

To: Erin Daughton, ComEd
From: Charles Ampong, Sharon Mullen, Laura Agapay-Read, Mack Shaughnessy, Navigant
CC: Jennifer Morris, ICC; Randy Gunn, Jeff Erickson, Rob Neumann
Date: August 24, 2018
Re: Net-to-Gross Research Results from PY9 for the ComEd Standard Program

INTRODUCTION

This memo presents results from Navigant’s free ridership and spillover research for the ComEd Standard Program, based on program year nine (PY9) participants. The research was conducted in November 2017 and January 2018 through data collection and computer assisted telephone surveys (CATI) completed with PY9 participants and using the Illinois TRM version 6.0 net-to-gross methodologies (IL-NTG Methods).¹ The IL-NTG Methods non-residential protocol combines three scores that test different ways of approaching free ridership: the Program Components Score, the Program Influence Score, and the No Program Score. Navigant combined these scores to calculate the final NTG value based on a designated algorithm that includes inputs with alternative specifications—the No-Program Score input has two alternative specifications. The results are two calculations of free ridership. In Table 1, Navigant presents the two estimates of free ridership using a ratio estimation method based on the kilowatts-hour weight of the project-level free ridership and rolled up to the population of the end-use categories. The participant free ridership and spillover analysis involved 104 survey completions by a sample of PY9 program participants (66 lighting and 38 non-lighting).

Table 1. ComEd Standard Program NTGR Sensitivity Analysis Findings

NTG Algorithm	End-use	Participant Free Ridership, (weighted)	Participant Spillover	Trade Ally Participant Spillover*	NTGR	Relative Precision on Free Ridership Results @ 90% CI
Algorithm 1	Lighting	0.19	0	0.02	0.83	4%
	Non-lighting	0.24	0	0.02	0.78	8%
	Population Roll-up	0.20	0	0.02	0.82	5%
Algorithm 2	Lighting	0.25	0	0.02	0.77	4%
	Non-lighting	0.27	0	0.02	0.75	9%
	Population Roll-up	0.26	0	0.02	0.76	7%

* Navigant analysis of PY8 trade ally and contractor self-reports approved by the SAG (see appendix).

Source: Navigant analysis of 104 participants survey responses from 1,879 unique population of PY9 participants.

Navigant recommends using a free ridership rate of 0.19 for lighting and 0.24 for non-lighting end-uses for CY2019, which come from Algorithm 1. These values were respectively estimated at 4 percent and 8 percent relative precision at 90 percent confidence interval.

¹ Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 6.0, Volume 4: Cross-Cutting Measures and Attachments, effective January 1st, 2018.

FREE RIDERSHIP COMPARISON

For comparison, the free ridership and spillover results in effect for PY9 and CY2018 program participants are presented below. These values are based on evaluation research conducted in PY7 and PY8.

Table 2. PY9 and CY2018 Deemed Free Ridership and NTGR

Program Path	Free Ridership*	Participant Spillover†	Trade Ally Participant Spillover†	NTGR
Lighting	0.31	0	0.02	0.71
Non-Lighting	0.32	0	0.02	0.70

* Navigant analysis of data from PY7 participant and trade ally self-reports, approved by the SAG (see appendix).

† Navigant analysis of PY8 trade ally and contractor self-reports approved by the SAG (see appendix).

FR = Participant Free Ridership; PSO = Participant Spillover; TPSO = Trade Ally Participant Spillover; NTGR = Net-to-Gross Ratio

NTGR = 1 – FR + PSO + TPSO

The PY9 research results presented in Table 1 show lower free ridership than the previous SAG-approved results in Table 2.

Spillover. The PY9 participant spillover results (0.09% or 0.0009) is very low. Thus, we determined participant spillover was zero from this sample in PY9. However, we believe the results from PY8 Standard Program participating trade ally spillover study remains valid and will include that estimate (0.02) in our draft recommendation for future NTG values.

FREE-RIDERSHIP SURVEY AND SAMPLE DISPOSITION

The PY9 free ridership and spillover research was conducted following a customer self-report approach through a telephone survey with 122 program participants who responded to questions about free-ridership and participant spillover. The randomized sample frame included 2,335 projects completed by 1,879 unique program participants. Projects were classified by end-use (lighting or non-lighting) and energy savings (large, medium, and small), using ex-ante energy impacts reported in the tracking database. Each project was placed into one of six end-use and impact size strata. A total of 73 lighting project participants and 49 non-lighting project participants were interviewed. Table 3 shows the details of the free-ridership and spillover sample disposition.

Each respondent was asked questions to assess free ridership and spillover on a project-by-project basis, hence the survey did not apply the same score to other projects if a customer had projects at other sites covering the same end-use. Customers with multiple projects were interviewed once on a specific project.

Table 3. Free Ridership and Spillover Research Decision Maker Survey Disposition

Free Ridership Stratum	Impact Size Stratum	Population Contacts (N)	Number of Completes	Dropped from the Analysis	Analyzed Completes*
L1	Large	55	15	1	14
L2	Medium	234	33	3	30
L3	Small	1,237	25	3	22
NL1	Large	20	4	0	4
NL2	Medium	63	8	2	6
NL3	Small	270	37	9	28
TOTAL		1,879	122	18	104

* Analyzed Completes provides the interview count used to develop the free ridership and spillover estimates. Analyzed Completes excludes responses that failed consistency checks or lacked required data. Navigant removed 18 records, reducing the sample from 122 to 104 before calculating rolled-up free ridership results (discussed further below).

Source: Navigant analysis of PY9 participants survey responses.

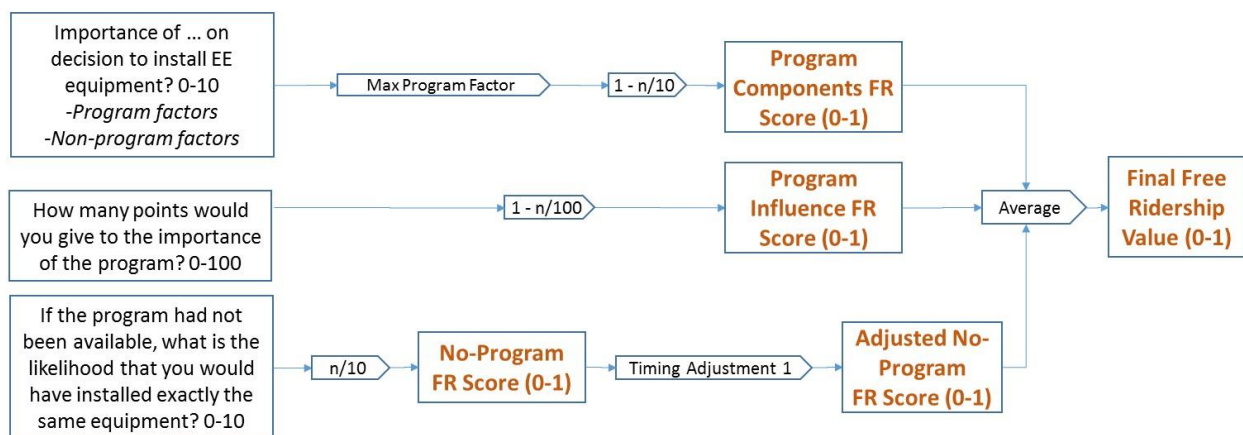
Number of Usable Contacts	Target Completes	Measure Installations Covered by Completed Interviews*	Dropped from the Analysis	Analyzed Completes†
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FREE RIDERSHIP ESTIMATES USING ALGORITHMS IN THE TRM VERSION 6.0

The following diagrams describe the TRM free ridership algorithms for core non-residential programs.

Figure 1. Core Free Ridership Algorithm 1

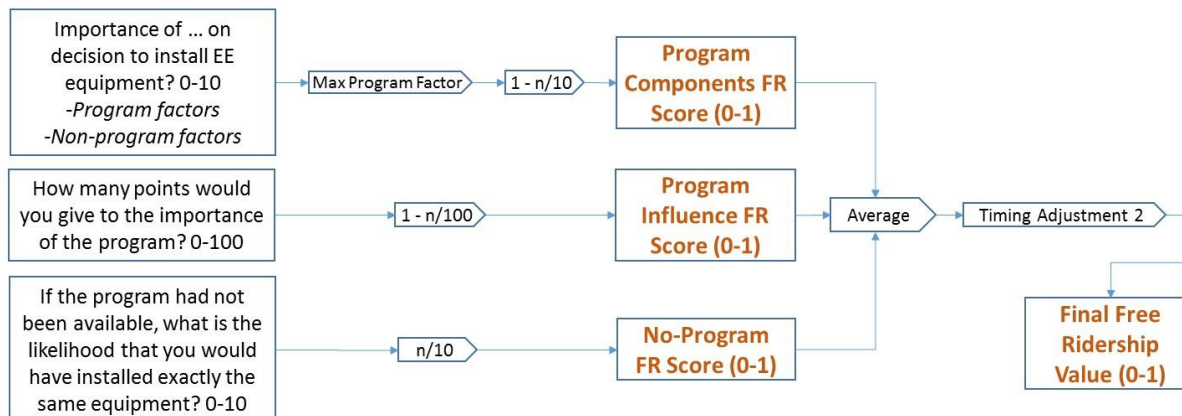
$$\frac{(\text{Program Components FR Score} + \text{Program Influence FR Score} + (\text{No-Program FR Score} * \text{Timing Adjustment 1}))}{3}$$



Source: Illinois TRM Version 6, Volume 4. Cross-Cutting Measures and Attachments, final February 8, 2017, effective January 1st, 2018.

Figure 2. Core Free Ridership Algorithm 2

$((\text{Program Components FR Score} + \text{Program Influence FR Score} + \text{No-Program FR Score}) / 3) * \text{Timing Adjustment 2}$



Source: Illinois TRM Version 6, Volume 4. Cross-Cutting Measures and Attachments, final February 8, 2017, effective January 1st, 2018.

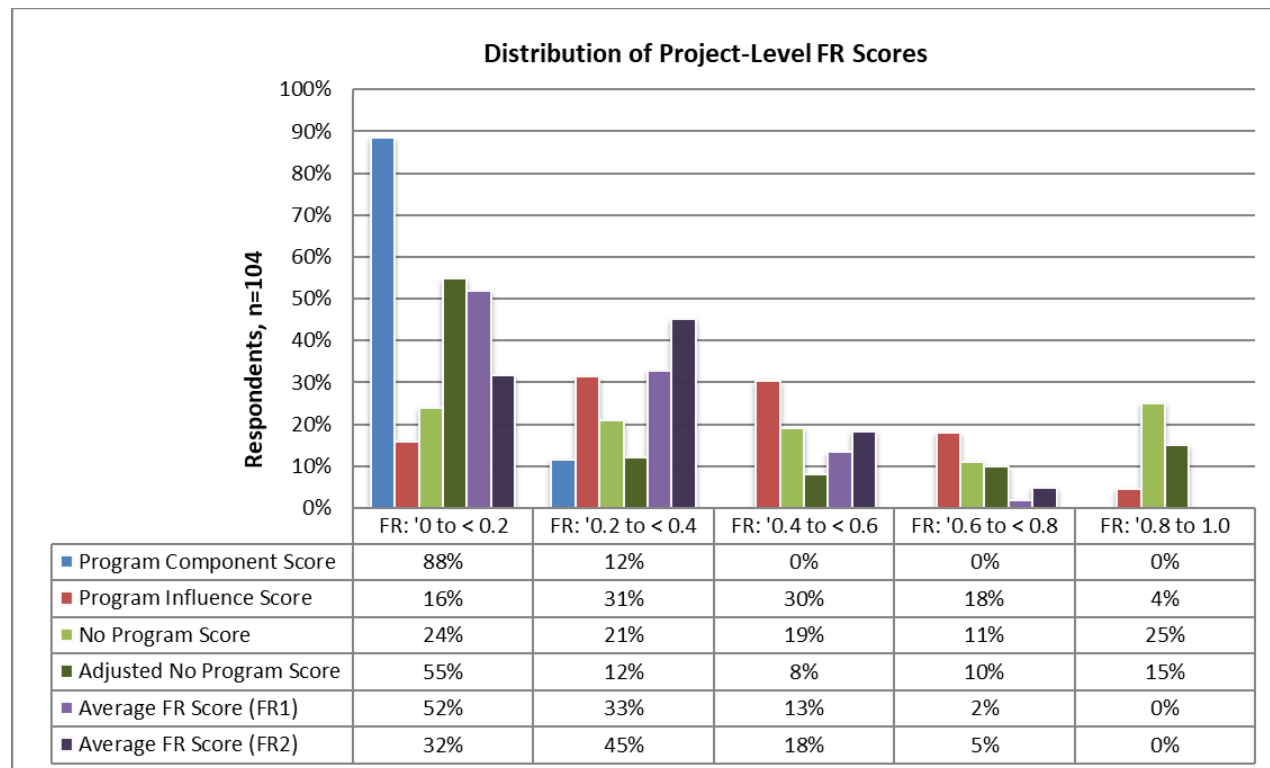
Navigant applied both algorithms indicated by the TRM version 6.0 flow diagrams to the data we collected from 122 PY9 Standard Program participants. Using the TRM defined consistency checks²², we found 53 inconsistent records out of the 122 respondents. Navigant removed 18 records before calculating rolled-up results because they offered inconsistent responses and no responses to open-ended questions that could clarify their intentions. The other 35 inconsistent records were reviewed closely.

For those 35 respondents, we analyzed their responses to the consistency check follow-up questions, which included an open-ended question. Their open-ended responses were consistent with the complex nature of their free ridership component responses. A common pattern was a high influence of the incentive as well as a high likelihood of implementing the efficiency improvement if the program did not exist, together with an open-ended response that the incentive helped with an improvement they needed to do anyway. This suggests that while these records failed numeric consistency checks, their numeric responses were consistent with their open-ended responses. Subsequently, we saw no reason to adjust the 35 responses. However, we propose reviewing the TRM consistency check criteria with the Illinois NTG Working Group, given the relatively high incidence of the pattern of false positives.

In Figure 3, we present the percentage distribution of the scoring (0 to 1 scale) for the final 104 respondents in the free ridership estimations, using each possible combination of designated input specifications. The majority of respondents had low free ridership as represented by the Program Component Score and Adjusted No Program Score.

²² Pages 31-32 in IL TRM v6 volume 4 section 3.1.1.1.5

Figure 3. Distribution of Project-Level Free Ridership Scores



Source: Navigant analysis of PY9 participants survey responses.

In context, the results for the program component score show that 88 percent of respondents scored between 0 to 0.2 free ridership and that 100 percent respondents scored less than 0.4 free ridership. This indicates a higher importance of the program components in the customers' decision to implement the energy efficient equipment that they installed.

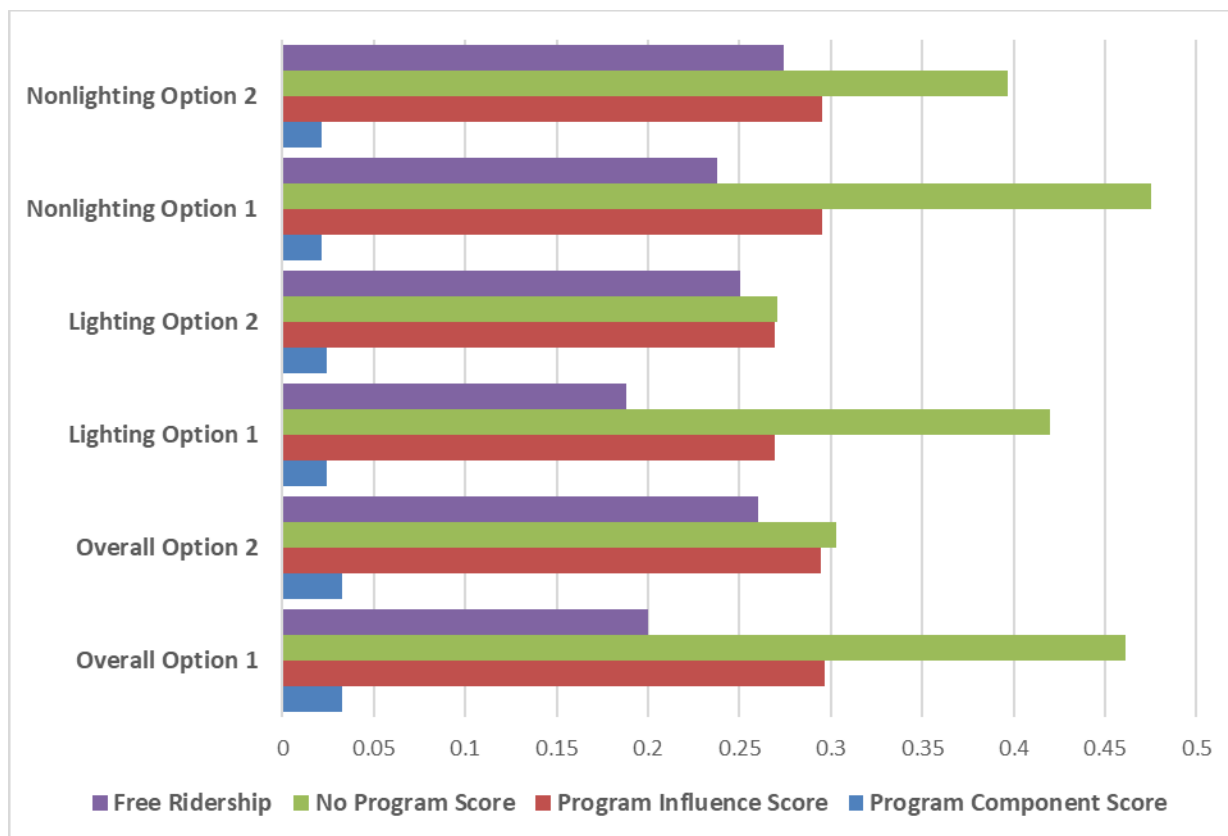
Table 4 and Figure 4 illustrate the details of the final free ridership components scoring for the end-use categories.

Table 4. Details of Free-Ridership Scores

NTG Algorithms	End-use	Program Components Score	Program Influence Score	No-Program Score	Free Ridership	Cronbach's Alpha Estimate
Algorithm 1	Lighting	0.02	0.27	0.42	0.19	0.15
	Non-lighting	0.02	0.30	0.48	0.24	0.29
	Overall	0.03	0.30	0.46	0.20	0.23
Algorithm 2	Lighting	0.02	0.27	0.27	0.25	0.29
	Non-lighting	0.02	0.30	0.40	0.27	0.38
	Overall	0.03	0.29	0.30	0.26	0.34

Source: Navigant analysis of PY9 participants survey responses.

Figure 4. Details of Free-Ridership Scores



Source: Navigant analysis of PY9 participants survey responses.

The evaluation team recommends the results from Algorithm 1. The rationale for selecting Algorithm 1 over Algorithm 2 is that Algorithm 1 provides for equal weighting of each of the three component free ridership scores, which represent different ways of determining program influence. In Algorithm 1, the timing adjustment modifies only one of the three components of free ridership. In contrast, in Algorithm 2, the timing adjustment modifies all three components of free ridership, which we believe gives it too much weight. Such a high weighting essentially discounts the effect of the other factors influencing program influence, which in our view is inappropriate.

PARTICIPANT SPILLOVER ESTIMATION

The respondents were asked if they installed additional electricity savings measures to reduce the energy consumption at their property since participating in the Standard Program. Navigant included questions to identify spillover candidates and measures, paraphrased below:

1. Since participating in the Standard program, have you purchased and installed any additional energy efficiency measures that you did not receive any rebate for?
2. Did participating in the Standard program influence you in any way to make these additional purchases?
3. On a zero to ten scale, where zero is not at all important and ten is extremely important, how important was your participation in the Standard program on your decision to purchase these additional energy efficiency services or equipment? [Measure Attribution Score 1.]
4. If you had not participated in the Standard program, how likely is it that you would have purchased the additional energy efficiency services or equipment? Please use a zero to ten

scale, where zero means that you definitely would not have purchased them and ten means that you definitely would have purchased them? [Measure Attribution Score 2.]

Following the TRM, Spillover would be attributed to the Standard Program if the following condition was met: the average of Measure Attribution Score 1 and (10 minus Measure Attribution Score 2) must exceed 5.0.

The Spillover rate is calculated at the project level or at the program level using the following formula:

$$\text{Spillover Rate} = (ISO+OSO)/(Ex Post Gross Impacts)$$

Where:

Net ISO = Inside Participant Spillover (additional program-induced EE measures at a program project site)

Net OSO = Outside Participant Spillover (program-induced EE measures at sites within ComEd's service territory at which program project measures were not implemented).

The evaluation identified 38 respondents from the 122 survey respondents who installed additional energy efficient equipment, but only eight indicated that participating in the Standard Program influenced them to make these additional purchases. Navigant determined that two of the eight potential spillover candidates had averaged spillover attribution scores greater than 5.0 and installed equipment (LED lamps and processing equipment) with quantifiable electricity savings.

Navigant was able to use the savings from the above-mentioned LED lamps to calculate spillover, though the information from the respondent with process equipment was insufficient to be quantified.³ The sample spillover rate was 0.0009 from the LED lamps when rolled up to the population. This spillover rate does not make a significant impact and therefore the participant spillover attributed to the program should be reported as zero. However, we believe the spillover estimate from our previous trade ally spillover study (using a different method) remains valid and will include that estimate (0.02) in our draft recommendation for SAG approval.

ESTIMATING CRONBACH ALPHA FOR SURVEY RELIABILITY

Cronbach's Alpha is a measure of internal consistency or reliability. It is used to assess how closely related a set of items are as a group. In this memo, Cronbach's Alpha is used to assess how closely related the items going into the NTG score are to each other. In general, the higher the measured Cronbach's Alpha value, the more consistent and reliable are the results. However, given the small number of items (i.e., the 3 scores) being considered in this application of Cronbach's Alpha, a high alpha value is not expected. Realistically, Alpha values ranging from 0.4 to 0.6 are considered an acceptable measure of reliability for this analysis given the small number of items being analyzed.

We used the Standardized Cronbach's Alpha calculation as specified below:

$$\alpha_{\text{standardized}} = \frac{K \cdot \bar{r}}{(1 + (K - 1) \cdot \bar{r})}$$

Where K is the number of variables or items of the scale or questionnaire, and r-bar is the average correlation among all pairs of variables. The simplified algorithm we used is below.
 $\text{Alpha} = (K)/(K-1) * (1 - (\text{Sum of Item Variances} / (\text{Standard Dev. of Responses or Scores})^2))$

³ Customer did not provide a response to Question SP3a "How did you experience with the Program influence your decision to install this high efficiency equipment on your own? Or SP3b "How many <SP3a RESPONSE> did you install without receiving an incentive?". Customer did not provide a response to Question SP3a "How did you experience with the Program influence your decision to install this high efficiency equipment on your own? Or SP3b "How many <SP3a RESPONSE> did you install without receiving an incentive?". The customer also provided a "Don't Know" response to question SP3e "Why did you purchase the <SP2a RESPONSE> without an incentive from <UTILITY>?"

Navigant determined alpha coefficient for the free ridership results using a combination of components that determined the Program Influence Score, Non-Program Score, and Program Component Score, for lighting and non-lighting end-use for each algorithm, and the overall Alpha value for the combined free ridership results in that option. We estimated 0.29 as the overall Cronbach’s Alpha value for the survey based on the standardized variable of the relatively heterogeneous variances in the mixture of dichotomous and multi-point scales in the survey.

NTG RESULTS

The NTG research results for the Standard Program PY9 participants are summarized in Table 5. In conclusion, Navigant recommends to the SAG to consider approval of the PY9 NTG values from Algorithm One for future use, based on reasons discussed above (see page 6).

Table 5. ComEd Standard Proposed NTGR Values

NTG Algorithm	End-use	Participant Free Ridership, (weighted)	Participant Spillover	Trade Ally Participant Spillover*	Mean NTGR	Relative Precision @ 90% CI
Algorithm 1	Lighting	0.19	0	0.02	0.83	4%
	Non-lighting	0.24	0	0.02	0.78	8%
	Overall	0.20	0	0.02	0.82	5%
Algorithm 2	Lighting	0.25	0	0.02	0.77	4%
	Non-lighting	0.27	0	0.02	0.75	9%
	Overall	0.26	0	0.02	0.76	7%

NTGR =1-FR+PSO+TPSO

* Navigant analysis of PY8 trade ally and contractor self-reports approved by the SAG (see appendix).

Source: Navigant analysis of PY9 participants survey responses.

APPENDIX: STANDARD PROGRAM NTG HISTORY

	Business Standard Incentive
PY1	<p>NTG 0.67 Free-Ridership 33% Participant Spillover 0% (qualitative evidence observed, not quantified) Method: Customer self-report. 95 interviews completed covering 101 projects from a population of 455 projects.</p>
PY2	<p>NTG 0.74 Free-Ridership 27% Participant Spillover 1% Method: Customer self-report. 90 interviews completed covering 114 projects from a population of 1,739 projects. Enhanced method. Ten trade allies called for 11 participants and their responses factored in to the customer free ridership calculation.</p>
PY3	<p>NTG 0.72 Free-Ridership 28% Participant Spillover 0% (qualitative evidence observed, not quantified) Method: Customer self-report. 108 interviews completed covering 292 projects from a population of 3,794 projects.</p>

	Business Standard Incentive
	Enhanced method. Two trade allies and three account managers were called for five participants and their responses factored in to the customer free ridership calculation.
PY4	<p>Deemed using PY2 values. PY4 Research NTG 0.70 Free-Ridership 31% Participant Spillover 1% Method: Customer self-report. 110 interviews completed covering 166 projects from a population of 4,603 projects. Enhanced method. Two trade allies called for two participants and their responses factored in to the customer free ridership calculation. NTGR (Free-Ridership only): All lighting =0.70 (90/±5%); Lighting, no T12s reported in base case 0.66 (90/±9%); Lighting, T12s reported in base case 0.80 (90/±14%) Non-Lighting = 0.63 (90/±16%).</p>
PY5	<p>SAG Consensus:</p> <ul style="list-style-type: none"> • Lighting: 0.74 • Non-Lighting: 0.62
PY6	<p>SAG Consensus:</p> <ul style="list-style-type: none"> • Lighting: 0.70 • Non-Lighting: 0.63
PY7	<p>Lighting NTG: 0.81</p> <p>Free Ridership: Measured and equal to 0.26 Justification: EPY5 ComEd Standard Program research, 63 participants</p> <p>Total Recommended Spillover = 0.07</p> <p>Participant and Non-Participant Spillover Identified by Participating Standard Program Trade Allies: Measured and equal to 0.05 Justification: EPY5 ComEd Standard Program research, participating trade ally sample 55</p> <p>Participant and Non-Participant Spillover Identified by Non-Participating Standard Program Trade Allies: Not measured for ComEd; a value of 0.02 is recommended Justification: Based on GPY2 results from Nicor Gas (0.02), and Peoples Gas and North Shore Gas (0.02).</p> <p>Non-Lighting NTG: 0.77</p> <p>Free Ridership: Measured and equal to 0.31 Justification: EPY5 ComEd Standard Program research, 64 participants</p> <p>Total Recommended Spillover = 0.08</p> <p>Participant and Non-Participant Spillover Identified by Participating Standard Program Trade Allies: Measured and equal to 0.06 Justification: EPY5 ComEd Standard Program research, participating trade ally sample 10.</p> <p>Participant and Non-Participant Spillover Identified by Non-Participating Standard Program Trade Allies: Not measured for ComEd; a value of 0.02 is recommended</p>

	Business Standard Incentive
	Justification: Based on GPY2 results from Nicor Gas (0.02), and Peoples Gas and North Shore Gas (0.02).
PY8	<p>Recommendation (based upon PY6 research): NTG Lighting: 0.74 NTG Non-Lighting: 0.63 Free-Ridership, Lighting: 0.27 Free-Ridership, Non-Lighting: 0.38 SO: 0.01</p> <p>Free Ridership was estimated in PY6 as 0.27 for lighting Free Ridership = 0.38 for non-lighting Both based on customer self-report data collected through phone interviews (n=59).</p> <p>In PY6, trade allies and business customers were interviewed in a separate study to estimate spillover broadly across the C&I market.</p> <p>The results of the cross-cutting C&I spillover study will be reported separately.</p>
PY9	<p>Recommendation (based upon PY7 research): NTG Lighting: 0.70 NTG Non-Lighting: 0.69 Free-Ridership, Lighting: 0.31 Free-Ridership, Non-Lighting: 0.32 Spillover, Lighting: 0.01 Spillover, Non-Lighting: 0.01</p> <p>NTG Research Source: FR = PY7 Participant Customers and Trade Allies SO = PY6 C&I NTG study</p>
CY2018	<p>Recommendation (based upon PY7 and PY8 research): NTG Lighting: 0.71 NTG Non-Lighting: 0.70 Free-Ridership, Lighting: 0.31 Free-Ridership, Non-Lighting: 0.32 Spillover, Lighting: 0.02 Spillover, Non-Lighting: 0.02</p> <p>NTG Research Source: FR = PY7 Participant Customers and Trade Allies SO = PY8 TA and Contractor Self-Report</p>

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