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Impact and Process Evaluation of 2014 (PY7) Ameren Illinois Company Commercial & Industrial Custom Efficiency Program

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Opinion Dynamics

Table of Contents

Opinion Dynamics

Table of Tables

Table of Figures

1. Executive Summary

This report presents results from the evaluation of the seventh program year (PY7) of the Ameren Illinois Company (AIC) Commercial and Industrial (C&I) Custom Program for electric and gas energy efficiency. In PY7 (June 1, 2014–May 31, 2015), AIC expected the Custom Program to account for 15% of the overall portfolio electric savings and 22% of portfolio therm savings.[1] Savings from the Custom Program come from the general Custom Program, the Competitive Large Incentive Project (CLIP), the Staffing Grant initiative, and New Construction Lighting.[2]

The PY7 evaluation of the Custom Program involved both impact and process assessments. To support the process evaluation, we interviewed Staffing Grant and CLIP participants, spoke with program staff, and reviewed implementation and marketing materials. Our impact evaluation research efforts included interviews with recipients of Staffing Grants and CLIP incentives and site visits to a stratified sample of locations that had incentivized custom equipment installed. We also conducted non-participant research to inform process findings and non-participant spillover for the overall Business Program. Below, we present the key findings from the PY7 evaluation.

1.1 Impact Results

Overall, the PY7 Custom Program performed well. As shown in Table 1 below, the program achieved 87,017 MWh in net electric savings and 2,185,563 therms in net gas savings. This level of savings enabled the program to exceed its PY7 electric and gas goals.

Table 1. Custom Program Impact Summary

Savings	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR*	Ex Post Net
Energy Savings MWh					
Total MWh	122,424	0.93	114,021	0.763	87,017
Demand Savings MW					
Total MW	13.4	0.80	10.7	0.763	8.2
Gas Savings Therms					
Total Therms	1,937,083	1.51	2,930,082	0.746	2,185,563

*Blended NTGR based on PY5 NTGR values (0.75 for electric and 0.74 for gas) for all Custom Program projects except those completed through the CLIP and Staffing Grant initiatives, for which a retrospective NTGR was applied based on PY7 research.

1.2 Process Results

In PY7, the Custom Program completed another highly successful year in terms of its performance against participation and savings goals. Now in its seventh year, the program's structure and implementation has

[1] Based on the Program Year Seven Implementation Plan, November 14, 2014.

[2] While AIC processes most new construction projects through the Standard Program, lighting and HVAC projects are processed through the Electric Custom Program. New construction lighting projects falling under the New Construction Lighting offering and large-scale HVAC projects in new construction are included in the Custom incentive offering.

remained relatively stable with several changes to special offerings and some small adjustments to the general electric and gas programs.

1.3 Conclusions and Recommendations

Interviews with participants in two special offerings, CLIP and Staffing Grant, revealed positive feedback for both programs. Participants in these programs also offered a few suggestions based on their experiences. Based on their feedback, our review of materials from PY7, and our engineering analyses, we make the following recommendations for the program:

- AIC may consider providing support for potential Staffing Grant recipients to help them identify projects that might be viable candidates for future Staffing Grants as well as to provide technical review of projects to help participants move beyond relatively simple lighting projects to more advanced measures and deeper energy savings.
- For CLIP projects, where the savings are large but potentially variable, the program may consider establishing a protocol for participants to reclaim the initially proposed incentive amount if the program staff's preliminary savings estimates are eventually shown by the ex post evaluation to be overly conservative. One option for this may be for the program to award the rebates in two phases such that the participants receive a portion of the rebate upfront and the remaining share prorated as necessary depending on the evaluated savings.
- We found high levels of variation in the realization rates for the Custom Program projects we sampled and for the program overall. Only 41% of the projects we sampled had realization rates that fell within ±20% of the project's ex ante estimate with individual realization rates ranging from 3% to 746%. Such large differences between ex ante and ex post savings estimates may make it hard for the program to plan with a high degree of certainty. AIC may consider implementing the following suggestions to improve realization rates in future years.
  - We recommend that vendor calculations go through a rigorous technical review, including a review of model files where applicable. Savings estimates for several projects were completed by vendors in PY7, and errors or misclassifications occasionally resulted in realization rates outside of acceptable bounds. Scrutinizing these calculations thoroughly at the beginning will help minimize the degree to which this occurs.
  - Post inspections could help improve some operational adjustments and likely would have captured several of the issues identified during evaluator site visits. Improperly installed equipment or incorrect operational specifications (e.g., occupancy sensors not working properly or incorrectly specified hours of use) could have been identified with a post inspection.
  - The program may consider giving special attention to projects predicting exceptionally large savings relative to the customer's bill. If savings are estimated to be more than 10% of the customer's bill, we recommend reviewing the project with increased scrutiny. While real cases do exist of savings above this threshold, they are very rare and should be thoroughly vetted. If the program is unsure the savings will be achieved, waiting for some billed data to become available may also help confirm the level of savings. This would require delaying finalizing the incentive amount (and associated payment) and may have other implications that need to be considered as well, but for significant projects it would likely help improve the realization rate.

- AIC may consider reviewing Custom project EM&V results and follow up with projects that may benefit from retrocommissioning, especially those that received lower than expected realization rates and experienced control issues.

2. Introduction

This report presents results from the evaluation of PY7 of the Ameren Illinois Company (AIC) Commercial and Industrial (C&I) Custom Program. The Custom Program is one of three programs within the AIC C&I portfolio, which also includes the Standard and Retro-Commissioning Programs. PY7 ran from June 1, 2014 through May 31, 2015.

The PY7 evaluation of the Custom Program involved both impact and process assessments. To support the process evaluation, we interviewed Staffing Grant and Competitive Large Incentive Project (CLIP) incentive recipients as well as program staff. We also reviewed program implementation and marketing materials. Impact evaluation research efforts included on-site visits to verify custom equipment performance and interviews with recipients of CLIP incentives and Staffing Grants. We also conducted computer-aided telephone interviews (CATI) with customers who have never participated in an AIC C&I program to support both our impact and process analyses.

2.1 Program Description

The C&I Custom Program offers incentives to AIC business customers to encourage the installation of energy efficient measures not covered through the Standard Program. Business customers often represent the highest potential for energy savings, but these savings often derive from highly specialized equipment designed for particular industries or types of facilities. Custom incentives cover a wide range of such equipment, allocated based on whether they incur electricity or gas savings. Custom electric measures include lighting, compressed air, energy management systems, and industrial process measures. Gas offerings include heat recovery, process heat, and steam system improvement.

Additionally, several specialized sub-programs are included in the Custom C&I Program:

- The CLIP initiative offers customers the opportunity to request the amount of incentive needed to complete large energy efficiency project(s) with total savings greater than 300,000 kWh and/or 30,000 therms. The payback period must be less than 10 years and there is no minimum payback required. Multiple technologies (such as lighting, variable-frequency drives [VFDs], compressed air, HVAC, and process improvements) are included.

- The Staffing Grant initiative provides customers with funding to help address energy efficiency project staffing needs. Launched in PY4, the program distributes funds based on the proportion of proposed savings ultimately achieved by the grant recipients and contributed to nine projects in PY7, four of which are Custom projects.

- The New Construction Lighting program offers additional incentives for lighting measures in new construction projects.[3] Also launched in PY4, New Construction Lighting incentives supported 45 projects in PY7—more than twice the number implemented in PY6.

- The Feasibility Study offering, also launched in PY4, helps participants define project costs and energy savings opportunities, primarily targeting manufacturing/industrial facilities with compressed air systems. Incentives cover up to 50% of the study cost, with an incentive cap of $10,000 or 25% of the

[3] AIC processes most New Construction projects through the Standard Program, but includes lighting projects in the New Construction Lighting initiative in the Custom Program. Additionally, large-scale new construction HVAC projects fall under the Custom Program.

annual estimated savings identified in the study. Four custom projects received these incentives in PY7.

- The Metering and Monitoring initiative, initiated in PY6, promotes customers' ability to review and curtail their energy use using sub-meters and software. The pilot allowed participants to submit their own plan for identifying energy savings opportunities by implementing energy monitoring software. AIC reimbursed approved customers for the cost of the software implementation: 50% of the cost up to $10,000 initially and 50% of the cost up to $10,000 after measures related to software/metering were installed. This pilot served as the basis for the Strategic Energy Management (SEM) Pilot currently slated for launch in PY8.

2.2 Research Objectives

This evaluation addresses the program's performance in PY7, which began in June 2014 and ended in May 2015. The objective of the PY7 Custom Program evaluation was to provide estimates of gross and net electric and gas savings associated with the program. In addition, we assessed the performance of special initiatives (such as CLIP and Staffing Grants) designed to improve the participation process and the uptake of the program, as well as participation by customers with new construction lighting projects. We applied program-level NTGRs from PY5. As in previous evaluations, we used interviews with Staffing Grant participants to develop NTGRs for retrospective application to PY7 savings from associated projects. Starting in PY7, we also used a similar methodology to develop project specific NTGRs for CLIP. In particular, the PY7 evaluation of the Custom Program focused on the research questions presented below:

1. What are the estimated gross energy and demand impacts from this program?
2. What are the estimated net energy and demand impacts from this program?
3. What are the levels of free-ridership and spillover among Staffing Grant and CLIP program participants?

The evaluation team also investigated several of the Custom Program's special initiatives and program components, including CLIP and Staffing Grants. We explored a number of process-related research questions outlined below:

1. For the Custom Program's special initiatives (CLIP and Staffing Grants), how many projects were completed? By how many unique customers?
2. Did customer participation meet expectations? If not, how different was it, and why?
3. How did participants become aware of these initiatives and program components?
4. Were participants in the special initiatives (CLIP and Staffing Grants) satisfied with their experiences? What aspects of program design or implementation could AIC change to improve program effectiveness and participant satisfaction?
5. What barriers to participation existed for the special program offerings such as CLIP? How was the program seeking to overcome them?

3. Evaluation Methods

The PY7 assessment of the AIC C&I Custom Program included both process and impact analyses. For most projects, we applied NTGRs from PY5 (0.75 for electric and 0.74 for gas), given that the program's implementation has remained relatively consistent, as has the NTGR for this program over its life. For Staffing Grant and CLIP projects, we determined NTGR based on interviews with participants from the respective offerings.

Table 2. PY7 Custom Program Evaluation Methods

Activity	PY7 Process	PY7 Impact	Forward Looking	Details
Review of Program Materials and Data	✓			Gather information about program implementation and performance.
Program Staff In-Depth Interviews[a]	✓		✓	Explore changes made since PY6, as well as the design and implementation of special initiatives, CLIP performance, Staffing Grant implementation, and anticipated developments for future program years.
Staffing Grant Participant Interviews	✓	✓	✓	Support the development of NTGRs for these participants to be applied retroactively
CLIP Participant Interviews	✓	✓	✓	Investigate CLIP project scopes, participant satisfaction, program processes, and areas for improvement. Support the development of NTGRs for these participants to be applied retroactively
Non-Participant Survey*		✓	✓	Gather data to assess non-participant spillover and potential barriers to participation.
Site Visits		✓		Collect data to inform measure verification and gross impacts.
Engineering Review		✓		Review the assumptions and associated savings calculations made by the program implementer, and, where warranted, re-estimate those savings based on a set of revised assumptions.
Net Impact Analysis		✓	✓	Estimate net impacts using PY5 NTGR values and interviews with CLIP and Staffing Grant participants and apply to both the gas and electric savings.

[a] Conducted in conjunction with the Standard Program.

3.1 Data Collection

The following activities informed the PY7 evaluation of the Custom Program.

3.1.1 Program Staff Interviews

As part of the evaluation of the Custom Program, the evaluation team conducted three in-depth interviews: one with program database staff, one with program marketing staff, and one with Leidos, the main program implementer. The interviews focused on program performance in PY7, Business Program-wide changes, and changes to the C&I Custom Program since PY6 as well as anticipated future developments and changes.

3.1.2 Review of Program Materials and Data

We conducted a comprehensive review of all program materials and tracking data including the program's implementation plan, applications, and extracts from the program-tracking database. We received extracts from the program-tracking database in April 2015 for evaluation planning and survey sampling, and we received updated data in July 2015 and then again in September 2015 as program implementers finalized the PY7 database.

3.1.3 Staffing Grant Interviews

We conducted in-depth interviews with Staffing Grant recipients between August and October 2015. These interviews focused on assessing free-ridership and spillover as well as gathering information about barriers to program participation and project completion. The team attempted a census of Staffing Grant recipients, shown in Table 3.

Table 3. Completed Staffing Grants Interviews

	Population of Grant Recipients		Completed Interviews	
	Unique Recipients	Associated Projects	Unique Recipients	Associated Projects
Standard Projects	4	5	3	4
Custom Projects	3	4	3	4
Total	7	9	6	8

3.1.4 CLIP Participant Interviews

We conducted interviews with CLIP participants representing fourteen of the sixteen projects completed in PY7. During the interviews, we explored program satisfaction, the potential for program improvement, and the program's influence on project timelines and outcomes. Some of these findings served to quantify free-ridership and spillover for these exceptionally large projects.

Table 4. Completed CLIP Participant Interviews

	Unique Participants	Associated Projects
Completed NTG Survey	6	9
Completed Informational Interviews	8	14
Population of CLIP Participants	10	16

Overall, the team spoke with participants responsible for 98% of the kWh savings and 77% of the therm savings associated with projects implemented by CLIP recipients. Most of these interviewees also completed a survey that provided inputs for estimating NTG ratios. Interviewees provided NTG survey responses accounting for 82% of kWh savings and 77% of therm savings.

3.1.5 Site Visits

Adjustments to claimed (ex ante gross) energy and demand impacts associated with the Custom Program were determined based on site audits and metering measurement and verification (M&V) of a sample of PY7 projects as well as a detailed engineering desk reviews of the projects discussed below. We used these site

visits and related analyses to develop a sample-based realization rate that was applied to the population of projects.

We selected the sample of PY7 projects for these activities in two waves, drawing from data included in two separate extracts from the Amplify tracking system taken on April 14, 2015 and July 16, 2015. We drew each sample from the entire population of the custom incentive offering including CLIP, New Construction Lighting projects, and projects related to Staffing Grants.[4]

The evaluation team selected a sample of 41 projects for engineering review and metered site verification in two waves. We chose the sample using a stratified random sample design. For the stratification, we used the Dalenius-Hodges method to determine strata boundaries and the Neyman allocation to determine the optimal allocation of the available projects to the strata. We also drew the sample in two waves to ensure a sufficient percentage of the savings from the program was assessed and to allow the team to complete the M&V in time to meet reporting deadlines.

Table 5 and Table 6 show the sample of projects with electric savings and gas savings, respectively, selected in both waves. Overall, the 41 sites with on-site verification account for 49% of the programs' ex ante kWh savings and 57% of the gas savings.[5]

Table 5. Two-Wave Custom Site Visit Sampling Approach for Projects with Electric Savings

Sampling Strata	KWh Savings Range	Number of Projects[a]	Site Visits Completed
Wave 1			
1	2,613-150,000	50	3
2	150,001-1,000,000	21	5
3	1,000,000-4,100,000	7	7
Wave 2			
1	4,382–550,000	29	3
2	550,001–3,000,000	10	5
3	3,000,001–13,205,002	4	4
Total		121	27

[a] Given that we selected the samples prior to the finalization of the PY7 program-tracking data, the total number of projects does not match the final Amplify extract and the project counts presented elsewhere in the report.

[4] Projects with no direct savings, such as feasibility studies and the metering and monitoring pilot, were not included in the population from which we drew the sample.

[5] Ex ante savings are estimates of savings in the utility tracking system or what the utility believed they had saved prior to the evaluation. Note that the sum of electric savings includes only savings from the sample of electric projects and does not include electric savings from the sample of projects with gas savings.

Table 6. Two-Wave Custom Site Visit Sampling Approach for Projects with Gas Savings

Sampling Strata	Therms Savings Range	Number of Projects[a]	Site Visits Completed
Wave 1			
1	682–25,000	9	2
2	25,000-113,482	7	4
Wave 2			
1	627–40,000	7	4
2	40,001–292,126	4	4
Total		27	14

[a] Given that we selected the samples prior to the finalization of the PY7 program-tracking data, the total number of projects does not match the final Amplify extract and the project counts presented elsewhere in the report.

Our sample design was expected to achieve results at the 90% confidence level ±10% precision. However, due to large variances between ex ante and ex post estimates for many projects, the final sample design provides statistically valid impact results at the 90% confidence level ±13% precision on a kWh basis and ±24% for therms savings. We calculated precision for our gross impact results by pooling the results from both waves of site visits.[6] We then developed case weights to account for the fact that the sample is disproportionate (see Figure 2)

To calculate relative precision, the team first determined the variance in the sample and then calculated the standard error and confidence interval. The figure below outlines the equations used.

To adjust the ex ante gross energy and demand impacts for all 171 total projects, the ratio adjustment method[7] was used. The team used the following ratio adjustment algorithm.

Figure 1. Ratio Adjustment Algorithm

$$I_{EP} = \frac{I_{EPS}}{I_{EAS}} * I_{EA}$$

where:

I_{EP} = the ex post[8] population energy and demand impacts
I_{EA} = the ex ante population energy and demand impacts
I_{EPS} = the ex post sample energy and demand impacts
I_{EAS} = the ex ante sample energy and demand impacts

[6] The error bound of the total savings is estimated by calculating the square root of the sum of the squared error bounds of each wave. These calculations are consistent with California Evaluation Framework.

[7] Cochran, William G. *Sampling Techniques.* 1977. New York: John Wiley & Sons.

Based on the on-site sample, the evaluation team calculated the gross realization rate and applied this ratio ($\frac{I_{EPS}}{I_{EAS}}$) to adjust the ex ante energy and demand savings for the population of all 182 projects.

Figure 2. Equations for Calculating Precision for Lighting Verification Visits

$$Stratified\ Ratio\ Estimator = \frac{\sum_{i=1}^{n} w_i\, y_i}{\sum_{i=1}^{n} w_i\, x_i} \qquad \text{Equation 1}$$

$$Standard\ Error = \frac{1}{\hat{X}} \sqrt{\sum_{i=1}^{n} w_i\ (w_i - 1)\ e_i^2} \qquad \text{Equation 2}$$

$$90\%\ Confidence\ Interval = \ 1.645 * Standard\ Error \qquad \text{Equation 3}$$

$$Relative\ Precision = \frac{Confidence\ Interval}{Stratified\ Ratio\ Estimator} \qquad \text{Equation 4}$$

where:

w = case weights for each stratum h (N_h/n_h)
y = ex post savings
x = ex ante savings
$e = y_i - b\ x_i$
$\hat{X} = \ w_i\ x_i$

3.2 Analytical Methods

3.2.1 Impact Analysis

Gross Impacts

The gross impact analysis of the Custom Program involved engineering review, data logging, engineering modeling, database and document verification, and on-site verification to determine ex post gross impacts. Overall, the evaluation team reviewed a sample of 41 Custom Program projects. For these projects, the team performed a desk review to compare the inputs provided in the application to the assumptions used in the ex ante analysis, verify consistency in savings estimates throughout the project file, and provide insight into the validity of the ex ante energy savings.

Additionally, the team completed site visits at all 41 of the sampled sites to provide increased accuracy in the gross impact results. For 26 sites (63%), the team used metered data collected through the installation of data loggers or the onsite energy management systems (EMS), or the most recent billing or production data to inform ex post impacts beyond traditional engineering calculations.

Projects fell into one of several categories: lighting, compressed air, VFDs, boiler/furnace, EMS/controls, and miscellaneous. The following sections provide additional details about the evaluation team's methodology and assumptions by project category.

- **Lighting**: Lighting projects accounted for 11 of the 41 projects verified through site visits. The lighting projects reviewed by the evaluation team involved efficient lighting systems for industrial buildings, storage buildings, and grocery stores. For retrofit projects, the evaluation team compared the proposed system to the existing system to determine ex post savings. For new construction projects, the evaluation team compared the proposed system to a baseline lighting power density based on the space type.[9]

  If the details about the fixture and bulb type were unavailable, the team calculated the ex post savings using the wattages supplied by the customer, vendor, or typical fixture wattage values. The team considered the energy consumption of the ballast, as well as the bulb, to estimate savings.

  The evaluation team verified the quantity of lights by inspection during the site visit and obtained the hours of operation from the customer during the visit. The team did not meter lighting systems that operated under fixed schedules or that ran continuously all year. However, the team installed data loggers on 4 of the 11 projects to verify hours of operation.

- **Compressed Air**: Compressed air projects accounted for 5 of the 41 projects verified through site visits. The compressed air systems involved replacing older air compressors with more efficient systems, newer variable frequency drive (VFD) controlled compressors, or automation systems to operate systems more efficiently. The ex post savings compared the original system to the proposed system for all of the projects evaluated. The team obtained the details of the original and proposed systems from the documentation available, as well as information collected during the site visits. When possible (4 of 5 sites), we installed energy loggers on the air compressors to determine typical and peak loading profiles.

  The team used metered data from these installations to determine typical loading and peak load conditions and then compared this information to the baseline system as described by the customer and project documentation. This ensured consistent loading profiles were used in both the baseline and energy efficient scenarios.

- **Boiler/Furnace:** The boiler and furnace projects accounted for 10 of the 41 projects verified through site visits. Projects in this category involved the installation of efficient furnaces or boilers, a high-efficiency burner, or controls to improve the efficiency of the boiler. During the site visit, the evaluation team verified the installation of the efficient furnace, boiler, or burner. For controls projects, the set points and operation of the boilers were verified though inspection and customer interviews. Additionally, we used billing data to inform ex post savings calculations for six of the seven projects.

- **EMS/Controls:** EMS/controls projects accounted for 4 of the 41 projects verified through site visits. One of these projects involved the installation of controls to allow for free cooling when the outdoor air temperature was low enough. Another project involved the installation of a new EMS with added functionality at an office building. The final two projects involved installing some additional equipment and adding controls to improve the functionality of the entire HVAC system.

  The team verified these projects through customer interviews and site visits. The team used a combination of billing data, data loggers, and readouts from the EMS to inform ex post estimates for these four projects.

[9] Based on the applicable International Energy Conservation Code in place at the time of the project's initiation.

- **Variable Frequency Drives (VFD):** VFD projects accounted for 4 of the 41 projects verified through site visits. Two projects involved the installation of VFDs on chilled water or cooling tower pumps. A second project involved the installation of VFDs on pool filtration pumps. The final project was for installing VFDs and additional controls on an industrial dust collection system. The team verified these projects through site visits and detailed customer interviews. When possible (2 of 4), we installed data loggers to verify the loading profiles for these systems.

- **Miscellaneous:** The team classified the remaining seven projects as "miscellaneous." Many of these projects required project-specific calculations. Projects in the miscellaneous category consisted of the following:

  - Replacement of an electric resistance heating coil with two steam heating coils on two separate dehumidification and space conditioning units, as well as installation of space relative humidity controls.

  - New construction refrigerated warehouse and refrigeration system which included a variety of measures: thermosiphon cooling, refrigeration management system, LED lighting, high levels of insulation, floor heating through heat recovery, and vertical dock door levelers.

  - Repairing a large number of steam leaks through an industrial facility.

  - Replacement existing refrigeration system at a grocery store as well as upgrading the case lighting for the refrigerated cases.

  - Capping of a flue gas intake to reduce the amount of outdoor air required to be passed through a regenerative thermal oxidizer

  - Replacement of existing 50 HP crossflow cooling towers with 40 HP counterflow cooling towers.

  - Installation of two new 1,000-ton high efficiency water cooled chillers instead of standard efficiency water cooled chillers.

Net Impacts

After gross impacts were estimated, the evaluation team applied the PY5 NTGRs of 0.75 and 0.74 for electric and gas projects, respectively, except those performed by Staffing Grant and CLIP participants. The NTGR values are based on self-reported information from the PY5 participant telephone survey that quantified the percentage of gross impacts for rebated projects, as well as participant spillover.

In addition, the team utilized findings from interviews with Staffing Grant and CLIP participants to retrospectively adjust the NTGR for Custom Program projects implemented by these participants. The following section outlines the methodology used to develop customer-specific NTGRs.

The evaluation team also conducted research with Business Program non-participants to update the Business Program's portfolio-wide non-participant spillover rate for application in PY9. The PY7 Standard Program evaluation report provides more detail about the non-participant survey and non-participant spillover results.

CLIP NTGR

The evaluation team conducted research with CLIP participants to estimate a NTGR specific to the CLIP program. We applied this NTGR retrospectively to all PY7 CLIP projects. Consistent with NTGR research conducted for other Business Program evaluations, we based the NTGR on self-reported information from a

CATI survey that quantifies the percentage of the gross program impacts that can reliably be attributed to the program. We used the same battery of free-ridership and spillover questions and methodology as the Standard Program's NTG research. The detailed methodology and results for the CLIP NTGR are described in Appendix B.

Staffing Grant NTGR

The evaluation team took the following steps to estimate the NTGR per participant that was applied to all of the projects that participants completed as a result of grants.[10]

1. **Application Review**: The team reviewed project documentation, specifically the Staffing Grants application, to assess the stated need for staff resources in order to complete projects. This review served as background for interviews with participating customers.

2. **Interviews**: Analyst staff conducted participant interviews to estimate NTGR. The NTGR consists of two scores: Program Influence Component 1 and Program Influence Component 2. These components were determined as follows:

   - *Program Influence Component 1*: This free-ridership score is based a single survey question (N6) that asks respondents to rate the importance of the Staffing Grants on their ability to implement the energy saving projects completed at their facility. To convert this response into the Component 1 score (LI), the team used the following formula:

     $$LI = 1 - (N6 \times 0.1)$$

   - *Program Influence Component 2*: This free-ridership score is based on two questions: the likelihood that each project would have been completed without the Staffing Grants (N10), and if the project would have been completed at the same time or later (N11). The team asked these two questions for each of the projects that the participant implemented as a result of the grant.

     The participant responses to N10 were converted into a value between 0 and 1 based on the following formula:

     $$QI = N10 \times 0.1$$

     In addition, the team assigned free-ridership values between 0 and 1 for responses to N11 using the following formula:

     IF N11 = "Never," T1 = 0

     IF N11 = "Same time," T1 = 1

     IF N11 = "Within 1 year," T1 = 0.66

     IF N11 = "Within 2–3 years," T1 = 0.33

[10] Please note that not all of the projects completed by Staffing Grant recipients were submitted through the Custom Program. Similar adjustments were made within the Standard Program.

As outlined above, each sub-component score (Quantity and Timing) can take on a value of 0 to 10, where a lower score means a lower level of free-ridership. The overall Component 2 score for a participant is the average of the QI and TI scores.

$$Component\ 2 = Average\ (QI, TI)$$

- *Overall Free-Ridership—Combination of Components 1 and 2*: To calculate an overall program influence score, the evaluation team averaged Component 1 and Component 2. The resulting free-ridership factor for each participant thus ranges from 0 (no free-ridership) to 1 (100% free-ridership).

$$FR = Average\ (Component\ 1, Component\ 2)$$

- *NTGR Score*: To develop the NTGR score, the team subtracted the free-ridership score from 1 as shown below:

$$NTGR = 1 - FR$$

- *Spillover*: The team also asked questions to gather information about potential spillover, which would be integrated with the NTGR score as NTGR = (1 − FR + SO). To determine the participant-level spillover factor, the team divided the estimated net savings of the measures installed outside of the program (but influenced by the program) by the gross savings the respondent realized through the program.

Figure 3. Spillover Algorithm

$$\text{Spillover} = \frac{Respondent\ Net\ Energy\ Savings\ from\ Measures\ Installed\ outside\ the\ Program}{Respondent\ Gross\ Energy\ Savings\ from\ Measures\ Installed\ through\ the\ Program}$$

3. **Consistency Check:** The evaluation team included questions in the survey to identify instances in which the interview findings contradicted the data available in the application and developed protocols to reconcile inconsistent findings, if identified. However, the team found that there were no cases in which interview results contradicted the data in the application.

4. **Final NTGR Determination**: As a final step in this process, the evaluation team compared the NTGR developed through the interview process above with the existing PY5 NTGRs for the various C&I programs.[11] The PY5 NTGR values were used as a floor and, if the NTGR developed through the Staffing Grants interview exceeded the PY5 value, the team applied the new NTGR to all of the projects completed by that participant in PY7.[12] However, if the newly developed NTGR fell below the established PY5 value, the team applied the appropriate PY5 value to each of the participant's projects. This type of adjustment was made for four projects associated with three participating customers.

[11] Per the Illinois NTGR Framework, the team generally applied PY3 NTGRs to determine PY6 net impacts.

[12] The team chose to establish a floor for two reasons: 1) Staffing Grant participants cannot be asked to speculate about the influence of the program and its incentive *if* they had a staff person to implement projects, and 2) it is reasonable to assume that the Staffing Grant participants are comparable to other AIC customers who went through the business programs via traditional channels, and therefore were selected for measure-specific NTGR survey batteries.

3.3 Sources and Mitigation of Error

Table 7 provides a summary of possible sources of error associated with data collection conducted for the Custom Program. We discuss each item in detail below.

Table 7. Possible Sources of Error

Research Task	Survey Error		Non-Survey Error
	Sampling Error	Non-Sampling Error	
Staffing Grant and CLIP Interviews	• N/A, census attempt	• Measurement error • Non-response and self-selection bias • Data processing error	• N/A
Site Visits	• Yes	• Measurement error	• Analysis error
Gross Impact Calculations	• N/A	• N/A	• Analysis error
Net Impact Calculations	• N/A	• N/A	• Analysis Error

The evaluation team took a number of steps to mitigate against potential sources of error throughout the planning and implementation of the PY7 evaluation

Survey Error

- **Sampling Error**
  - **Site Visits.** The evaluation team completed site visits for 41 of 171 Custom projects, drawing two waves of stratified samples separately for projects claiming electric and gas savings. For gross impact results, at the 90% confidence level, we achieved a relative precision of 6.7% for kW savings, 12.8% for kWh savings, and 23.9% for therm savings. High relative precision is largely attributable to realization rates showing substantially more variation than anticipated during the sampling process.
- **Non-Sampling Error**
  - **Measurement Error.** The validity and reliability of survey data were addressed through multiple strategies. First, we relied on the evaluation team's experience to create questions that align with of the idea or construct that they were intended to measure (i.e., face value validity). We reviewed the questions to ensure that we did not ask double-barreled questions (i.e., questions that ask about two subjects, but allow only one response) or loaded questions (i.e., questions that are slanted one way or the other). We also checked the overall logical flow of the questions to avoid confusing respondents, which would decrease reliability.

    All survey instruments were reviewed by key members of the evaluation team and by AIC and ICC Staff. To determine whether question wording was clear and unambiguous, we pre-tested each survey instrument, monitored the telephone interviews, and reviewed the pre-test survey data. We also used the pre-tests to assess whether the length of the survey was reasonable and shortened the survey as needed.

    To minimize data collection error during site visits, the evaluation team used trained engineers and technicians familiar with the equipment covered by the Custom Program and the methods used to calculate the gross impacts.

- **Non-Response and Self-Selection Bias.** Although the response rate for the interviews with CLIP and Staffing Grant participants was very high, there is still some potential for non-response bias. We attempted to mitigate possible bias by contacting each prospective respondent in the sample at least eight times via phone and email over several months. To assess whether evidence of non-response bias exists, we compared respondents to the population based on project types and savings. We found no evidence to suggest that non-respondents differed significantly from respondents.

- **Data Processing Error.** The team addressed processing error by training interviewers and checking the quality and consistency of completed survey data. Before they began interviewing, Opinion Dynamics interviewers underwent rigorous training that included a general overview of the research goals and the intent of the survey instrument. Through survey monitoring, members of the evaluation team also provided guidance on proper coding of survey responses. We also carried out continuous, random monitoring of all telephone interviews.

Non-Survey Error

- **Analysis Error**

  - **Gross Impact Calculations.** We determined gross impacts using data collected during site visits, engineering algorithms, and modeling. To minimize data analysis errors, the evaluation team had all calculations reviewed by a separate team member to verify that calculations were performed accurately.

  - **Net Impact Calculations.** For Staffing Grant and CLIP participants, the evaluation team had all calculations reviewed by a separate team member to verify that all NTGR calculations were performed accurately.

4. Detailed Findings

4.1 Process Findings

The evaluation team performed a targeted process evaluation of two Custom Program special offerings in PY7: the Competitive Large Incentive Project (CLIP) and the Staffing Grants initiative. Questions focused on project scope, participant expectations, program awareness and satisfaction, internal decision-making processes, and barriers to participation. We also reviewed program materials and records and completed several interviews with program staff. The results of these research efforts are presented below.

4.1.1 Program Description and Participation

The C&I Custom Program offers incentives to AIC business customers for energy efficiency projects involving equipment not covered through the C&I Standard Program. The availability of this program allows customers to propose additional measures and tailor projects to the specific needs of their facilities. It also provides an avenue for piloting new measures prior to incorporating them into the Standard Program. Custom incentives are available for a variety of electric measures including lighting, compressed air, and energy management systems and for gas measures such as heat recovery and steam system improvements.

The Custom Program also provides several special program offerings: the CLIP initiative, Staffing Grants, Feasibility Studies, and the Metering and Monitoring Pilot.[13] As in prior years, the PY7 Custom Program serves as the channel for the submission of New Construction Lighting projects.

Program Participation

Overall, the Custom Program approved 171 unique projects for completion in PY7. This represents an increase from 160 projects completed in PY6. Of these projects, 78 are special program offerings, including 45 New Construction Lighting projects and 16 CLIP projects. Table 8 lists these offerings along with their PY7 participation, the number of unique participants associated with each offering, and claimed savings.

Table 8. Custom Program Offering Participation in PY7

Initiative	Total Incentives/Grants	Unique Customers	Gross Ex Ante Savings		
			MW	MWh	Therms
Custom Incentive	93	78	4.4	35,682	1,440,965
New Construction Lighting	45	36	0.9	9,638	--
CLIP	16	9	8.0	77,104	496,118
Staffing Grants	7	7	--	--	--
Metering and Monitoring Pilot	6	4	--	--	--
Feasibility Studies	4	4	--	--	--
Total	**171**	**138**	**13.4**	**122,424**	**1,937,082**

[13] The program does not claim direct savings from feasibility studies and metering and monitoring pilot. Savings from measures identified and installed due to these offerings are claimed

4.1.2 Program Design and Implementation

The structure of the AIC C&I Program in PY7 remained generally consistent with the previous program year. The program implementer, Leidos, implemented some internal changes to refine the roles and responsibilities of their staff. A new project management organization reduced the administrative responsibilities of field staff, allowing them to focus more on customer outreach and communication. Some additional efficiencies were created across the portfolio: for example, marketing staff reported that some staff divided their time between the commercial and residential portfolios. Despite this organizational shift, program offerings and delivery remained largely the same as they were in PY6. As a whole, the C&I Program continued to operate smoothly and was able to effectively attract program participants and meet savings goals.

Implementation Changes

Of the few changes made to the Custom Program in PY7, most centered on special offerings and pilot programs.

- Program administrators made several adjustments to the structure of Custom incentives, including a reduction of the gas incentive from $1.20 to $1.00 per therm, a reduction of electric non-lighting incentives from 8 cents to 7 cents per kWh. Both changes helped the program stay within its incentive budgets for PY7.
- All Custom projects in PY7 benefited from increased flexibility in timelines. Program staff cited the program's recently incorporated three-year cycle as the primary source of the improvement. By allowing participants to complete projects approved in PY7 after the end of the program year, customers received the time they needed and implementers gained the option of funding projects that may not have fit into the PY7 budget.
- AIC also reduced the maximum project size (in terms of kWh or therms) for Custom incentive projects in an effort to increase submissions for CLIP projects and consequently boost competitiveness among CLIP applications. This change coincided with AIC reducing the CLIP offering's minimum electric project size from 500,000 to 300,000 kWh.
- In response to participant feedback, AIC moved the CLIP application process forward by about five weeks, leaving more time between project approval and the end of the program year, effectively improving participants' ability to complete their projects by the end of the year.
- The CLIP program changed its bonus offerings in PY7, implementing a tiered bonus structure to incentivize early project completion. Participants received bonuses of 20% for finishing in 2014 or 15% for finishing by the end of April 2015. This provision paired well with the more flexible timelines, allowing participants to take the necessary time to complete their projects but encouraging them to finish quickly allowing the program to claim additional savings in PY7.
- AIC introduced the Large C&I Pilot in PY7, but the initiative failed to attract its target customers. Target customers included large companies that may have received CLIP incentives in previous years. To these large commercial customers, the new offering may have seemed redundant with the CLIP program still in place and functioning well.
- To ensure that Staffing Grants generated quantifiable savings, the application incorporated a written commitment from recipients to submit subsequent project proposals within a specified time-period.

Marketing and Outreach

Overview of Marketing Strategy

Overall, the program's marketing strategy maintained similar objectives to past years. At the start of PY7, program staff began by reviewing a number of applications deferred from PY6, which allowed them to approach marketing and outreach from a less reactive standpoint than in years past. This shift in approach enabled them to focus more on proactive promotion of program awareness among targeted community and business organizations not contacted in prior years. Having a head start on reaching program year savings goals also allowed program staff to place more emphasis on strategic recruitment and to better manage budget constraints.

In PY7, several new marketing initiatives helped to boost program effectiveness: increased engagement with existing program allies, hosting large customer lunch-and-learn events, and expanding digital advertising.

Coupled with a decreased level of urgency to recruit new projects in PY7, the program's recent change to allow multi-year CLIP and Staffing Grant projects permitted the marketing staff to continue building the program's pipeline of potential CLIP and Staffing Grant projects, solidifying the program's progress toward future savings goals. For CLIP specifically, the program expanded marketing outreach in PY7 to additional previously uncontacted customers, which the marketing staff expects will yield additional projects in future program years.

For Staffing Grant projects, the marketing team believes that the combination of adding multi-year projects and adjusted marketing efforts have increased customer awareness and comfort with the program, and will result in a more competitive process for future program years.

The program emphasized engagement with current allies over recruiting new program allies and shifted focus toward larger program allies. Moving forward, this will include periodic program follow-up with allies and enhanced co-branding efforts. To support these efforts, the program launched a new trade ally portal on the AIC website. The password-protected portal serves as a central communication hub allowing program staff to circulate program news updates to program allies, and provide training documents, informational videos, and co-branding materials.

The large customer lunch-and-learn events in PY7 targeted locations with high concentrations of large AIC commercial customers. Organizers motivated large customer attendance by asking program Energy Advisors and Ameren Key Account Executives to conduct targeted customer outreach prior to the events. Each lunch-and-learn involved a presentation on the Business Program and attempted to help match customers with Energy Advisors to motivate program participation. These events were well attended and are expected to continue moving forward.

Digital advertising efforts expanded to include Facebook advertising, and optimized their website for mobile devices. Facebook advertising tied into overarching corporate marketing campaigns and employed videos with testimonials from previous program participants.

4.1.3 Participant Experience and Satisfaction

In-depth interviews with CLIP Incentive and Staffing Grant recipients allowed us to explore participant experience and satisfaction for these initiatives in PY7.

CLIP

Participant Characteristics

The majority of CLIP participants interviewed represented companies with large industrial facilities, including four involved in food processing and storage and a plastics manufacturer. The remaining three interviewees consisted of a hospital, a college, and a systems logistics company. One of the food processing businesses implemented seven of the sixteen completed CLIP projects in PY7. Of the six companies that completed the full survey, facility ages ranged from less than one to over 100 years old, and only one participant considered themselves small relative to other companies in their industry. This same participant was also the only one of this group to report having fewer than 300 employees at the facility where the project was completed.

Satisfaction

Respondents indicated high satisfaction with the CLIP offering and reported a mean overall satisfaction score of 8.4 on a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied," with ratings ranging from 7 to 10. On the same scale, respondents provided an average score of 9 or more for the application process, the incentive amount, and the contractor used. The time to receive the incentive and the program's technical review staff received ratings of 8.3 and 7.1, respectively. While these scores are still relatively high, two participants mentioned a delay in receiving their incentive and another two referenced frustrating experiences with technical review staff.

Benefits and Barriers

Many CLIP participants indicated that they would have had difficulty justifying or completing the project without the availability of the large incentive they received. These respondents were quick to point to the size of the incentive provided as the primary benefit of the program offering.

Respondents also expressed appreciation for the program's flexible timeline, and two respondents who had participated in the past identified it as the primary improvement from previous program years. This increased flexibility resulted from two changes made in PY7: the entire application process shifted forward so that approval could be received earlier in the program year and the new tiered bonus structure allowed the option to push completion into the following program year. All of the participants interviewed completed projects in PY7 and some had other CLIP projects that benefited from the timeline being extended into PY8.

Two respondents suggested that use of their own facility staff for on-site pre-approval review and equipment installation would have been faster and more efficient than using program allies. Still, these respondents expressed understanding for this requirement and a high level of appreciation for the way program staff manage the program's implementation.

CLIP participants in PY7 tended to be large companies with ample technical resources available, and therefore had no trouble managing project implementation or completing the application. They described the application process as clear and straightforward, reporting that they needed minimal assistance from program staff. Although interviewees represented companies well-equipped to handle technical aspects of the application and implementation process, two of them mentioned that the calculations required by the application could present a barrier for companies with lesser technical resources. These participants also suggested that the auditing process and identification of custom equipment needed for CLIP projects required a level of expertise that other, less technically capable companies might not possess.

Participant Decision Making

Because CLIP participants tend to be such large companies, their decision-making processes generally feature multiple considerations and levels of approval. Most participating contacts we interviewed work in some capacity of facilities management and are responsible for compiling information about projects to present to an executive or board for final approval. Participating contacts indicated varying degrees of involvement over the course of the application and implementation process, but most were intimately involved with each stage of their project.

For the majority of participants we interviewed, simple payback/return on investment (ROI) was the key criterion used to justify large-scale infrastructural investments. For most of these companies, the size of the incentive they received was therefore important in moving forward with the capital investment.

Some interviewees also identified the early completion bonus specifically as an important factor in their company's decision to complete the project. Among the five CLIP participants who received early completion bonuses (all of whom were interviewed), three indicated that the bonus played a part in project planning, and two predicted that projects receiving bonuses would likely have taken longer to complete in absence of the bonus.

In addition to ROI, several respondents pointed out that their company places high value on maximizing efficiency and reducing wastefulness. Four of the eight interviewees pointed to a corporate environmental or energy policy that contributed to their company's decision to pursue the incentivized project. In three of the four cases, policies consisted of relatively loose guidelines but represented the company's considerations of environmental or energy factors in project planning. Whether quantitative or qualitative, the stated energy efficiency goals often served to represent both financial and environmental considerations.

Opportunities for Improvement

Overall, PY7 participants expressed high satisfaction with the CLIP offering, and no single program component emerged as an overwhelming weakness. However, our interviews with participants revealed several areas for improvement.

The two participants who did not receive payment in a timely manner both suggested that clearer information about the payment schedule would have been helpful. In one of the two cases, the respondent took issue with the fact that the incentive ended up going to their contractor instead of directly to them.

One interviewee asked that the program expand to include a wider variety of LED lighting options. With LED prices continuing to drop, they suggested that the program shift its focus to incorporate the significant savings potential of the more energy efficient lighting available.

Another participant described an experience where their project's pre-approved incentive amount was lowered because the program staff used a conservative savings estimate. While the respondent understood the reasoning behind the low estimate, they suggested that future participants should have the opportunity to reclaim the proposed incentive amount if program staff's preliminary savings estimates are eventually shown by the ex post evaluation to be overly conservative.

Staffing Grants

The evaluation team completed interviews with six Staffing Grant recipients of the seven who completed Staffing Grant projects. Two of the six participants completed two projects; the other four completed only one

project. The project types completed with the assistance of the Staffing Grants included steam trap repair and replacement, custom projects, and standard lighting for business projects.

None of the interviewed participants reported hiring additional employees as a result of the Staffing Grant funds. Instead, participants stated that the funds allowed them to focus existing internal resources on energy efficiency projects to a greater degree than they otherwise could have. Participants consistently mentioned that the Staffing Grant improved the financial outlook for the projects they wanted to implement and made it easier to justify the use of limited capital resources on the selected projects as compared to other projects they considered.

Several participants reported that the timing of the Staffing Grant made it difficult for them to take advantage of the opportunity. Some interviewed participants reported do not have enough lead time to identify projects and make decisions about applying for the Staffing Grant before the applications are due to AIC. These participants suggested that having longer lead times, or other ways to better anticipate and align project and funding cycles, would help them participate to a greater degree.

Participants recommended several areas in which AIC could improve the Staffing Grant offering. Some participants suggested that AIC could provide additional value by helping to identify projects that might be viable candidates for Staffing Grants. One participant also suggested that AIC could assist potential Staffing Grant participants with technical reviews of projects to help them move beyond relatively simple lighting projects towards more advanced measures and deeper energy savings.

Overall, participants report high satisfaction with all phases of the Staffing Grant process. Using a scale of 0 to 10 where 0 is "very dissatisfied" and 10 is "very satisfied," participants provided mean satisfaction ratings for the application process, the final review process, and the grant award process as 8.3, 8.5, and 8.7, respectively.

Participants reported that they first learned about the Staffing Grant offering through a number of channels, including AIC directly, through either business symposiums or direct contact with AIC staff at their facility, over the phone, or by email. Some participants also reported first learning about the Staffing Grant through word of mouth or internal staff who had experience with Staffing Grants at previous jobs.

4.2 Impact Assessment

4.2.1 Verification and Gross Impacts

For the Custom Program, we verified program participation and gross impacts through site visits with a sample of participating customers. The site-specific M&V led to the development of a gross realization rate that was applied to the population of all projects in the program.

Site-Specific Results

Table 9 presents the results of the gross savings analysis for the 41 Custom Program sites in our sample.[14] Realization rates for individual projects ranged from 22% to 342% for electric and 3% to 746% for gas. Across

[14] Detailed site visit reports from 10 of the largest Custom Program projects are included in Appendix C.

both fuel types, the realization rate of only 41% of sampled projects fell within ±20% of the project's ex ante estimate.[15]

[15] Although site visit data includes both electric and gas savings where available, only the savings and realization rates associated with the fuel type for which the project was sampled are used for reporting and analysis.

Table 9. PY7 Gross Impact Realization Rate Results for the Custom Program Sample

Project ID	Sample			Ex Ante Savings			Ex Post Savings			Realization Rate		
	Fuel Type	Wave	Stratum	kW	kWh	Therm	kW	kWh	Therm	kW	kWh	Therm
600336	Electric	1	1	5	51,633	0	8	35,771	0	152%	69%	N/A
700213	Electric	1	1	5	36,299	0	5	50,332	0	108%	139%	N/A
700647	Electric	1	1	19	108,439	0	14	120,334	0	74%	111%	N/A
700116	Electric	1	2	46	252,285	0	32	158,163	0	70%	63%	N/A
700120	Electric	1	2	23	199,533	-1,163	0	374,225	-9,337	0%	188%	803%
700386	Electric	1	2	0	193,623	0	0	99,999	0	N/A	52%	N/A
700633	Electric	1	2	59	513,962	29,186	37	224,425	15,794	63%	44%	54%
700959	Electric	1	2	61	266,234	0	0	257,554	0	0%	97%	N/A
601349	Electric	1	3	498	1,424,985	0	199	1,057,327	0	40%	74%	N/A
700002	Electric	1	3	230	2,817,647	0	277	2,274,400	0	120%	81%	N/A
700020	Electric	1	3	443	4,099,074	0	481	4,366,938	0	109%	107%	N/A
700069	Electric	1	3	151	2,321,851	0	354	2,213,219	0	235%	95%	N/A
700132	Electric	1	3	135	1,186,396	0	29	728,143	0	21%	61%	N/A
700155	Electric	1	3	135	1,177,502	0	134	1,177,502	0	100%	100%	N/A
700379	Electric	1	3	168	1,472,364	0	277	2,425,232	0	165%	165%	N/A
601262	Gas	1	1	0	0	19,762	0	0	22,181	N/A	N/A	112%
700159	Gas	1	1	30	259,347	21,942	6	54,822	22,255	21%	21%	101%
600059	Gas	1	2	0	0	113,482	0	0	846,227	N/A	N/A	746%
700026	Gas	1	2	0	0	90,510	0	0	2,851	N/A	N/A	3%
700447	Gas	1	2	3	27,287	62,748	3	28,569	71,051	85%	105%	113%
700448	Gas	1	2	0	0	49,183	0	0	11,853	N/A	N/A	24%
700036	Electric	2	1	12	104,566	0	12	58,967	0	100%	56%	N/A
701319	Electric	2	1	26	129,713	0	12	80,126	0	48%	62%	N/A
800034	Electric	2	1	6	48,715	0	16	55,247	0	280%	113%	N/A
601285	Electric	2	2	247	1,244,295	0	90	4,252,927	0	36%	342%	N/A

Project ID	Sample			Ex Ante Savings			Ex Post Savings			Realization Rate		
	Fuel Type	Wave	Stratum	kW	kWh	Therm	kW	kWh	Therm	kW	kWh	Therm
700047	Electric	2	2	-44	2,036,742	0	-44	768,930	0	100%	38%	N/A
700190	Electric	2	2	39	619,782	0	62	673,240	0	161%	109%	N/A
700394	Electric	2	2	219	1,840,467	0	212	1,782,123	419,902	97%	97%	N/A
700941	Electric	2	2	97	851,391	0	37	183,824	0	38%	22%	N/A
600387	Electric	2	3	1,102	9,203,904	0	1,384	11,880,816	0	126%	129%	N/A
700004	Electric	2	3	1,507	13,205,002	0	999	8,313,095	0	66%	63%	N/A
700016	Electric	2	3	721	5,511,828	0	210	2,517,216	0	29%	46%	N/A
700028	Electric	2	3	1,076	9,424,816	0	1,017	9,567,157	0	95%	102%	N/A
700058	Gas	2	1	-3	-13,357	38,672	-3	-12,770	38,945	99%	96%	101%
700145	Gas	2	1	1	12,179	8,628	1	0	8,628	100%	0%	100%
700242	Gas	2	1	51	442,792	627	42	303,242	591	84%	68%	94%
700641	Gas	2	1	0	0	22,125	0	0	11,297	N/A	N/A	51%
600063	Gas	2	2	0	0	292,126	0	0	294,262	N/A	N/A	101%
700393	Gas	2	2	0	0	71,742	0	0	32,418	N/A	N/A	45%
700396	Gas	2	2	0	0	256,030	0	0	532,073	N/A	N/A	208%
700464	Gas	2	2	0	0	49,629	0	0	11,971	N/A	N/A	24%
Total				7,065	61,071,296	1,125,228	5,903	56,071,097	2,332,963	N/A	N/A	N/A

Table 10 presents the electric savings results of the gross savings analysis for the 41 Custom Program sites in our sample by technology category.

The relatively low electricity realization rate in the EMS/Controls category is a result of two main factors. For one project, the ex ante savings assumed that the baseline units would be ventilating (i.e., bringing in nearly 100% outdoor air) nearly all year. While it was true that this facility was operating their rooftop units in occupied mode all year, assuming they were ventilating continuously likely led to over estimation of the baseline energy usage. The second is due to an overestimation of the chiller run time hours and loading for a different project. Based on the information collected during the site visit, the free cooling could only be run when the outdoor air temperature was less than 30F, and the chillers were only loaded at approximately 45% during the metered period. This resulted in lower overall hours at lower loading, reducing the potential savings.

The low kWh realization rate for the boiler/furnace category was driven exclusively by one significant project. This project consisted of installing a 25 metric ton holding furnace that is capable of being shut down at the end of each day to replace two existing 40 ton holding furnaces that cannot be shut down at the end of the day. However, during the site visit it was determined that the furnace is not being shut down as anticipated due to a dispute between the furnace operators and facility engineers. Therefore, the furnace runs continuously in the post case, which reduced the savings.

Table 10. Custom Program Site Visit Results: Electric and Demand Impacts

Technology	Qty	kW Savings			kWh Savings		
		Ex Ante	Ex Post	Realization Rate	Ex Ante	Ex Post	Realization Rate
Lighting	11	1,151	1,377	120%	11,876,586	11,346,213	96%
Compressed Air	5	3,198	2,267	71%	25,014,633	19,241,737	77%
VFDs	3	1,406	1,689	120%	11,862,664	15,034,191	127%
EMS/Controls	2	59	37	63%	707,585	324,424	46%
Boiler/Furnace	1	(44)	(44)	100%	2,036,742	768,930	38%
Miscellaneous	5	1,215	527	43%	8,844,839	8,981,738	102%

Table 11 presents the natural gas savings results of the gross savings analysis for the 15 Custom Program gas projects in our sample by technology category. Note that some of the projects listed in Table 10 also appear in Table 11 because they achieved both electricity and gas savings. Overall, there was more variation in the realization rates for technologies with gas savings compared with the electric savings presented in Table 10. Among gas measure categories, variation was similar with the exception of the miscellaneous category.

Table 11. Custom Program Site Visit Results: Gas Impacts

Technology	Quantity	Therm Savings		
		Ex Ante	Ex Post	Realization Rate
Boiler/Furnace	9	902,897	1,016,932	113%
EMS/Controls	2	58,257	20,599	35%
VFDs	1	21,942	22,255	101%
Miscellaneous	2	114,109	846,817	742%

The low therm savings realization rate in the EMS/Controls category is a result of one of the same projects discussed in the electrical savings section previously. For this project, the ex ante analysis assumed that the HVAC system was ventilating most of the year. This would have also overestimated the gas savings during the

heating season as it did with the electrical savings during the cooling season. The second project involved replacing an existing hot-deck-cold-deck system with a variable air volume system. Based on the site inspection, the system still utilizes a hot deck and only utilizes the variable frequency drives to modulate air flow based on the damper position. This limited the gas savings to only the difference in supply temperatures realized during the heating season.

The very high realization rate for the miscellaneous category is due to a single large project for repairing steam leaks. The customer had completed a steam audit that was included in the project documentation. The ex ante savings used the number of leaks from the report, but changed the leak rate for all of the leaks to 5 lb/hr of steam, even though some were indicated as being much larger. The exact reason for this adjustment in the ex ante calculations was not noted. However, the savings were confirmed using a billing analysis and normalizing the gas usage to both production and heating degree days. This showed overall savings very near the savings estimated in the audit report.

Overall Program Results

Table 12 below presents the overall Custom Program realization rates, based on the site visit results detailed above. These results reflect the pooled results from a two-wave sample design and are not the simple average of the two waves. The relative precision of the realization rate is 13% for kWh and 7% for kW. For gas projects, the relative precision of the realization rate is 24% therms.

Table 12. Custom Program Gross Impacts

Program	Projects	Ex Ante Gross			Ex Post Gross			Realization Rate		
		MW	MWh	Therm	MW	MWh	Therm	MW	MWh	Therm
Custom	171	13.4	122,424	1,937,082	10.7	114,021	2,930,082	80%	93%	151%

4.2.2 Net Impacts

As described in the methodology section, the team applied the PY5 NTGR values (0.75 for electric and 0.74 for gas) to Custom Program gross impacts to determine PY7 net impacts for all Custom Program projects except those completed through the CLIP and Staffing Grant initiatives. Including the retrospective NTGR of these projects resulted in a slight increase in the overall NTGR compared to the deemed PY5 values.

- For the three Staffing Grant participants we interviewed, we assigned the NTGR developed through the interview process to all Custom Program projects completed by those participants if the NTGR based on interview findings was higher than the corresponding PY5 NTGR. In total, this affected three of the four Custom program projects associated with Staffing Grants. Based on the interviews, we adjusted the NTGR of the applicable Custom Program electric projects from 0.75 to 0.88, 0.81, and 0.88. For the fourth Custom project associated with a staffing grant, we used the PY5 value of 0.75.

- Based on interviews with participants representing nine CLIP projects, we developed NTGR values of 0.770 for electric savings and 0.760 for gas savings and applied these retrospectively to all PY7 CLIP projects. We developed an MBTU-weighted free-ridership rate of 0.24 applicable to both electric and gas savings. We then applied a CLIP-specific PY7 participant spillover rate of 0% and a non-participant spillover rate of 1% for electric and 0% for gas savings based on the PY5 non-participant spillover analysis.

Table 13 presents the PY7 net impacts for the Custom Program based on the Staffing Grants results and the application of PY5 NTGRs.

Table 13. Custom Program Net Impacts

Savings Category	Ex Post Gross	NTGR	Ex Post Net
Energy Savings (MWh)	114,021	0.763	87,017
Demand Savings (MW)	10.7	0.763	8.2
Gas Savings (Therms)	2,930,082	0.746	2,185,563

5. Conclusions and Recommendations

Overall, AIC has achieved great success with the implementation of the Custom Program in PY7 and the program met both its electric and gas savings goals. All aspects of the program continue to fulfill their objectives while running smoothly and efficiently. All program stakeholders with whom we spoke (program staff, Staffing Grant recipients, and CLIP participants) reported that they were generally satisfied with the program, and identified no major barriers to participation or process issues. Nevertheless, we identified some areas in which the program could improve, several of which aim at reducing realization rate variance (i.e., differences between ex ante and ex post savings).

Based on our research, we provide the following recommendations for the program:

- AIC may consider providing support for potential Staffing Grant recipients to help them identify projects that might be viable candidates for future Staffing Grants as well as to provide technical review of projects to help participants move beyond relatively simple lighting projects to more advanced measures and deeper energy savings.
- For CLIP projects, where the savings are large but potentially variable, the program may consider establishing a protocol for projects to reclaim the initially proposed incentive amount if the program staff's preliminary savings estimates are eventually shown by the ex post evaluation to be overly conservative. One option for this may be for the program to award the rebates in two phases such that the participants receive a portion of the rebate upfront and the remaining share prorated as necessary depending on the evaluated savings.
- We found high levels of variation in the realization rates for the Custom Program projects we sampled and for the program overall. Only 41% of the projects we sampled had realization rates that fell within ±20% of the project's ex ante estimate with individual realization rates ranging from 3% to 746%. Such large differences between ex ante and ex post savings estimates may make it hard for the program to plan with a high degree of certainty. AIC may consider implementing the following suggestions to improve realization rates in future years.
  - We recommend that vendor calculations go through a rigorous technical review, including a review of model files where applicable. Savings estimates for several projects were completed by vendors in PY7, and errors or misclassifications occasionally resulted in realization rates outside of acceptable bounds. Scrutinizing these calculations thoroughly on the front end will help minimize the degree to which this occurs.
  - Post inspections could help improve some operational adjustments and likely would have captured several of the issues identified during evaluator site visits. Improperly installed equipment or incorrect operational specifications (e.g., occupancy sensors not working properly or incorrectly specified hours of use) could have been caught with a post inspection.

- The program may consider giving special attention to projects predicting exceptionally large savings relative to the customer's bill. If savings are estimated to be more than 10% of the customer's bill, we recommend reviewing the project with increased scrutiny. While real cases do exist of savings above this threshold, they are very rare and should be thoroughly vetted. If the program is unsure the savings will be achieved, waiting for some billed data to become available may also help confirm the level of savings. This would require delaying finalizing the incentive amount (and associated payment) and may have other implications that need to be considered as well, but for significant projects it would likely help improve the realization rate.

- AIC may consider reviewing Custom project EM&V results and follow up with projects that may benefit from retrocommissioning, especially those that received lower than expected realization rates and experienced control issues.

Appendix A. Data Collection Instruments

The following files contain the CLIP interview guide and Staffing Grant interview guide.

CLIP Interview Guide PY7 FINAL.pdf

Staffing Grant Interview Guide PY7

Appendix B. CLIP NTGR Results

In PY7, the evaluation team conducted research with CLIP (Competitive Large Incentive Program) participants to estimate a NTGR specific to the CLIP program. Unlike the majority of NTGR research conducted as part of the AIC portfolio evaluation, we applied this NTGR retrospectively to all PY7 CLIP projects. Consistent with NTGR research conducted for other Business Program evaluations, we developed the NTGR based on self-reported information from a CATI survey that quantifies the percentage of the gross program impacts that can reliably be attributed to the program.

Key Findings

Table A-1 presents the results of our PY7 NTG analysis for retrospective application. Due to a small number of CLIP projects included in our analysis, we developed a free-ridership rate applicable to both electric and gas. Our CLIP-specific PY7 spillover analysis found a participant spillover rate of 0%. Our PY5 non-participant spillover analysis found a NPSO (non-participant spillover) electric savings rate of 1% and a NPSO gas savings rate of 0%.

Table A-1. CLIP NTGR for PY7 Application

Program	Free-Ridership	Spillover	NTGR (1-FR+SO)
CLIP - Electric	0.240	0.010	0.770
CLIP – Gas	0.240	0.000	0.760

NTGR Background

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 program-induced savings, indicated as a NTGR, is made up of free-ridership (FR) and spillover (SO) and is calculated as (1 – FR + SO). Free-ridership is the portion of the program-achieved verified gross savings that would have been realized absent the program and its interventions. Spillover is generally classified into participant (PSO) and non-participant spillover (NPSO). Participant spillover occurs when participants take additional energy-saving actions that are influenced by the program interventions but did not receive program support. Non-participant spillover is the reduction in energy consumption and/or demand by customers who did not participate in the program, but were influenced by it.

The formula to calculate the NTGR is:

$$NTGR = 1 - FR + PSO + NPSO$$

Free-Ridership

Introduction

The evaluation team implemented four newly developed free-ridership algorithms[16],in the course of the evaluation of the Standard Program, evaluated the results, and chose a specification for use in PY7. More detailed methodology and results from these algorithms are available in Appendix C of the Standard Program evaluation report. For consistency, we estimated a NTGR for the CLIP program using the same algorithm specification as we chose for the Standard Program (Approach 1a). This evaluation also conforms with the current requirements specified in the version of the Illinois TRM currently in effect.

Methodology

Free-riders are program participants who would have implemented the incented energy-efficient measure(s) even without the program. Free-ridership estimates are based on a series of questions that explore the influence of the program in making the energy-efficient installations as well as likely actions had the program not been available.

For all CLIP projects we surveyed, we implemented Approach 1a of the free-ridership algorithm.[17] The algorithm consists of three scores: 1) influence of program components score, 2) overall program influence score, and 3) no-program score (counterfactual), as well as a timing adjustment. Each sub-score serves as a separate estimator of free-ridership and can take on a value of 0 to 1, where a higher score means a lower level of free-ridership. The overall free-ridership score for a project is the average of the three scores, with a timing adjustment applied to the no-program score. The free-ridership score for each project thus ranges from 0 (no free ridership) to 1 (100% free ridership).

The three scores included in the algorithm and the timing adjustment are described below.

1. **Influence of Program Components (PC)**. This score is based on a series of four questions that ask respondents to rate the importance of 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"). Program components considered (if applicable) include the incentive amount, recommendation from program staff, information from program marketing materials, and recommendation from a utility account manager. The free-ridership score is calculated as:

   $$\text{Program Components FR Score}_{\text{Original}} = 1 - (\text{Maximum Program Factor Rating} / 10)$$

   Greater importance of the program components means lower level of free-ridership. If a respondent rated the program rebate 10 out of 10, the recommendation of program staff 8 out of 10, and the information from program materials 8 out of 10, the final Program Components free-ridership score would be a 0.

[16] While the draft attachment contains six specifications of the free-ridership algorithm, at the time of the fielding of our participant survey, only four specifications had been fully developed, and a question required to implement the other two specifications was not included in our participant survey.

[17] In this appendix, we present results from four newly developed algorithms as well as the algorithm used in the previous evaluations of this program, select one algorithm as our choice to calculate program free-ridership, and justify our choice of algorithm.

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 implement the energy-efficient equipment. 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 free-ridership. For example, if a respondent gave the program 70 points out of 100, the Program Influence free-ridership score would be 0.30.

3. **No-Program Score (NP).** This score is based on the likelihood that the exact same energy efficient equipment would have been installed without the program, using scale of 0 to 10 (where 0 is "Not at all likely" and 10 is "Very likely"), plus a timing adjustment (discussed next). The score is calculated as follows:

   $\text{No-Program Score}_{\text{Adjusted}}$ = (Likelihood to Install Same Equipment / 10) * Timing Adjustment

4. **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 free-ridership. 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 free-ridership. Table A-22 provides detail on how participant responses correspond to various timing adjustments.

Table A-22. 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

The timing adjustment is applied to the no-program free-ridership score (as shown above).

We attempted a census of all CLIP participants, given the small number of projects completed through the program. Some participants completed more than one CLIP project. Where possible, we gathered necessary information to estimate free-ridership for as many of an individual participant's CLIP projects as possible, but the length of the free-ridership battery meant that we were unable to question some participants about all projects they completed due to interview length.

Because we did not complete an interview representing each CLIP project, and decision-making processes are likely different for CLIP projects than Custom projects in general, we developed a final weighted free-ridership estimate to be applied to all CLIP projects.

To produce a final weighted free-ridership estimate, we weighted the responses from each completed interview by the ex post gross savings of the associated project(s). Because of the small number of projects completed through the program, we chose to develop a free-ridership estimate applicable to both electric and gas savings, weighted by MMBtu.

Results

We were able to estimate project-specific free-ridership values for 9 of the 16 CLIP projects completed in PY7, representing 88% of ex ante gross MWh savings and 77% of ex ante gross therm savings. Table A-3 displays PY7 free-ridership results for the CLIP program.

Table A-3. PY7 CLIP Free-Ridership Results

Program	Free-Ridership	Ex Post Gross MMBtu in Sample[a]
CLIP - Electric	0.191	215,022
CLIP – Gas	0.422	57,879
CLIP - Overall	**0.224**	**272,900**

[a] Column does not sum due to rounding

Participant Spillover

Methodology

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

We examined both inside and outside spillover in CLIP projects using participant responses in our phone interviews. To calculate participant spillover as a rate, we conduct an engineering analysis of participant responses to determine the savings associated with measures identified as spillover.

After calculating the spillover savings present in our sample, we use Equation A-1 to develop the program participant spillover rate.

Equation A-1. Participant Spillover Rate

$$Participant\ Spillover\ \% = \frac{Total\ Spillover_{Participant\ Sample}}{Total\ Program\ Savings_{Participant\ Sample}}$$

Results

We examined both inside and outside participant spillover in projects from lighting and non-lighting end-uses using CLIP participant responses in the phone interviews. Based on this data, we found no participant spillover among CLIP participants, and therefore, our participant spillover rate for CLIP in PY7 is 0%.

Non-Participant Spillover

Methodology

Non-participant spillover refers to the installation of energy efficient measures by program non-participants that were influenced by the program but did not receive an incentive. An example of non-participant spillover is a customer who installed equipment with the intention of submitting an application for a program incentive and then neglected to submit the paperwork.

To calculate non-participant spillover as a rate, we first identify cases of non-participant spillover using non-participant phone survey responses and callbacks, as necessary. If necessary, we then conduct an engineering analysis of survey responses to determine the savings associated with measures identified as spillover. Finally, we extrapolate these savings to the non-participant population using expansion weights and divide the total population-level spillover savings by the ex post gross savings of the AIC Business Program in the corresponding time period. This approach allows us to express non-participant spillover as a factor of ex post gross program savings. Equation A-2 presents the equation used to calculate the non-participant spillover rate.

Equation A-2. Non-Participant Spillover Rate

$$Non\text{-}Participant\ Spillover\ \% = \frac{Total\ Spillover_{Non-Participant\ Population}}{Total\ Ex\ Post\ Gross\ Savings_{Business\ Program}}$$

Results

We apply portfolio-wide NPSO rates approved by the Illinois SAG to the AIC Business Program. These rates were estimated as part of the PY5 evaluation and are presented in Table A-4.

Table A-4. Approved NPSO Rate for PY7

Fuel Type	Non-Participant Spillover Rate
Electric	0.010
Gas	0.000

Appendix C. Site Visit Reports

Provided in a separate document.

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