NAVIGANT

150 N Riverside Plaza
Suite 2100
Chicago, IL 60606
www.navigant.com

To: Nicor Gas
CC: Jennifer Morris, ICC Staff; Randy Gunn, Kevin Grabner, Nick Beaman, Laura Agapay-Read, Navigant
From: Cher Seruto, Navigant
Date: (First Draft: August 8, 2019);
(Revised and Final: August 30, 2019)
Re: Net-to-Gross Research Results for Nicor Gas BEER Program 2018: Steam Trap and Non-Steam Trap Measures

EXECUTIVE SUMMARY

This memo presents the results of the net-to-gross (NTG) research of steam trap and non-steam trap measures of the Nicor Gas Business Energy Efficiency Rebate (BEER) Program for the 2018 program year. Our NTG and process[1] research included the following four activities:

- a NTG and process research survey for BEER 2018 participating customers with non-steam trap measures
- a NTG and process research survey targeting non-steam trap trade allies (TAs) who participated in 2018
- a NTG and process research survey for BEER 2018 participating customers with steam trap measures
- a NTG and process research survey targeting steam trap trade allies (TAs) who participated since 2014 and that also sought input from non-participating trade allies.

These results will inform Navigant's September 2019 recommendations to the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) of NTG values to be used for this program in 2020 (as detailed at the end of this memo in Table 9).

Table 1. Net-to-Gross Research Results for BEER All Measures 2018

	FR	SO
Participants	0.23	
Private Sector	0.23	0.04
Public Sector	0.20	
Trade Allies	0.11	0

Source: Navigant analysis of data from surveys conducted with 2018 Nicor Gas Business Energy Efficiency Program participants and trade allies.

FREE RIDERSHIP AND SPILLOVER SURVEY DISPOSITION

The non-steam trap participant survey was fielded by Blackstone through computer assisted telephone interviewing software (CATI) during Q2 of 2019. Of the 151 unique program participants with contact information, 25 responded to the attempted census survey[2] for a 17% response rate. Responding participants represent 14% of non-steam trap savings achieved for the BEER program in 2018. Navigant engineers conducted the non-steam trap TA outbound telephone interviews in Q2 of 2019. Twelve TAs responded to the survey for an 11% response rate. The 12 TAs represent 42% of non-steam trap BEER savings in 2018.

Blackstone fielded the Steam Trap Participant Survey during Q3 of 2019, using CATI software. Navigant created the sample as a census of steam trap participants from Q1 2018 through Q2 2019. Of the 29

[1] Navigant will report process results in a separate document in Q3 of 2019.
[2] Two of the 25 respondents provided free ridership scores for two measures each, for a total of 27 measure-level responses.

participants from 2018 with contact information, 6 responded to the attempted census survey for a 21% response rate. Responding participants represent 35% of 2018 steam trap savings and 26% of total 2018 program savings.

Table 2**Error! Reference source not found.** presents survey dispositions for the participant survey results broken out by non-steam traps and steam traps. At the sector level (public/private), the sample's representation is low, and we include the private and public sub-categories only for qualitative purposes. We do not recommend using the private and public sector free ridership results as they are not based on a statistically significant subset of the population.

Table 2. Survey Dispositions for All Measures

Category	Sample Population*	Completes	Response Rate	Share of Non-Steam Trap Savings Represented by Analyzed Completes	Share of Steam Trap Savings Represented by Analyzed Completes	Share of Total Program Savings Represented by Analyzed Completes‡
Non-Steam Trap Participants	151	25	17%	14%	NA	4%
Public	19	7				
Private	132	18				
Steam Trap Participants	29	6	21%	NA	35%	26%
Public	5	2				
Private	24	4				
All Participants	180	31	17%	NA	NA	30%

*The population is the number of unique contacts with contact information from the BEER 2018 participation database.
‡ Includes steam traps and non-steam trap measures. Non-steam traps were 25% of 2018 BEER program savings, and steam traps were 75%.
Source: Navigant analysis

FREE RIDERSHIP AND SPILLOVER PROTOCOLS

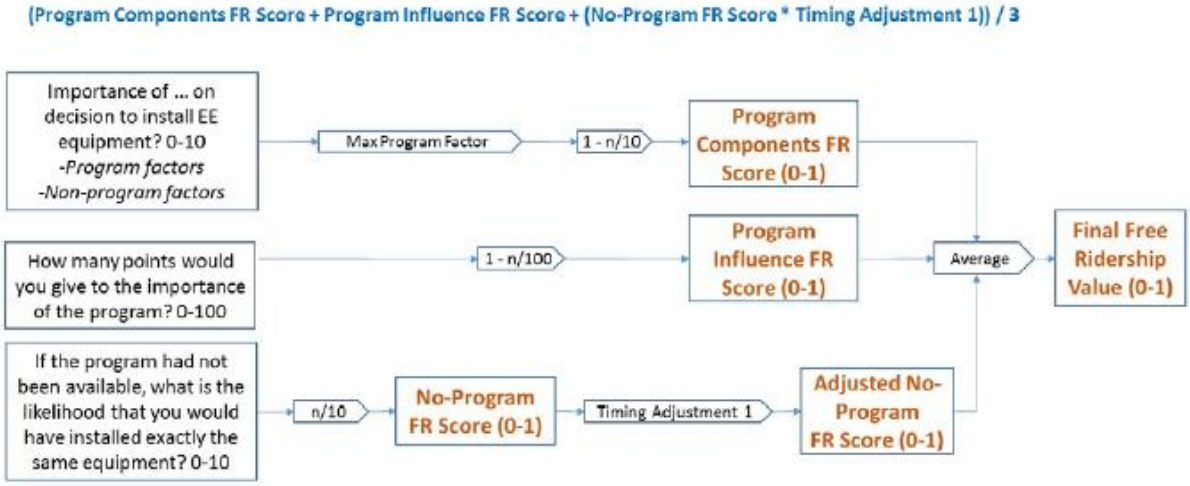
The evaluation team applied the relevant free ridership and spillover guidance from Illinois Technical Reference Manual Version 7.0 (TRM) as follows:

- Participant perspective: Section 3.1.1.1 Core Free Ridership Scoring Algorithm
- Trade ally perspective: Section 5 Cross-Sector Protocols

Navigant adjusted the wording of the core participant free ridership algorithm slightly for service-based upgrades (such as equipment tune-ups), though the scoring is the same for both equipment installations and service-based upgrades.

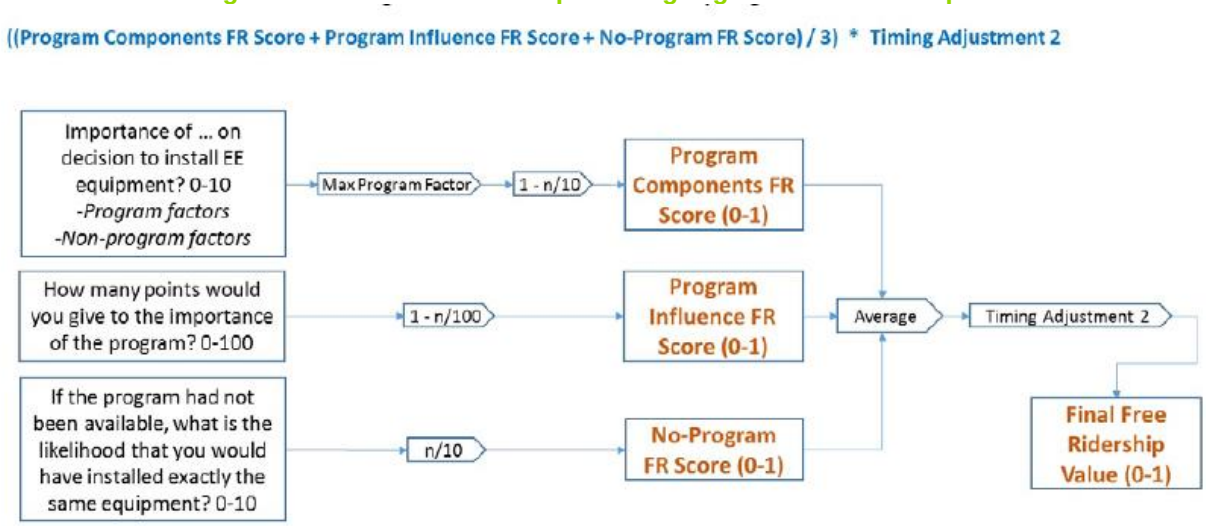
The evaluation team's preferred algorithm specification is Core Free Ridership Algorithm 1, shown graphically below (Figure 1). The majority of NTG findings discussed below are based on this version. The second option, Core Free Ridership Algorithm 2 (Figure 2) has also been analyzed, and those findings are presented as a sensitivity case later in this memo. The rationale for selecting Algorithm 1 over Algorithm 2 is that Algorithm 1 provides for equal weighting of each of the three sub-scores, which represent different ways of determining program influence. In contrast, Algorithm 2 applies a 50% weight to the program's effect on the timing of the project, which we believe is too high. Such a high weighting essentially discounts the effect of the other factors that drive program influence, which in our view is inappropriate.

Figure 1. Core Free Ridership Scoring Algorithm 1 – Participants



Source: Illinois TRM Version 7.0, Volume 4 Figure 3-1

Figure 2. Core Free Ridership Scoring Algorithm 2 – Participants



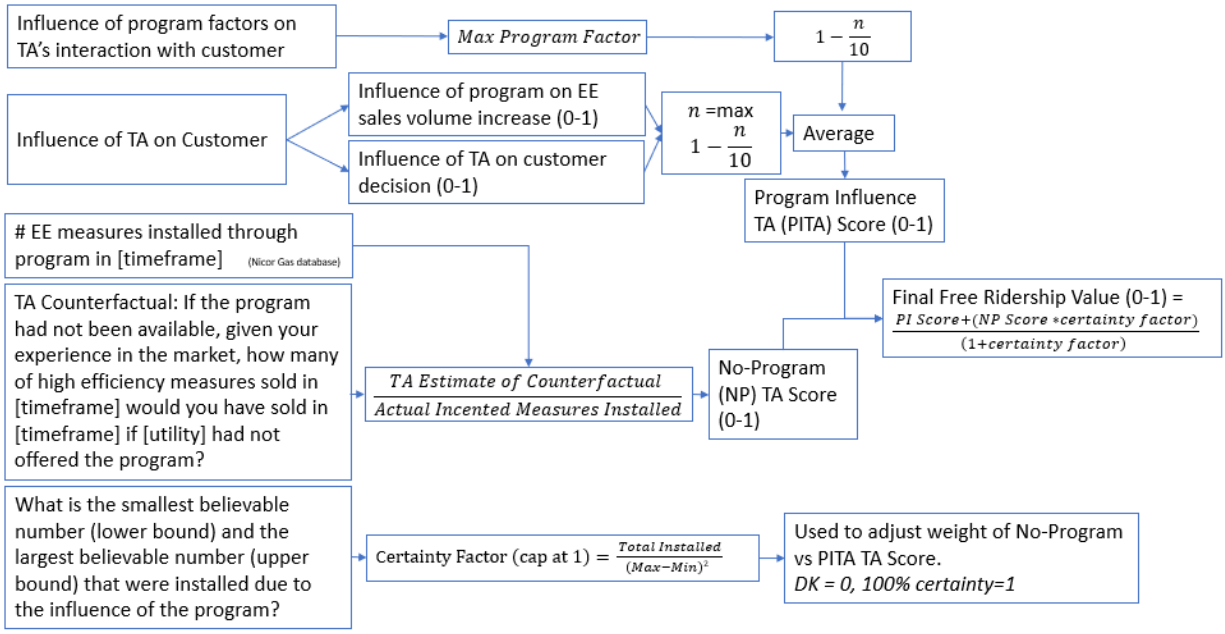
Source: Illinois TRM Version 7.0, Volume 4 Figure 3-2

Version 7.0 of the TRM does not specify an approach for measuring trade ally perspective of free ridership, though Navigant proposes that an approach be developed for future versions of the TRM. For this study, Navigant developed the following method to assess free ridership from a trade ally perspective. We designed the method to align with the triangulation approach of the TRM's participant free ridership algorithms. This includes the following trade ally perspectives, as diagrammed in Figure 3:

- An estimate of the program's influence on the Trade Ally (the PITA score)
  - The influence of program factors on the ability of the trade ally to sell the energy efficient service or product to the customer
  - The influence of the program on any sales or stock increases of energy efficient equipment OR the influence of the program on the customer decision
- A No-Program (NP) score: The estimate of the number of energy efficient items the trade ally would have installed or serviced absent the program

- A certainty factor adjusts the weight of the No-Program score (compared to the PITA score) when calculating the final free ridership value

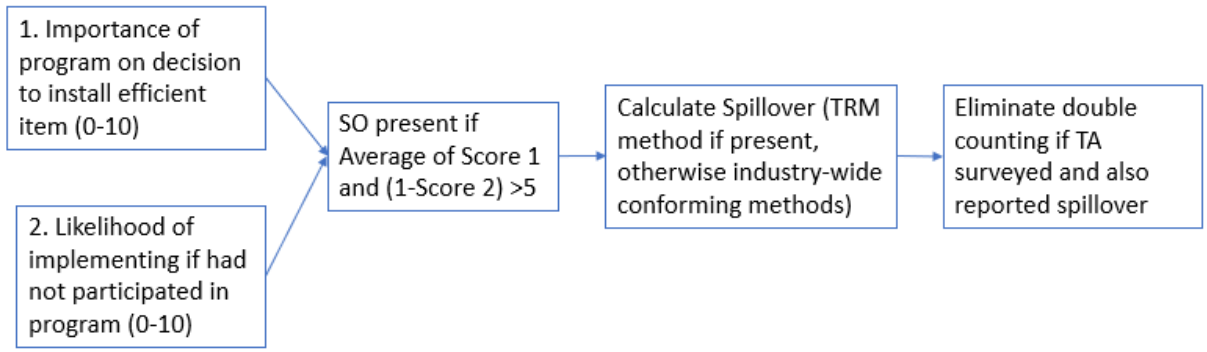
Figure 3. Trade Ally Free Ridership Protocol



Source: Navigant

Navigant assessed spillover according to the TRM, which specifies protocols for participant and trade ally spillover. Participant spillover is documented by the following process (Figure 4):

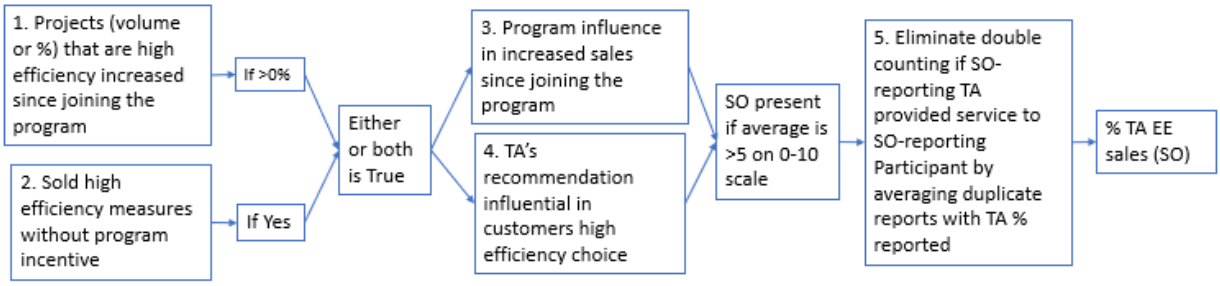
Figure 4. Participant Spillover Protocol



Source: Illinois TRM Version 7.0

Trade ally spillover is assessed by estimating the increase of sales of high efficiency products or services that are not rebated, as shown below in Figure 5.

Figure 5. Trade Ally Spillover Protocol



Source: Illinois TRM Version 7.0

The process to calculate trade ally spillover contains multiple steps as defined in the TRM:

1) Calculate the % of an individual trade ally's high efficiency equipment sales that received an incentive

$$= \frac{\%\ of\ Total\ Sales\ that\ are\ HE,\ \ received\ incentive}{(\%\ of\ Total\ Sales\ that\ are\ HE, received\ incentive + HE\ \%\ that\ did\ NOT\ receive\ incentive)}$$

2) Calculate the savings of the high efficiency equipment sales that did not receive an incentive

$$= \frac{\sum TA\ savings\ from\ Program\ Database}{1)\ \%\ of\ TA's\ HE\ Sales\ that\ received\ an\ incentive} - \sum TA\ savings\ from\ Program\ Database * Size\ Adjustment$$

3) Develop the spillover ratio for sampled trade allies by summing individual trade ally spillover savings and dividing that total by program-tracked savings associated with the sampled trade allies
4) Develop spillover savings for the population of active trade allies by applying the spillover ratio from step 3 to all program savings associated with active trade allies
5) Develop the overall spillover ratio for active trade allies by dividing the trade ally spillover estimate from step 4 by total program savings

$$= \frac{4)\ Total\ TA\ tracked\ program\ savings * 3)\ \frac{2)\ \sum_1^n TA\ reported\ spillover\ savings}{\sum_1^n TA\ sample\ tracked\ program\ savings}}{5)\ Total\ Program\ Savings}$$

DETAILED NTG RESULTS

Free Ridership Consistency Check Analysis

Trade Ally Results

The evaluation team manually checked numeric free ridership responses for consistency with verbatim responses and found all to be consistent (for each respondent). Thus, of the 12 responding non-steam trap trade allies, no responses were removed from the analysis. Only four of the 12 trade allies provided an estimate of sales absent the program, therefore the PITA score was used as the primary free ridership value for the remaining eight trade allies.

Of the eight responding steam trap trade allies, one respondent was removed from the NTG analysis due to non-response to the free ridership and spillover questions. Five of the seven steam trap trade allies

remaining provided an estimate of sales absent the program, resulting in the PITA score being used as the primary free ridership value for the remaining two steam trap trade allies.

Participant Results

Of the 27 measure-level non-steam trap participant completes, 17 triggered consistency checks. To evaluate these inconsistent responses, we reviewed all related open-ended responses and numeric responses. Of the 17 inconsistent responses, we determined that seven needed no adjustment because their verbatim response was consistent with their numeric responses. Of the remaining ten, we excluded the Program Component (PC) score of one, the Program Influence (PI) score of four, and the No Program (NP) score of seven (in some cases we excluded two inconsistent scores). In general, the inconsistent responses reflected confusion with the PI questions and the NP questions. Table 3 summarizes our participant free ridership consistency check analysis results.

Table 3. Free Ridership Consistency Check Disposition for Non-Steam Trap Participants

Measure Response Disposition	Private	Public	Total
Measure installations covered by interviews	**20**	**7**	**27**
Excluded: Non-response	0	0	0
Excluded: Triggered and Failed Consistency Check	2	0	2
Total of Excluded Responses	**2**	**0**	**2**
Analyzed Sample	18	7	25
Evaluated to Require no Exclusion	7	0	7
Evaluated to Exclude PC Score	1	0	1
Evaluated to Exclude PI Score	4	0	4
Evaluated to Exclude NP Score	5	2	7

Source: Navigant analysis of data from CATI surveys conducted with 2018 Nicor Gas Business Energy Efficiency Program participants.

No adjustments were made to free ridership scores for the six steam trap respondents.

To obtain the program-level free ridership, the project-level free ridership values were weighted by ex-ante gross therm savings. The results of our analysis, showing free ridership subcomponent scores, are included in Table 4 below.

Table 4: Researched Free Ridership Findings, by Free Ridership Sub-Score

Category	PC Score	PI Score	NP Score	Free Ridership
Steam Traps	0.05	0.33	0.29	0.22
Non-Steam-Traps	0.09	0.28	0.24	0.27
Combined	0.06	0.32	0.28	0.23

Source: Navigant team analysis.

Spillover Estimation

Two non-steam trap TAs responded that they believed spillover to be present, however neither gave information that would allow Navigant to quantify spillover (e.g. the types of equipment or frequency with which customers engage in spillover). One responded: “I give [the customer] the [rebate] information, but

it is up to them to follow through." One steam trap trade ally reported minimal spillover, resulting in less than 0.50 percent spillover for steam trap trade allies.

Six non-steam trap participant respondents reported installing a non-rebated energy efficiency upgrade after participating in the program. Two of these passed the criteria for ranking the program as influential in their decision to install the item. For one of the spillover items (HVAC equipment), Navigant was able to estimate the natural gas savings (65 therms), but the other item (fan flow rate adjustments) achieved electricity savings and no natural gas savings. One steam trap participant reported the program was extremely important in their decision to change O&M policies to identify and repair or replace failed steam traps, reporting 36 steam traps did not receive rebates (31,676 therms). The spillover ratio for the all combined respondents (779,698 therms) is 0.04.

The steam trap process research began with a list of 18 inactive TAs that we identified from the GPY1/2/3 database, plus two additional firms we found through a Google search. Sixteen of these had valid contact information, four refused, two completed our interview, and the remainder did not respond. We asked each of the two respondents if they had installed any program eligible steam traps in Nicor Gas territory in the past 12 months. Neither did; one installs only Venturi steam traps, which are ineligible for rebates. The other did not think they had installed any program-eligible steam traps in the prior 12 months.

Table 5. Spillover Research Results

Category	Spillover therms	Spillover Ratio	Respondents Contributing to Spillover
Participants	31,741	0.04	2
Trade Allies	0	0	0

Source: Navigant analysis of data from surveys conducted with 2018 Nicor Gas Business Energy Efficiency Program participants and trade allies, and non-participating steam trap trade allies.

Free Ridership and Spillover for Measure Type NTG Ratio

Participant and Trade Ally Free Ridership Scores

Table 6 summarizes the confidence and precision results for free ridership for participants. Although we contacted a census of 2018 participants, the results did not achieve the desired 90/10 confidence/precision by measure type (steam trap or non-steam trap) or sector (public or private). The results for the total combined population provide the best precision (C/P = 90/11).

Table 6. Confidence / Precision Results for BEER Trap 2018 Participants

Category	Precision at 90% Confidence Interval
Total Participant Population	11%
Private	14%
Public	13%
All Sector Steam Trap	18%
All Sector Non-Steam Trap	14%

Source: Navigant analysis of data from surveys conducted with 2018 Nicor Gas Business Energy Efficiency Program participants.

Combining Participant and Trade Ally Free Ridership Scores

The TRM suggests trade ally perspectives of participant free ridership and spillover be combined with participant perspectives *where trade allies play a prominent role in delivering the energy efficiency measure and promoting the program*. The BEER program is comprised of two components: an assessment and direct install component conducted by a program implementer, and the rebate program component. Customers and trade allies do not always interact with the rebate program in the same way, whereas the assessment and direct install component is generally performed in the same manner for all customers.

Of the twelve contractors responding to the BEER non-steam trap trade ally survey, three (representing 78% of the savings of responding trade allies) stated they do not actively promote the program. One stated without prompting “we are not a trade ally”. The general sentiment from these three respondents is if a customer asks the installation contractor to sign the rebate paperwork, they do, but they do not promote the program.

The remaining nine installation contractors did not comment on how much they do or do not promote the program. Despite the hesitation of a few responding installation contractors to refer to themselves as “program trade allies”, all twelve installation contractors did respond to questions about the influence on the program on their ability to sell energy efficient products and services to their customers, and their responses are summarized by the resulting NTG score.

The TRM recommends the following triangulation weighting approach as a method to combine participant and trade ally perspectives of the free ridership present in the program.

We weighted the following items according to our analysis of the results:

1. How likely is the approach to provide an accurate estimate of free ridership?
    a. We assigned the participant response a value of 80% because we followed the TRM approach which is considered the most appropriate approach at the time of development based on the IL NTG working group and SAG perspectives. However, the findings of our consistency check analysis indicate that some respondents do not understand the intent of the survey questions.
    b. We assigned the trade ally a value of 40%, because the TRM does not currently contain a standardized approach for measuring free ridership from trade allies – this is a new approach in Illinois that has not been reviewed or refined yet through the NTG working group process. Three respondents we considered to be trade allies rejected that description, suggesting that a single trade ally protocol may not be sufficient, and different free ridership protocols may be required for some types of equipment vendors.
2. How valid is the data collected / analysis?
    a. We assigned the participant response a value of 70%, because we followed the TRM approach. However, there was sample frame bias because we did not have telephone contact information for all participants. The 18% response rate may have produced some non-response bias, and participants from the first half of 2018 may have recall bias for a survey fielded in Q2 2019.
    b. We assigned the trade ally results a value of 30%. Factors that lower this score are potential non-response bias and quantitative estimates from trade allies that rely on best estimates made at the time of the call rather than historical record keeping.
3. How representative is the sample?
    a. We assigned the participant results a rank of 30%, because this is the amount of program savings represented by the responding participants.
    b. We assigned the trade ally results a rank of 22%, because this is the amount of program savings represented by the responding trade allies.

The weighting values and results are summarized below in Table 7.

Table 7. Triangulation Weighting Approach for Non-Steam Trap Participant and TA Free Ridership Perspectives.

NTG Triangulation Data and Analysis	Participants	Trade Allies
1. How likely is this approach to provide an accurate estimate of free ridership?	80%	40%
2. How valid is the data collected / analysis?	70%	30%
3. How representative is the sample?	30%	22%
Average Score	60%	31%
Sum of Averages	91%	
Weight	**66%**	**34%**

Source: Navigant analysis of data from surveys conducted with 2018 Nicor Gas Business Energy Efficiency Program participants and trade allies

The triangulation of participant and trade ally scores result in the following weighted free ridership values for the BEER program (Table 8).

Table 8. Free Ridership and Weighted Average

Sector	Participant Free Ridership	Trade Ally's Perspective of Participant Free Ridership	Weighted Average Free Ridership
All Sector Steam Traps	0.22	0.10	NA
All Sector Non-Steam Traps	0.27	0.14	NA
All Sector All Measures	0.23	0.11	0.19
Private Sector	0.23		0.19
Public Sector	0.20		0.17

Source: Navigant analysis of data from surveys conducted with 2018 Nicor Gas Business Energy Efficiency Program participants and trade allies.

We present results from the participant survey broken out by measure type (steam traps/non-steam traps) and sector (private/public) only for qualitative purposes because, at the measure or sector level, the sample's representation of savings is too low to yield statistically significant results.

Table 9 below summarizes our recommendations of NTG values for the BEER program for 2020.

Table 9. Recommended NTG Values for BEER Program

Measure Group	Free Ridership	Participant Spillover	Non-Participant Spillover*	NTG
All Measures	0.19	0.04	0.01	0.86

*http://ilsagfiles.org/SAG_files/NTG/2019_NTG_Meetings/Corrected_NTG_Values/Nicor_Gas_NTG_History_and_2019_Recommendations_Aerator_Showerhead_Correction_2019-04-12.xlsx. Non-participant spillover from GPY2 research consisted of 31 non-participating trade ally interviews, of which 10 responded to spillover questions and two identified spillover amounting to 2% of program savings. Reviewing the 2018 steam trap NTG research that included participants, and participating and non-participating trade allies, we revised the steam trap non-participant spillover to zero. We did not change the non-participant spillover for non-steam traps. Combining the two estimates results in a non-participant spillover of 0.01.

Source: Navigant analysis

APPENDIX 1: COMPARISON OF FREE-RIDERSHIP ALGORITHM 1 VERSUS ALGORITHM 2

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 greater the internal consistency of the items. However, given the small number of items (i.e., the three sub-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:

$$\alpha = \frac{N \cdot \bar{r}}{1 + (N - 1) \cdot \bar{r}}$$

Where:

N = the number of items
$\bar{r}$ = the average correlation

We calculated the Cronbach Alpha for the two algorithm variations discussed previously.

Table 10 below presents free ridership results, free ridership precision, and the Cronbach's Alpha for the two NTG ratio algorithm variations for the 2018 BEER Program (non-steam trap measures). Overall, Cronbach's Alpha values for 2018 are high, 0.76 for Algorithm 1 and 0.79 for Algorithm 2.

Table 10. Comparison of Algorithm 1 and 2 (n= 25 total; 18 Private, 7 Public)

Category	Free-Ridership Value	Precision at 90% Confidence Interval	Cronbach's Alpha
Algorithm 1			
Private Non-Steam Trap	0.28	18%	
Public Non-Steam Trap	0.09	9%	
All Sector Non-Steam Trap	0.27	13%	0.76
Algorithm 2			
Private Non-Steam Trap	0.27	18%	
Public Non-Steam Trap	0.08	10%	
All Sector Non-Steam Trap	0.25	13%	0.79

Source: Navigant

Together, the Cronbach's Alpha results suggest that both sets of free ridership sub-scores (those from Algorithm 1 and those from Algorithm 2) have high internal consistency. However, this does not change our fundamental preference for Algorithm 1 over Algorithm 2 for the reasons stated earlier.

APPENDIX 2: BEER NTG HISTORY

	BUSINESS ENERGY EFFICIENCY REBATE PROGRAM
GPY1	**NTG** 0.73 **Free ridership** 0.27 **Spillover** 0.00 **Method**: Customer self-report: 34 surveys completed from a population of 146. Standard Rigor approach. No quantifiable participant spillover was found from customer self-reports.
GPY2	**NTG** 0.73 **Free ridership** 27% **Spillover** 0% **Method**: SAG approved NTG ratio based on GPY1 research.
GPY3	**NTG** 0.83 **Free ridership** 27% **Spillover** 10% **Method**: SAG approved NTG ratio based on GPY1 free-ridership research and deemed spillover.
GPY4	**NTG** 0.83 **Free ridership** 27% **Spillover** 10% **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** 0.68 **Free ridership** 35% **Participant Spillover** 1% **Non-Participant Spillover**: 2% **Method**: NTG ratio based on GPY4 free-ridership and participant spillover research consisting of interviews with 44 GPY3 customer participants and 20 GPY3 trade ally participants. Standard Rigor approach. Non-participant spillover drawn from GPY2 research consisting of 31 non-participating trade ally interviews.
GPY6	**NTG** 0.68 **Free ridership** 35% **Participant Spillover** 1% **Non-Participant Spillover**: 2% **Method**: NTG ratio based on GPY4 free-ridership and participant spillover research. Non-participant spillover drawn from GPY2 research consisting of 31 non-participating trade ally interviews.
GPY7	**NTG:** 0.68 **Method**: No new research. Retained GPY6 final value.

Source:
http://ilsagfiles.org/SAG_files/NTG/2019_NTG_Meetings/Corrected_NTG_Values/Nicor_Gas_NTG_History_and_2019_Recommendations_Aerator_Showerhead_Correction_2019-04-12.pdf