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Date: August 24, 2018

Re: Net-to-Gross Research Results from the EPY9/GPY6 Non-Residential New Construction Program

INTRODUCTION

This report presents the results of the real-time net-to-gross (NTG) analyses conducted during the EPY9/GPY6 evaluation activities of the Coordinated Utility Non-Residential New Construction Program (New Construction Program) implemented for ComEd, Nicor Gas, Peoples Gas, and North Shore Gas Companies.

The memo presents the NTG ratio estimation algorithm, NTG ratio analysis results, related process findings, and verbatim excerpts from the interviews. EPY9/GPY6 covers June 1, 2016 through December 31, 2017.[1]

METHODOLOGY

Free ridership. During the course of the EPY9/GPY6 evaluation, the evaluation team again employed a "real-time" approach for researching free-ridership and spillover which was used in EPY8/GPY5, with a few modifications. This overall methodology involved a review of project documentation followed by a post-reservation phase interview with key decision makers of participating project teams. The participant survey instrument asked about awareness of the measures identified and their inclination to pursue incorporation of those measures into design plans absent the program.

1) **Documentation Review.** The evaluation team began by reviewing the documentation on each sampled project provided by the implementation contractor to identify potential points of influence. This component included:
    a. Reviewing email correspondence for indications of program influence
    b. Reviewing building plans from throughout the project's participation to identify changes in efficiency throughout the construction process
    c. Discussing the project with the implementation contractor to confirm areas where they believe the program was influential, if needed
2) **Post-Reservation Interview.** Once a sampled project reaches the reservation stage, the implementation contractor provided the evaluation team with contact information for key decision makers and the team conducted a post-reservation interview as soon as possible. We also incorporated customized questions for each project linked to the points of influence identified in the documentation review. The in-depth-interview guide used in these interviews is provided as an attachment.

[1] The program has historically run from June 1 to May 31 but was extended to include a bridge period in EPY9/GPY6 as the utilities shifted from a fiscal to a calendar year cycle.

Spillover. In prior years, the evaluation team also conducted post-verification interviews with participants once a project was complete, to collect additional free-ridership information as well as participant spillover data. Because in previous evaluations the second interview consistently provided little new information, we suspended the post-verification interview. Over the course of the program's life, the annual evaluations have found very little evidence of spillover. Therefore, the team has omitted the post-completion project interview since the EPY8/GPY5 evaluation.

Instead, the evaluation team shifted from annual spillover research to conducting a periodic standalone spillover survey to quantify any spillover that has occurred because of program's activities since participation.[2] We utilized an online survey and in-depth interviews with participants and training recipients from previous program years. As new construction projects typically take several years to complete, we surveyed participants from past program years to identify any energy efficient equipment or efficient designs incorporated in other buildings without receiving incentives from the New Construction Program or other ComEd, Nicor Gas, Peoples Gas or North Shore Gas programs.

Data collection included an online survey with a census attempt of participants from EPY6/GPY3 through EPY8/GPY5 and training recipients from past as well as current program years (EPY7/GPY4 through EPY9/GPY6) to identify potential cases of spillover. For those cases, a member of our engineering team administered a follow-up interview to quantify the potential spillover savings. We surveyed a total of 2,033 unique participants, consisting of 147 past program participants and 1,886 training participants.[3] Of these, 120 responded to the survey, resulting in an 8% response rate after accounting for email bounce backs and screened out respondents.

NET-TO-GROSS ALGORITHM

The NTG analysis estimates the energy savings which each project would be expected to achieve in a counterfactual scenario in which the New Construction Program does not exist - that is, it identifies how much of the gross savings are attributable to program activities. Our analysis relied on data gathered through interviews with program participants in the reservation phase of the program or later. We asked interviewees a battery of questions about how the program influenced the project's design and the expected efficiency of the project had the program not been available. Responses to our NTG questions were used to calculate three different scores, which, in turn, were used to triangulate project-specific NTG ratios. We employed the C&I New Construction NTG approach of the Illinois TRM v6.0 protocol to combine these estimates into a project-specific NTG ratio. This approach is very similar to other commercial programs but acknowledges that new construction energy efficiency programs are not expected to alter a project's timeline. Each of these free-rider scores, the corresponding interview questions used to calculate them, and the overall equation for determining our NTG ratio is provided below in Table 1.

[2] The evaluation team plans to conduct the periodic spillover survey every three years and last conducted it in EPY6/GPY3.
[3] Note that some part program participants also took part in trainings offered by the program.

Table 1. Net-to-Gross Analysis Plan (Free Rider Question Score Map)

NTG ratio=1 – FR, where FR = (PI +PC+NP)/3)

Free Rider score	Questions	Algorithm Notes
Program Influence (PI score)	FR6a–b	These questions ask respondents to rate the relative importance of the program versus non-program influences by allocating a total of 100 points between the program (FR6a) and other factors (FR6b). Then, the PI score is calculated as one minus the program point divided by 100.
Program Components (PC score)	FR5a-mm	These questions ask respondents to rank the influence of multiple program and non-program factors on a scale of zero to ten, where zero corresponds to "no influence at all" and ten corresponds to "extremely influential". Then, the PC score is calculated as one minus the maximum program factor score divided by 10.
No-Program (NP score)	FR8	This question asks respondents to rank the likelihood the project would have included the same level of energy efficiency has the program not been available, on a scale from zero to ten, where zero corresponds to "not at all likely" and ten corresponds to "extremely likely". Then, the NP score is calculated by dividing this score by 10.

FINDINGS SUMMARY

Free-Ridership

To obtain the program-level NTG ratio, the project-level NTG ratio values were weighted by ex ante gross kWh savings and gross therm savings (for joint projects, using savings without interactive effects). The results of our analysis are included in **Table 2** below. For ease of comparison to the overall NTGR, each component free-rider score is presented as a difference from one. The NTG ratios presented below are based upon the 24 interviews conducted in EPY9/GPY6.

Table 2: Researched Net-to-Gross Findings

Savings Type	PI Score (1-FR)	PC Score (1-FR)	NP Score (1-FR)	NTG ratio
kWh/kW	0.34	0.83	0.44	0.54
Therms	0.34	0.81	0.29	0.48

Source: Navigant team analysis, Data Collection Instrument

The variation across free-ridership scores is likely a result of the inherent difficulty in estimating attribution in new construction programs and highlights the benefits of including multiple variations of attribution questions in participant surveys. The decision-making process in new construction projects is complex, involving multiple market actors with varying degrees of influence coordinating over a period that could stretch into years.

The evaluation team also attempted to isolate NTG estimates by measure or end uses, when deemed appropriate by the respondent. Only a few respondents elected to provide different responses to the free-ridership battery questions by end use, and in most cases the mechanics of the algorithm produced the same final NTG.[4] Yet those who did provide different responses by measures tended to provide higher influence scores for the program incentive and the program's technical assistance for lighting controls and

[4] For example, if a specific program factor was rated 8 for some measures and 7 for others, but the Program's technical assistance was rated 10 for all measures, because the NTG algorithm only incorporates the highest rated program factor these measures would have the same PC Score.

window properties and lower scores for those program factors for indoor and outdoor lighting power densities.

Spillover

In an attempt to identify and quantify potential cases of spillover resulting from the program, our team conducted an online survey of program participants and training participants. A total of 120 past program participants and training participants completed the survey. Based on the survey results, we identified four cases of potential spillover.[5] Our engineering team followed up with these respondents and three responded to our request for interviews. In all three instances, our team determined that there was no related spillover. The findings for each of these interviews are shown in **Table 3**. As a result, our EPY9/GPY6 evaluation found no quantifiable cases of spillover.

Table 3. Spillover Findings by Respondent

Participant	Results
1	Pursuing custom incentive
2	Not in ComEd's service territory
3	Unreachable
4	Training recipient who is active in the ComEd Standard and Custom Commercial programs. Of the potential spillover measures identified, one received a ComEd Standard incentive and the others did not qualify for the Standard incentive. These were considered more appropriately represented in the Standard program's spillover estimate.

Additional Findings

In addition to answering quantitative questions in the free-ridership battery of questions, respondents also gave qualitative responses about the program's influence on current or past projects and provided suggestions on how the program may be able to influence future projects. In the post-reservation interviews, respondents often highlighted or indicated there were opportunities for the New Construction Program to expand to better serve high-efficiency participants. Nearly half of the participants we interviewed (10 of 24 respondents) indicated either that the program had minimal influence on their project's design or indicated that they would like to see the program offer rebates on more advanced measures or offer more tailored support to project teams. Almost one-third of interviewed participants (7 out of 24) indicted the rebated measures their project included are beginning to become standard practice in the industry or that one or more of the rebated measures would have been included in their specific project regardless of their participation in the New Construction Program. Several respondents (3 out of 24) indicated a lack of awareness of the higher-level support offered by the program or stated they would be open to a more in-depth participation process. One of these participants commented that the detailed nature of program recommendations, regarding specific equipment efficiency ratings or lighting power densities may limit the program to influencing decisions around the margin as opposed to higher order impacts.

Similarly, many participants discussed non-program factors which they identify as influential in their decision to install the energy efficiency measures rebated by the program which reveal that the new construction market in ComEd's service territory may be experiencing an increase in naturally-occurring

[5] The evaluation team identified cases of potential spillover through a series of survey questions. To be considered spillover savings, the improvement had to be completed in ComEd's service territory (and the applicable gas company's territory if a gas measure), not be required by building code, not receive an incentive from their utility, and rate the New Construction Program or training as influential (>5 on a 0-10 scale) in incorporating the measure into the project.

or market-driven energy efficiency. For instance, 6 of 24 respondents indicated that current building codes were an important factor in the installation of program-rebated measures.

Therefore, there may be opportunities for the program to better serve participants who already plan to install many energy efficiency measures in their project. The underlying sentiment was that design teams who already plan to build an energy efficient building both are in need of and would respond well to advanced levels of program support. This could be useful to projects teams who have to meet strict city building codes or who are planning to apply for LEED certification. Overall, this is promising news for the programs new Accelerated Performance program, which is likely to be well received and subscribed by program participants. In addition, it highlights the importance of the program's new focus on small businesses and public-sector buildings which may not yet exhibit high levels of energy efficiency in their initial design.

Verbatim Responses

Below we provide quotes from the in-depth interviews to provide additional context around the quantitative NTG results

Table 4. Select Verbatim Responses from In-Depth Interviews

Topic	Quote
Expanded Technical support and Recommendations	"The parameters by which the program seems to be based are on pretty hard numbers like EER for equipment that we're not anywhere near selecting... so I guess I would be a little unclear as to what they could do for us earlier, but if they can educate us on what that help would be then we'd be more inclined to take the time to engage them. Sometimes adding one more [consultant to the process] is more than we'd like but if they can show that they'd be useful beyond what our energy model might already be doing then we'd be happy to engage them sooner."
Expanded Technical support and Recommendations	"I think maybe if there was more of a sit-down or a longer conference call ...something where maybe they educate a little bit more. I feel like maybe that's something that's a little lacking. Usually for us it's been, 'We've already done all this stuff. Here's what we've done. Take a look at it. What can we achieve?'"
Expanded Technical support and Recommendations	"I don't know if we've necessarily been engaged as much about all the other capabilities that they have or services they are willing to provide…I don't know if there a bigger picture that we're missing."
Limited Recommended Measures	"It's just there are a lot of [measures] that I typically do anyway... I was planning on [installing that measure] regardless of any incentives from you, but it's nice to see that there was a program that's encouraging this type of construction so you do have better efficiency buildings out there."
Limited Recommended Measures	"The measures that were agreed upon are like I said very consistent with what we are doing as a standard practice and again thrilled that [the program] is recognizing that."
Limited Recommended Measures	"I will say that the measures presented were somewhat prescriptive or somewhat typical I'd say and not perhaps as creative. I'm not sure to what extent the program is given access to really make what I would call a more creative decision or creative recommendation about the way the building is operated or designed."
Limited Recommended Measures	"[The recommended measures] start to look familiar across multiple projects…and frankly for the most part it is kind of a baseline spec for us now anyways"
Limited Recommended Measures	"The project would include [the rebated measures] regardless of whether the program existed or not"
Limited Recommended Measures	"What I recall is that the program reviewed our design and really identified measures that were in the design that we would qualify for [incentives]. So I don't think we made any changes to the design."
Limited Recommended Measures	"I was planning on doing that regardless of any incentive from you, but it's nice to see that there was a program that's encouraging this type of construction."
Building Codes	"The [rebated measure] is again, it's a requirement here in this city as well so …we were bound to do that regardless"
Building Codes	"So these [rebated measures] are probably some of the most consistent approaches that our team sues to meet current energy codes
Program Satisfaction	"To try and maintain our standard of high performance buildings and pushing the envelope when it comes to energy efficiency, we've had to work hard to do that and the support we get from programs like this is really critical to help us maintain that."
Energy Model	"[The energy model] was very useful to the [client] because it gave them a good idea as far as the energy cost of the project before it was ever constructed."
Energy Model	"[An energy model] is very time-consuming and cumbersome work. So to… get [a] very detailed energy model free of charge as part of the program if you qualified I was pretty impressed."
Energy Model	"The building owner was encouraged to make certain decisions that were better for a lifecycle cost kind of decision making based on the program's guidance."

APPENDIX 1.: COMED NON-RESIDENTIAL NEW CONSTRUCTION PROGRAM NTG HISTORY

	Business New Construction Service
EPY1	NTG was not evaluated for EPY1 because program began in EPY2.
EPY2	**NTG** 0.59 **Free-Ridership** 41% **Spillover** 0% **Method**: Customer self-report. 14 projects were assessed from a population of 16. Enhanced method. NTG scores were adjusted for standard design national retail stores.
EPY3	**NTG** 0.65 (0.69 for Systems Track and 0.54 for Comprehensive Track) **Free-Ridership** 35% **Spillover** 0% **Method**: Customer self-report. 13 interviews with individuals representing 15 projects out of population of 37 projects. Enhanced method. NTG scores were adjusted for standard design national retail stores.
EPY4	**Compressive Track – Retroactive application of NTG of 0.54** **Systems Track used PY2 value of 0.59** **NTG 0.57** (based on weighted avg. of 0.59 for Systems Track and 0.54 for Comprehensive Track) **EPY4 Research Comprehensive Track 0.54** **EPY4 Research Systems Track 0.59** **Free-Ridership** 43% **Spillover** 0% **Method**: EPY3 deemed value for Systems Track projects. Customer self-report for Comprehensive Track projects. Interviews with individuals representing 5 of 6 Comprehensive Track projects. Enhanced method. NTG scores were adjusted for standard design national retail stores and LEED projects.
EPY5	SAG Consensus: • 0.65
EPY6	SAG Consensus: • 0.52
EPY7	**Full Program NTG: 0.59** **Comprehensive NTG: 0.59** **Systems Projects NTG: 0.64** **Free-Ridership 0.43** **Spillover (all types) 0.05** **Source**. The NTG from estimate is from the EM&V EPY4 participant survey. Spillover is an EM&V estimate based on our literature review. In 50 participant interviews from EPY2-4 we found 2 spillover projects. Some of those interviews were early in the program's life when spillover is less likely. We also looked at existing literature on past studies and a wide range of spillover values. For example, in September of 2012, National Grid Rhode Island published a study: "2011 Commercial and Industrial Programs Free-Ridership and Spillover Study." For commercial new construction, they found 78% participant

	Business New Construction Service
	spillover and 0% non-participant spillover. Southern California Gas recently did a study to estimate spillover for its 2013 and 2014 Savings By Design program by looking at past studies. They only found a couple of older California studies relevant to commercial new construction. The 2003 BEA reported 11% participant spillover and 1% non-participant spillover. A 2002 study by the same evaluator showed 13% participant spillover and 5% non-participant spillover. Finally, they also looked at the NYSERDA New Construction Program Impact Evaluation Report from 2007-2008, which found participant spillover of 20% and non-participant spillover of 61%. This study has been questioned and we understand that NYSERDA is reevaluating its validity. Our conclusion is that, given the ComEd program design and implementation approach, it is reasonable to expect that a meaningful amount of spillover is being created and should be credited to the program. Given the range of spillover amounts we found in our literature review, we believe a spillover amount of 5% is probably a realistic and probably conservative estimate. That spillover is probably occurring through the action of architects, engineers, and builders who have had exposure to the program and, to a lesser degree, building owners who had a building go through the program. Given that mix, we have not tried to differentiate between participant and nonparticipant spillover.
EPY8	**Recommendation (based upon PY6 research):** **Full Program NTG: 0.80 – Preliminary, updated number to be provided later** **Free-Ridership: 0.20** **Spillover: 0.00** The researched NTGRs are being developed using a “real-time” approach where the evaluation team conducts interviews with program participants both after each project passes the reservation phase, and again after it passes the verification phase.
EPY9	**Full Program NTG: 0.77** **Free-Ridership: 0.23** **Spillover: 0.00** **NTG Research Source:** Free-Ridership: Participant and service provider self-report through real time EMV Spillover: NTG real time research methods in EPY6 combine participant and service provider survey results.
EPY10	**Full Program NTG: 0.60** **Free-Ridership: 0.40** **Spillover: 0.00** **NTG Research Source:** Free-Ridership: PY8 Participant and service provider self-report through real time EMV Spillover: NTG real time research methods in EPY6 combine participant and service provider survey results.

Source: http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.pdf

APPENDIX 2.: PEOPLE GAS (PGL) AND NORTH SHORE GAS (NSG) NON-RESIDENTIAL NEW CONSTRUCTION PROGRAM NTG HISTORY

	Business New Construction
GPY4	**NTG** 0.52 **Method and Source**: PGL and NSG have joined the Business New Construction (BNC) Program offered by Nicor Gas and ComEd. The BNC Program NTG value was the recommended value for Nicor Gas for GPY4.
GPY5	**NTG** 0.92; **Free ridership** 0.08, **Spillover** 0.00 **Method and Source**: Value drawn from gas-weighted free-ridership and spillover results from participant interviews conducted for the Nicor Gas and ComEd GPY3/EPY6 Business New Construction Program.
GPY6	**NTG** 0.67 **Method and Source**: FR, PSO, and NPSO research conducted for Nicor Gas and ComEd for GPY4/EPY7 resulted in a NTG of 0.57 for gas. SAG consensus for GPY6 is a three-year average of 0.52, 0.92, and 0.57. Also applies to small business new construction.
GPY7	**NTG:** 0.77 **Method**: Research conducted for ComEd and gas utility program partners for GPY5/EPY8 resulted in a NTG ratio of 0.83 for natural gas measures. SAG consensus for GPY6 and GPY7 was to use a three-year average of the most recent NTG research values. For GPY7, the three most recent research values are: 0.92, 0.57, and 0.83, producing an average of 0.77. The NTG value also applies to small business new construction. The research applied TRM v5.0 NTG algorithms.

Source:
http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/PGL_and_NSG_NTG_Summary_GPY1-7_2017-03-01_Final.pdf

APPENDIX 3.: NICOR GAS NON-RESIDENTIAL NEW CONSTRUCTION PROGRAM NTG HISTORY

	Business New Construction Service
GPY1	**NTG** 0.33 **Free ridership** 67% **Spillover** 0% **Method**: Customer self-report for all projects. Interviews with individuals representing 4 of 7 projects with gas incentives. NTG scores were adjusted for standard design national retail stores and LEED projects.
GPY2	**NTG** 0.52 **Free ridership** N/A **Spillover** N/A **Method**: SAG deemed NTG ratio based on electric program evaluation results from EPY4.
GPY3	**NTG** 0.52 **Free ridership** N/A **Spillover** N/A **Method**: SAG deemed NTG ratio based on electric program evaluation results from EPY4.
GPY4	**NTG** 0.52 **Free ridership** N/A **Spillover** N/A **Method**: NTG values for GPY4 were deemed using values from GPY3, and reported in Table 14 of the Nicor Gas filed Energy Efficiency Plan for GPY4-GPY6.
GPY5	**NTG** 0.92 **Free ridership** 8% **Spillover** 0% **Method**: Gas-weighted free-ridership and spillover results from participant interviews conducted for the Nicor Gas and ComEd GPY3/EPY6 Business New Construction Program evaluation.
GPY6	**NTG** 0.67 **Method**: FR, PSO, and NPSO research conducted for Nicor Gas and ComEd for GPY4/EPY7 resulted in a NTG of 0.57 for gas. SAG consensus for GPY6 is a three-year average of 0.52, 0.92, and 0.57. Also applies to small business new construction.
GPY7	**NTG:** 0.77 **Method**: Research conducted for ComEd and gas utility program partners for GPY5/EPY8 resulted in a NTG ratio of 0.83 for natural gas measures. SAG consensus for GPY6 and GPY7 was to use a three-year average of the most recent research values. For GPY7, the three most recent research values are: 0.92, 0.57, and 0.83, producing an average of 0.77. The NTG value also applies to small business new construction.

Source: http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/Nicor_Gas_NTG_Summary_GPY1-7_2017-03-01_Final.pdf