Midwest). Note that the values reported for Union and Enbridge are researched values representing all sectors resulting from the 2007-2008 attribution study. Caution should be used in interpreting trends due to the small sample sizes. Nevertheless similar trends emerge. Enbridge and Union NTG values are below the average values.

Figure E1. Net-of-Free Ridership and Spillover Values



Source: Navigant analysis. Note that the sample size (n) represents the number of unique NTG results (program-utility-year combinations).

GEC Response to APPrO Interrogatory #2

Question:

Reference: L.GEC.1 i) Page 29

Preamble: The evidence indicates that: *"However, since the majority of the increase in savings I would expect from Union would come from T2/R100 customers, which have historically provided the most cost-effective savings in Union's portfolio, it is possible if not likely that the estimate of additional net benefits for Union are even greater than my simple extrapolation suggests".*

a) Please provide any and all data or documentation that you have used to support or assess the base level of efficiency and conservation measures that are undertaken by T2/R100 customers.

b) Please provide any and all data to support:
   i. Your assessment that Union's most cost-effective measures are for T2/R100 customers; and
   ii. The relative cost-effectiveness of Union's undertaking the efficiency measures on behalf of T2/R100 customers and T2/R100 customers undertaking the efficiency measures directly.

Please provide all assumed or estimated costs related to administration and overhead.

Response:

a) I have not estimated the "base level of efficiency and conservation measures that are undertaken by T2/R100 customers". That was not necessary to reach the conclusion referenced in the preamble. I do not doubt that those customers have undertaken efficiency investments in the past or that they would do so in the future. Frankly, all customers make some "base level" of investment or changes in behavior or operations. It is also true that DSM programs of all kinds, targeted to all markets, will end up providing incentives or other support for efficiency projects that would otherwise have been undertaken anyway. Few programs, other than low income programs, have free rider rates of zero or close to zero. However, as long as the programs are obtaining significant savings from non-free riders, and doing so at a reasonable cost, they are beneficial. Of course, efforts should always be made to refine program designs in ways that minimize free ridership (provided such changes do not have other significant adverse effects).

b) Responses are as follows:
   i. My assessment of the relative cost-effectiveness of the T2/R100 savings is based on Union's historic assessment of the cost-effectiveness of its various program offerings. For example, in 2014 the benefit-cost ratio for Union's savings from T2 and R100 customers was 4.15 and 6.90, respectively. The net benefits associated with those two sets of customers' savings – after adjusting for an

assumed 54% free rider rate and without accounting for any spillover effects – was over $90 million. The only other program that produced better benefit-cost ratios in that year was Union's Residential Efficiency Kits program (BCR of over 34 and net benefits of about $12 million); the custom offerings to T1 customers had a BCR of 5.61 (in the middle of the T2/R100 BCRs) and net benefits of about $11 million. All other programs had BCRs of less than 3.5.[1]

ii. The premise of this request is flawed. By definition, DSM program savings are only considered DSM savings because they would not have been undertaken without the program.

[1] Union Response to B.T6.Union.GEC.4, Attachment 3.

GEC Response to APPrO Interrogatory #3

Question:

Reference: L.GEC.1

i) Page 32

"*virtually all of Union's eligible large industrial customers are participating in its Self-Direct program*".

ii) EB-2012-0337 Exhibit B5.15, in which Union provided the following interrogatory response:

Filed: 2012-10-25
EB-2012-0337
Exhibit B5.15
Page 1 of 1

UNION GAS LIMITED

Answer to Interrogatory from
Association of Power Producers of Ontario ("APPrO")

Reference: Exhibit A, Tab 1, Appendix B
Preamble: Union provides some of the program incentives on slide 8. APPrO would like to better understand these incentives proposed.

a) For customers that would typically be eligible for Rate 100 or T2, and for each of the 10 program elements shown on slide 8, please provide the average cost of implementing these program elements (where reasonably possible) and show the total cost of implementing the program, incentive amount provided by Union, the amount that the customer would fund on its own and the percentage funded directly by each of Union through ratepayer funded DSM and the percentage funded directly by the customer.

Response:

Union does not track the cost of implementing at the program element level. Union does track the incentives provided and customer project cost at the measure level. Please see the table below for incentive funding provided by Union, the amount the customer would fund on its own and the percentages funded directly by Union and the customer accordingly.

Rate T1 / Rate 100 - 2011 Results				% Funding - average		$ Funding - average	
Offering	# of Projects	Incentive $ Provided By Union	Customer Project $	By Union	By Customer	By Union	By Customer
O & M	157	$ 1,989,254	$ 23,169,661	9%	91%	$ 12,670	$ 147,577
Capital	43	$ 1,180,959	$ 31,632,015	4%	96%	$ 27,464	$ 735,628
Engineering Feasibility	17	$ 104,373	$ 395,718	26%	74%	$ 6,140	$ 17,138
Process Improvement	33	$ 444,509	$ 1,394,046	32%	68%	$ 13,470	$ 28,774
Steam Trap	20	$ 80,243	$ 252,633	32%	68%	$ 4,012	$ 8,620
Education	2	$ 16,000	$ 45,185	35%	65%	$ 8,000	$ 14,593
	272	**$ 3,815,338**	**$ 56,889,258**				

iii) EB-2012-0337 Transcript Volume 2, February 1, 2013

Witness: Chris Neme

Preamble: APPrO would like to review Mr. Neme's understanding of the participation in Union's DSM program by Rate T2 and Rate 100 customers.

a) Please confirm that T2 and Rate 100 rates currently include mandatory funding for Union's DSM program to fund customer incentives and Union overheads. If not confirmed, please explain.
b) Please confirm that all customers in T2 and Rate 100 are eligible to receive the customer incentive portion of the DSM funding that they paid for in rates via Union's Self-Direct program.
c) Please confirm that it would be logical for any T2 or Rate 100 customer that is interested in reducing its energy costs and reducing its emissions to offset a portion of the total cost to implement the energy efficiency measure to apply for a refund of a portion of the amount paid in rates. If not confirmed, please explain.
d) Please confirm that the Self-Direct program requires the customers to submit an energy plan to Union for "approval" prior to the customer knowing that the project will be funded.
e) From Reference ii), please confirm that the average amount of customer DSM incentive funds provided by Union as a percentage of the total cost to implement those customer projects funded by Union is approximately 6.7% ($3,815,338/$56,889,258).

Response:

a) Confirmed.
b) Confirmed.
c) If the question is asking whether a customer that would implement an efficiency measure without a DSM program would be smart to take advantage of a financial incentive the utility offers, the answer is generally "yes". That is why there is some amount of free ridership in almost every type of program.
d) That is my understanding.
e) Confirmed, for the time period for which the data were applicable.

GEC Response to APPrO Interrogatory #4

Question:

Reference: L.GEC.1, i) Page 16 ii) Ontario's Climate Change Update, page 16

Preamble: Mr. Neme's evidence indicates that natural gas accounts for approximately 30% of all greenhouse gas (**GHG**) emissions in the province of Ontario (the **Province**) and that the 2030 projected emissions are anticipated to be at 1990 levels in a business as usual (**BAU**) scenario.

a) Please provide any and all data and documentary support and all third party verification relied upon to arrive at the assertion that natural gas accounts for 30% of all GHG emissions in the Province.

b) Please confirm that 1990 GHG emissions in Ontario are approximately 25 MT lower than 2005 emissions and 2014 emissions are approximately 42 MT lower than BAU.

c) Please confirm that the assertion that Provincial emissions will increase to 1990 levels (they are currently more than 6% below 1990 levels) by 2030 is in the absence of the announced cap and trade program and conservation measures that are set out in footnote 32 of Mr. Neme's evidence.

d) Please confirm that the implementation of a carbon policy in Ontario will have a direct impact on Union and Enbridge's large volume customers (**LVC**), who are intended to be included in the cap and trade scheme.

e) Please confirm that the evidence suggests that LVCs should be required to both pay for DSM in rates and pay for any and all required emission allowances.

f) Please confirm that even if a customer responded to the intended carbon price signal and decreased usage, it would still be required to pay for DSM in rates under your proposal.

g) Please justify your adopted carbon price estimate and complete the following chart:

Auction Period		Auction Price		
2013	Q1	California	Québec	RGGI[2]*
	Q2			
	Q3			
	Q4			
2014	Q1			
	Q2			
	Q3			
	Q4**			
2015	Q1			
	Q2			

*while not technically linked, Québec provides for consideration of RGGI allowances in related export transactions for power.

**California/Québec linked auction.

h) Please provide the net present value (**NPV**) of each and all measures and their lifespans (a) using the actual carbon prices for Québec, (b) reflecting the actual lifespan of each measure, and (c) adjusting for free-ridership.

i) Please provide any and all assumptions that you have made about the point of carbon regulation for each and all of the following sectors:
i. transportation
ii. buildings
iii. electricity
iv. industry

Witness: Chris Neme

Response:

a) Please see reply to M.GEC.EP.3(a).

b) According to Canada's National Inventory Report 1990-2013 Ontario's GHG emissions were 182 mt in 1990 and 211 mt in 2005. Therefore emissions grew by 29 mt between 1990 and 2005. For 2014, based on Figure 9 in Ontario's Climate Change Update 2014 Ontario's "business as usual" emissions in 2014 would have to be ~213 mt for actual emissions (~171 mt) to be 42 tonnes lower. However based on Figure 9 the BAU projection for 2014 appears to be between 185 and 190 mt. Therefore 2014 emissions appear to be 14-19 mt below "business as usual".

c) Confirmed.

d) It is my understanding that the government intends to cover emissions from natural gas consumption under the cap. See M.GEC.IGUA.1 Attachment 1. It is not clear yet whether emissions from gas consumption by large users will be regulated as part of the cap on emissions by each large user, or as part of regulation of gas distributors, but the former is more likely.

e) Yes, the LVCs should pay for the gas and infrastructure they use, the allowances related to their carbon emissions (whether those are assessed on the LVC directly or through the utility) and the cost of DSM programs. The LVCs would benefit from gas utility DSM from their reduced purchases of gas, their reduced emission-allowance responsibility (whether that is regulated at the utility or emission-point level), and the lower price of allowances (for their gas use and other sources of emissions) as a result of the reduced demand for allowances. These benefits would be partially offset by the DSM charges in rates. Put another way, this would not be a "double payment" requirement as the wording of the question could be read to imply. Even if their emissions are regulated directly, the LVCs would only pay for emission allowances associated with the gas they are still consuming. They would not have to pay for the emission allowances that would have been associated with the gas that DSM helped them to avoid consuming.

f) A customer that is interested in reducing gas use through increased efficiency (as opposed to reducing economic activity) would be eligible for assistance from the DSM programs. Reducing its usage would reduce its payments for gas, infrastructure, emission

allowances, and payments for DSM programs. As stated in my testimony, it may be appropriate to modify the design of the T2/R100 program so that the (probably rare) customer that has actually implemented all cost-effective DSM would no longer be obligated to pay for the program.

g) See Section III.B.1 of Mr. Chernick's evidence. For historical data on the requested carbon prices, see the following tables.

For California/Quebec:

		Current Vintage		Future Vintage		
	Settlement Price	USD	CAD	USD	CAD	Year
Joint Auctions						
3	May 2015	$12.29	$15.01	$12.10	$14.78	2018
2	February 2015	$12.21	$15.14	$12.10	$15.01	2018
1	November 2014	$12.10	$13.68	$11.86	$13.41	2017
Quebec						
	March 2014		$11.39			
California Air Resources Board Quarterly Auctions						
8	August 2014	$11.50		$11.34		2017
7	May 2014	$11.50		$11.34		2017
6	February 2014	$11.48		$11.38		2017
5	November 2013	$11.48		$11.10		2016
4	August 2013	$12.22		$11.10		2016
3	May 2013	$14.00		$10.71		2016
2	February 2013	$13.62		$10.71		2016
1	November 2012	$10.09		$10.00		2015

For RGGI:

Auction Number	**Clearing Price**
Auction 28 6/3/2015	$5.50
Auction 27 3/11/2015	$5.41

Witness: Chris Neme

Auction 26 12/3/2014	$5.21
Auction 25 9/3/2014	$4.88
Auction 24 6/4/2014	$5.02
Auction 23 3/5/2014	$4.00
Auction 22 12/4/2013	$3.00
Auction 21 9/4/2013	$2.67
Auction 20 6/5/2013	$3.21
Auction 19 3/13/2013	$2.80

h) The GEC witnesses have not conducted an analysis of all possible efficiency measures using the assumptions in the question. Such an analysis was not necessary to reach the conclusions we reach in our testimony and would be extremely time-consuming to pursue. Several other factors make the proposed analysis even more problematic:

- The T2/R100 program is a custom program, promoting custom measures. By their very nature, they cannot be anticipated or characterized ahead of time at the measure level.
- We do not know the "actual carbon prices for Québec" after 2015 (or 2018, if the future vintage allowances, plus interest, are considered to be "actual"). That said, as Mr. Chernick's testimony makes clear, fully valuing avoided carbon emissions will result in higher avoided costs and higher TRC net benefit across the board.
- It is inappropriate to include free ridership factors in measure screening. They should only be applied at the program level. That said, free ridership assumptions tend not to affect benefit-cost ratios very much under the TRC.

i) Mr. Neme did not make any explicit assumption about the point of regulation for any of these sectors. For the natural-gas component of the buildings sector, regulation is likely to be at the utility level, for efficiency. For electricity, regulation is likely to be at the generator or possibly the EDC. For the natural-gas component of industrial emissions,

regulation may be at the utility or at the burner-tip. The point of regulation does not affect either the cost-effectiveness of reducing emissions or the benefits of reduced emissions for participants and energy consumers throughout the province.