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Memorandum

To: Fernando Morales, Ameren Illinois Company; Jennifer Morris, Illinois Commerce Commission

From: Opinion Dynamics Evaluation Team

Date: September 21, 2020

Re: Updated AIC Retro-Commissioning Net-to-Gross Ratios

Introduction

The Retro-Commissioning Initiative helps AIC business customers evaluate their existing mechanical equipment, energy management, and industrial compressed air systems to identify no-cost and low-cost efficiency measures to optimize existing energy-using systems.

In 2019 and 2020, the evaluation team conducted research with Retro-Commissioning (RCx) participants to update the net-to gross ratios (NTGRs) for equipment types available through these offerings. We developed the NTGRs using self-reported information from computer-aided telephone interviewing (CATI) surveys with program participants. All interviews were conducted by a member of the evaluation team who was familiar with the initiative and research objectives. We used both participant survey responses to develop estimates of free-ridership (FR) and participant spillover (PSO).

Summary of NTG Results

Table 1 summarizes the results of our Retro-Commissioning NTG analyses. Results are from a relatively small number of completed interviews (6) involving projects completed in both 2019 and 2018. This is particularly the case for interviews done with participants that reported gas savings (2). Compared with results from our previous recommendation in PY9, FR scores here are higher, leading to a lower overall NTGR (0.75 vs. 0.89).

Table 1. 2019 Retro-Commissioning NTG Research Results

Energy	FR	PSO	NPSO[a]	NTGR (1-FR+PSO+NPSO)
(British Thermal Unit) Btu	0.25	0.00	0.0002	0.75
Electric	0.27	0.00	0.0002	0.73
Gas	0.22	0.00	0.0002	0.78

[a] From most recent Business Program NPSO research.

Data Collection and Sampling Methodology

Given the generally small number of participants in AIC's Retro-Commissioning Initiative, we conducted a census attempt aimed at both 2019 and 2018 participants. Participants were contacted in two waves (in August 2019 and April 2020) to ensure that they were providing input as close as possible to when they participated in the program. Table 2 below shows the number of surveys that were completed for each offering, as well as the percentage of savings that were captured in our sample.

Table 2. Data Collection and Sample Development

Offering	Number of Projects in Population	Number of Survey Completes (*n*)	% of Projects Covered in Survey	% of Electric Savings Covered in Survey	% of Gas Savings Covered in Survey
Compressed Air Retro-Commissioning	25	4	16%	16.7%	N/A
Retro-Commissioning Lite	1	1	100%	100%	100%
Large Facilities Retro-Commissioning	3	1	33%	11.8%	5.7%
Industrial Refrigeration Retro-Commissioning	1	0	0%	0%	0%
Total	**30**	**6**	**20%**	**16.0%**	**12.1%**

NTGR Methodology

Net impact evaluation is generally described in terms of determining program attribution. Program attribution accounts for the portion of gross energy savings associated with a program-supported measure or behavior change that would not have been realized in the absence of the program. The share of program-induced savings, indicated as a NTGR, is made up of FR and SO and is calculated as (1 – FR + PSO). FR is the portion of the program-achieved verified gross savings that would have been realized absent the program and its interventions. PSO occurs when participants take additional energy-saving actions that are influenced by the program interventions but did not receive program support.

The formula to calculate the NTGR is:

$$NTGR = 1 - FR + PSO$$

The Illinois evaluation teams have worked with the Illinois Commerce Commission (ICC) and the Illinois Stakeholder Advisory Group (SAG) to create a standard Illinois Statewide NTG approach for use in Illinois energy efficiency evaluation, measurement, and verification work. Per the NTG Methods attachment to the Illinois TRM (IL-TRM),[1] all NTG data collection and analysis activities for program types covered by the attachment that began after January 1, 2019 must conform to the statewide NTG methods. While data collection occurred in 2019, our survey covered all inputs required by IL-TRM version 8.0. This evaluation therefore conforms with the requirements of Version 8 of the IL-TRM.

Free-Ridership (FR)

Methodology

Free-riders are program participants who would have who would have implemented the incented energy-efficient measure(s) even without the program FR estimates are based on a series of questions that explore the influence of the program on participants' purchasing decisions as well as actions the participant likely would have taken had the program not been available.

For all Retro-Commissioning Initiative projects included in the participant survey, we implemented two specifications of the FR algorithm, following the IL-TRM's Study-Based Free-Ridership protocol. Each specification of the algorithm consists of three scores: (1) influence of program components score, (2) overall

[1] Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 8.0. Volume 4: Cross-Cutting Measures and Attachments. Dated: October 17, 2019. Effective: January 1, 2020.

program influence score, and (3) no-program score (counterfactual), as well as a timing adjustment (in some cases). Each sub-score serves as a separate estimator of FR and can take on a value of 0 to 1, where a higher score means a higher level of FR. The overall FR for a project is the average of the three scores. The FR score for each project thus ranges from 0 (no FR) to 1 (100% FR).

The three scores included in the algorithms, their variations, and the timing adjustment are described below.

1. **Influence of Program Components**. This score is based on a series of questions that ask respondents to rate the importance of program and non-program components in their decision to install the energy-efficient equipment, using a scale of 0 to 10 (where 0 is "Not at all important" and 10 is "Very important"). Components considered are summarized in Table 3.

Table 3. Program and Non-Program Components Considered

Component	Type
The subsidized retro-commissioning study	Program factors (PF)
Recommendations made by an (Retro-Commissioning Service Provider) RSP	
Information from the program	
A recommendation from an AIC representative	
Technical assistance from an RSP	
Standard practice in business or industry	Non-program factors (NPF)
Age or condition of existing equipment	
Corporate policy or guidelines	
Previous experience with retro-commissioning	Either program or non-program factors, depending on follow-up questions
Expected energy savings	
Financial criteria, such as payback or return on investment	
Other factors	

Equation 1. Program Components FR Score

$$PCS = 1 - \left(\frac{PF_{max}}{10}\right)$$

Greater importance of the PC means a lower level of FR. In this approach, if a respondent rated the subsidized retro-commissioning study 10 out of 10, the recommendation of an RSP 8 out of 10, and the information from the program 8 out of 10, the final Program Components FR Score would be 0.

2. **Program Influence (PI)**. This score is based on a survey question asking the respondent to rate the importance of the program compared to the importance of other factors in their decision to complete improvements. To do so, respondents were asked to divide 100 points between the program and other, non-program factors. This score is estimated as:

Program Influence FR Score = 1 – (Points Given to Program / 100)

More points allocated to the program means lower level of FR. For example, if a respondent gave the program 70 points out of 100, the Program Influence FR score would be 0.30.

3. **No-Program Score (NP).** This score is based on the likelihood that the exact same energy efficient improvements would have been made without the program. The IL-TRM provides two options for calculating this score. Both options are computed on the measure-level and then rolled up to the project-level using measure-level savings weights to accurately represent the importance of each measure completed.

   NP Score – Option 1

   Option 1 follows the IL-TRM's Core Non-Residential FR approach and uses responses to a counter-factual likelihood question combined with a timing adjustment. Respondents are asked to answer the likelihood they would have completed a given retro-commissioning improvement if the program had not been available, using a scale of 0 to 10 (where 0 is "Not at all likely" and 10 is "Very likely"). This answer is then used to calculate a NP score, presented below:

   $$\text{NP Score} = \text{Likelihood to Complete Same Improvements} / 10$$

   A greater likelihood of participating without the program means higher level of FR. For example, if the participant provides a likelihood rating of 7 to complete the same improvements in the absence of the program, their NP FR score would be a 0.70.

   This score is then combined with a timing adjustment (discussed next) as follows:

   $$\text{NP Score}_{\text{Adjusted}} = (\text{Likelihood to Install Same Equipment} / 10) * \text{Timing Adjustment}$$

Program Timing Adjustment

The program timing adjustment is based on two questions: (1) if the installation would have been done at the same time without the program; and (2) if the installation would have been done later, how much later. Later implementation without the program means lower level of FR. This adjustment is calculated on a 0 to 1 scale. A timing adjustment of 1 means that there is no evidence the program changed the timeframe in which the project would have been implemented, while a lower value of the timing adjustment means that the program caused the project to be implemented sooner. The timing adjustment provides the program with some credit for accelerating the project by reducing the level of FR. Table 4 provides detail on how participant responses correspond to various timing adjustments.

Table 4. Timing Adjustments

Participant Survey Response	Timing Adjustment
In absence of program, would have completed project…	
within 6 months	1.0
seven months to one year later	0.93
more than one year up to two years	0.71
more than two years up to three years	0.43
more than three years up to four years	0.14
more than four years later	0.14

NP Score – Option 2

Option 2 utilizes more detailed-measure level questions to assign the NP score at the measure level. The rules presented below are followed in order to assign the NP score.

a. If the respondent indicates that they conduct regular maintenance on the equipment treated through the program, and that the regular maintenance always includes the improvements made through the program, then the NP FR Score = 1.

b. If the respondent indicates that they were unaware of the performance issue corrected by the improvement made, that they would have been very unlikely to conduct a retro-commissioning study on their own, and that there is not regular maintenance conducted on the treated equipment that always includes the improvement made through the program, then the NP FR Score = 0.

c. If the respondent indicates that they were unaware of the performance issue corrected by the improvement made, that they were very unfamiliar with the recommended improvement, and that there is not regular maintenance conducted on the treated equipment that always includes the improvement made through the program, then the NP FR Score = 0.

d. For all other combinations of responses, NP Score – Option 1 is used to calculate FR.

Determining Overall Free-Ridership

As mentioned above, we implemented two specifications of the FR algorithm, following the IL-TRM's Study-Based Free-Ridership protocol. Both specifications of the algorithm consists of a combination of the three scores mentioned above, and the overall FR score for a project is the average of the three scores.

This evaluation implemented and analyzed the following two specifications of the FR algorithm.

- **Approach 1:** (PC FR Score + PI Score + NP Score – Option 1) / 3
- **Approach 2:** (PC FR Score + PI Score + NP Score – Option 2) / 3

Results

Table 5 presents our results by approach. Because we conducted a census attempt of all 2019 and 2018 participants, there is no sampling error around our results.

Table 5. FR Results by Approach

Approach	FR Score	α
Approach 1	0.25	0.572
Approach 2	0.39	0.552

The evaluator is tasked with determining which specification of the algorithm is most appropriate for application. We used Cronbach's alpha (α in the table above) as a tool to help us evaluate the different algorithm specifications for the Retro-Commissioning Initiative. As each of the three scores incorporated into the final FR estimate serves as a separate estimate of FR, we used Cronbach's alpha to examine the internal consistency of the three scores for each specification, working from the basis that a higher degree of internal consistency is desirable for the algorithm. A general rule of thumb is that a Cronbach's alpha of 0.7 or higher indicates an acceptable level of internal consistency.

As can be seen, neither of the approaches produced a Cronbach alpha that is particularly high. However, Approach 1 has a slightly higher alpha score and is consistent with the algorithms used in past evaluations. As such, we are selecting Approach 1 for our recommendation.

Participant Spillover

Participant spillover (PSO) refers to the installation of energy efficient measures or completion of energy-efficient improvements by program participants that were influenced by the program but did not receive an incentive. An example of PSO is a customer who completes improvements in one facility and, as a result of the positive experience, installs additional equipment or completes improvements at another facility but does not request an incentive (outside SO). In addition, the participant may install additional equipment or complete improvements, without an incentive, at the same facility because of the program (inside SO).

We examined both inside and outside SO in projects using participant responses to the phone survey. Per the IL-TRM, we used a threshold approach to determine whether unincentivized measures or improvements made by program participants could be considered SO. The threshold condition for SO is based on responses to the following two survey questions:

- On a scale of 0-10, where 0 means "no influence" and 10 means "greatly influenced," how much did your experience with the AIC Retro-Commissioning program influence your decision to install high efficiency equipment or change maintenance practices on your own beyond those recommended in the retro-commissioning project?
- If you had NOT participated in the AIC Retro-Commissioning program, how likely is it that you would still have installed this additional energy efficient equipment or changed your maintenance practices? Please use a 0 to 10 scale, where 0 means you "definitely WOULD NOT have implemented this equipment or changed maintenance practices" and 10 means you "definitely WOULD have implemented this equipment or changed maintenance practices".

The response to the first question cited above is "Measure Attribution Score 1," and the response to the second question cited above is "Measure Attribution Score 2." Spillover is considered attributable to the program if the "Spillover Score" is greater than 7.0. The "Spillover Score" is defined as follows:

$$\text{Spillover Score} = (\text{Measure Attribution Score 1} + (10 - \text{Measure Attribution Score 2}))/2$$

Results

Only one out of the 6 respondents reported making any additional operational improvements following their participation in the AIC Retro-Commissioning program. However, in the follow-up question, that respondent indicated that the additional improvements were done through an AIC Energy Efficiency Program. Therefore, we found no spillover in this evaluation.