IMPACT & PROCESS EVALUATION OF 2008 (PY1) AMEREN ILLINOIS UTILITIES COMMERCIAL AND INDUSTRIAL PROGRAMS

Final

Prepared for:

HEIDI MERCHANT

Prepared by:

OPINION DYNAMICS CORPORATION
230 Third Avenue
Third Floor
Waltham, MA 02451
(617) 492-1400
www.opiniondynamics.com

Contact: Bill Norton, Vice President
October 2009

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 1

2. INTRODUCTION 3

2.1 Program Descriptions 3

2.2 Evaluation Questions 4

3. EVALUATION METHODS 6

3.1 Data Sources and Analytical Methods 6

3.2 Sample Design and Completed Surveys 14

4. RESULTS AND FINDINGS 17

4.1 Task Specific Results 17

4.2 Process Results 20

4.3 Impact Results 27

5. CONCLUSIONS AND RECOMMENDATIONS 33

A. DATA COLLECTION INSTRUMENTS 36

B. DUE DILIGENCE AND VERIFICATION MEMO 37

C. AIB DATABASE REVIEW MEMO 38

D. TECHNICAL REFERENCE MANUAL MEMO 39

E. ENGINEERING DETAILS 40

F. RETRO-COMMISSIONING PROGRAM 42

TABLE OF TABLES

Table 1. C&I Portfolio Net Impacts 1
Table 2. Completed Survey Points 14
Table 3. Summary of Quality Assurance Activities in Place and Recommendations 17
Table 4. How Participants First Hear about the Program 22
Table 5. Participant Mean Ratings on the Ease of Program Processes 24
Table 6. Participant Utilization of Support Services 24
Table 7. Participant Mean Satisfaction Ratings for Various Program Elements 25
Table 8. Gross Impacts – Prescriptive Program 28
Table 9. Net Impacts – Prescriptive Program 29
Table 10. Gross Impacts – Custom Program 30
Table 11. Net Impacts – Custom Program 31

TABLE OF FIGURES

Figure 1. Usefulness of Marketing Materials 22

Figure 2. Main Benefits to Participating in the Program 26

Figure 3. Prescriptive Lighting Hours of Operation (by measure) 29

Figure 4. Prescriptive Lighting Projects NTGR 30

Figure 5. Custom Lighting Projects NTGR 32

Appendix Figure 1. Ex Post Algorithms for Lighting End Use 40

Appendix Figure 2. Ex Post Algorithms for Motors End Use 41

Appendix Figure 3. Basic Net to Gross Algorithm for Standard and Standard Revised Projects 41

1. EXECUTIVE SUMMARY

This report presents results from the evaluation of the first program year of the Ameren Illinois Utilities (AIU) Act On Energy Business Incentive Programs. For Program Year (PY) 1, the portfolio of business programs included the prescriptive and custom programs and a pilot effort for a retro-commissioning program.

Impact Evaluation

AIU exceeded their planned Program Year 1 energy savings goal for the commercial and industrial portfolio, but fell short of the planned demand impacts.[1]

Table 1. C&I Portfolio Net Impacts

Program	2008 Planned Impacts[a]		2008 Ex Post Net Impacts	
	kW	MWh	kW	MWh
Ameren Illinois Utilities Contribution to C&I Portfolio				
C&I Prescriptive	8,355	35,276	1,565	13,677
C&I Custom	756	5,817	5,682	38,596
C&I Retro-Commissioning	12	513	117	1,022
Commercial New Construction	-	-	-	-
Street Light	-	4,249	-	-
Commercial Demand Credit	2,328	47	-	-
Total	**11,541**	**42,902**	**7,364**	**53,295**

Note: The AIU portfolio of ex post impacts are at the 90 percent certainty level with a 5.8% relative precision (90±5.8%). There are no ex post impacts for the Commercial New Construction, Street Light, and Demand Credit Programs as they were inactive during Program Year 1.

[a] From Energy Efficiency and Demand-Response Plan (Ameren Illinois Utilities), November 15, 2007, Table 12.

The AIB program tracking database was easy to use and was an invaluable tool during the impact assessment. The ability to access so much specific information by project for each and every project was unprecedented for our team. We commend AIU and their implementer for their efforts in creating and maintaining this database.

The Reference Manual (TRM), another key tool for the impact evaluation, has a number of issues that need to be addressed both immediately and over time to ensure the accurate calculation of energy savings estimates. The Evaluation Team identified areas of disagreement including over lighting, HVAC, and motor measure definitions, as well as lighting and HVAC assumptions and results.

[1] AIU has kWh reductions to meet statutory requirements, but the statutory requirements for kW impacts are based on demand-response programs, not energy efficiency programs. The kW demand impacts shown in this document are from the energy efficiency programs only as there was no C&I demand response program in place in PY1.

Based on our assessment of impacts, we make the following recommendations:

- Update the TRM:
  - thoroughly document units, baselines, and algorithms;
  - clarify demand values as peak coincident or non-coincident;
  - provide a peak coincident value for all measures;
  - closely review motors and HVAC data to improve as deemed possible.
- Continue the practice of inputting multiple types of information into AIB. It has been a valuable resource during the impact evaluation.
- Update AIB to more easily pull needed data for the Total Resource Cost test for PY2 and PY3.

Process Evaluation

Overall, AIU's quality assurance and verification procedures for the Act On Energy Prescriptive and Custom Incentive Programs are rigorous and ensure high quality projects and tracking data. In particular, the programs are strongest in the areas of post-inspection, verification of project documentation, and assessment of customer satisfaction.

Customer satisfaction with the prescriptive and custom programs is high. The program and implementation staff handled the early oversubscription of the prescriptive program well, with minimal disruption to customers. Participants in both the prescriptive and the custom programs give virtually all program components high satisfaction scores, including the application process, responsiveness and technical ability of program staff, the measures offered, the incentive amount, and the program and AIU overall.

Customers are also satisfied with the contractors they have worked with and would uniformly recommend them to others. However, program participants are not aware of the existence of the Program Ally Network, which could be more heavily promoted in future program years.

Key recommendations based on the process evaluation are as follows:

- Where possible, efforts should be made to create greater fluidity between program years. The ability to process applications for pre-approval during the crossover period would improve efficiency and keep potential participants engaged.
- Given the lack of participant awareness of "Program Allies," AIU should develop a strategy to raise awareness among their customers and demonstrate the value of this program component.
- AIU should consider ways to draw upon the high levels of participant satisfaction with the program in future marketing and outreach efforts.
- We recommend periodically reviewing the AIB database to ensure that all fields are complete and to correct database entries where information has been entered inconsistently or incorrectly.

2. INTRODUCTION

This report presents results from the evaluation of the first program year of the Ameren Illinois Utilities (AIU) Act On Energy Business Incentive Programs.[2] For Program Year (PY) 1, the portfolio of business programs included the prescriptive and custom programs and a pilot effort for a retro-commissioning program. For PY2, AIU will fully implement the retro-commissioning program.[3] There were three programs included in the originally filed plan that are not part of this evaluation. The C&I new construction program is still under design and may be implemented in PY2 or PY3. The Commercial Demand Credit Programs is still under assessment by AIU for inclusion into the portfolio while the Street Lighting program is no longer planned to be implemented at any time. While not included in the originally filed plan, AIU is adding a commercial demand response thermostat program in PY2.

The following sections cover the PY1 process and impact results from the C&I Prescriptive and Custom Programs. High-level findings related to the Retro-commissioning Program are included in Appendix A due to the fact that this program was a pilot during Program Year 1 with a small amount of savings. Following the evaluation plan for impact evaluation, the ex ante[4] impacts from the retro-commissioning program were not assessed within the impact evaluation. For this program ex post[5] impacts equal ex ante impacts.

To support the evaluation, qualitative research was conducted including a review of program materials and interviews with program administrators, implementation staff, AIU Key Account Executives, and an engineering desk review of projects. Quantitative research efforts included a survey of an attempted census of customers who participated in the Prescriptive Program and the Custom Program.

2.1 Program Descriptions

The Prescriptive and Custom Incentive Programs offered by AIU were designed to overcome barriers related to cost, awareness/information, transaction cost and resistance to the adoption of new more energy efficient technologies. The cost of energy efficiency improvements is addressed through the incentives offered by the program; awareness by the recruitment of program allies and the establishment of a formal program ally network; and transaction costs through the development of program materials, including applications, that are easy to understand and complete. Those involved in program design foresee the use of case studies and press releases as a mechanism to convince potential participants of the benefit associated with removing inefficient equipment even if it is still functional.

[2] This set of programs was titled the Business Energy Efficiency Solutions Program in the plan filed on November 15, 2007.

[3] This effort is underway in the second program year, although is not part of this evaluation report.

[4] Ex ante impacts are the values as stated in the program tracking database.

[5] Ex post impacts are the values based on the evaluation findings.

2.1.1 C&I Prescriptive Incentive Program

The C&I Prescriptive Incentive program offers AIU commercial and industrial customers fixed incentives for the installation of specific energy efficiency measures. The program covers lighting, HVAC, and refrigeration equipment as well as motors, and provides customers with the option of submitting an application for pre-approval before installation of the select equipment.[6] Participants must also compile and present documentation of project completion through the final application process.

The prescriptive program stopped accepting new applications in September 2008 due to the over-subscription of the program. As a result, measures previously incentivized under this program were completed under the custom program.[7] These prescriptive measures were also subject to the same program stipulations as measures included in the custom program, including requirements for payback period and incremental cost.

In March 2009, AIU implemented an on-line store for small businesses which offers certain prescriptive measures at discounted prices. While the PY1 evaluation did not include the on-line store, this program component will be offered in 2010 and will be considered for inclusion in the PY2 evaluation effort.

2.1.2 C&I Custom Incentive Program

The C&I Custom Incentive program allows AIU commercial and industrial customers to complete energy efficiency projects that involve equipment not covered through the prescriptive program. The option to propose additional measures provides customers with the ability to tailor projects to their facility and equipment needs. Similar to the prescriptive program, custom incentives are available for lighting, HVAC, refrigeration, and motors. In addition, participants can also implement projects related to measures such as compressed air, geothermal, and industrial processes. However, incentive applications are evaluated using criteria such as payback period. All customers must get pre-approval for their energy efficiency projects and provide documentation and calculations of estimated energy savings when submitting their final application for payment.

The custom program was modified in September 2008 when the prescriptive program became over-subscribed. At that point, customers interested in installing measures available through the prescriptive program were allowed to apply for those incentives through the custom program, although their applications were subject to the more rigorous custom project review process. The program tracking database (AIB) clearly documented this shift by denoting these measures as “standard revised” in the measure type variable field.

2.2 Evaluation Questions

The overall evaluation objectives are to:

[6] Pre-approval is required in Program Year 2.

[7] The incentive structure in place for these prescriptive measures paid out under the custom program was such that the smallest incentive was paid. For example, if the prescriptive program paid out 4¢/kWh for a measure while the custom incentive was 5¢/kWh, the incentive was 4¢/kWh.

1. Consider and analyze demand-side management and energy efficiency measures and document the gross and net energy and demand savings associated with the Act On Energy Business portfolio;
2. Provide verification and due diligence of project savings as reported by the program implementer;
3. Suggest improvements to the design and implementation of existing and future programs through process evaluations;
4. Support AIU in developing a best of class evaluation infrastructure for the Act On Energy Business portfolio.

All assessment activities tie directly to one or more of these objectives.

3. EVALUATION METHODS

3.1 Data Sources and Analytical Methods

The assessment of the first program year of AIU C&I programs included both process and impact analyses.

3.1.1 Process Analysis

The process analysis used data from three data collection methods: depth interviews, structured quantitative telephone surveys, and review of secondary data. Depth interviews provided the evaluation team with a comprehensive understanding of the program. We performed depth interviews with one program manager, seven implementation contractors, and five key account executives. Additionally, we fielded two Computer Aided Telephone Interview (CATI) surveys, one to all prescriptive participants and those custom participants who received "prescriptive-like" incentives (i.e., those designated as standard revised); the other to custom participants. Secondary data received from the utility and depth interviews provided context for the report while the CATI surveys were analyzed using descriptive statistics.

Task 2 – Review of Verification and Due Diligence Procedures

We compared the program with best practices for energy efficiency programs using best practices guidelines.[8] For the Act On Energy Prescriptive and Custom Incentive Programs, we explored the quality assurance and verification activities currently carried out by program and implementation staff. We compared these activities to industry best practices for similar business programs to determine:

1. If any key quality assurance and verification activities that should take place are currently not implemented.
2. If any of the current quality assurance and verification activities are biased (i.e., incorrect sampling that may inadvertently skew results, purposeful sampling that is not defendable, etc.).
3. If any of the current quality assurance and verification activities are overly time-consuming and might be simplified or dropped.

This assessment primarily relied on depth interviews with program and implementation staff and documentation of current program processes as outlined in the Technical Reference Manual. Results are summarized in Section 4.1.1. The full review memo is provided in Appendix B.

[8] See the Best Practices Self Benchmarking Tool developed for the Energy Efficiency Best Practices Project: http://www.eebestpractices.com/benchmarking.asp.

Task 3 – Database Review

The tracking systems for the prescriptive and custom programs are managed by the implementation contractor. Under this task, we performed our own verification of the program tracking database and determined the level of input, outliers, missing values, and potentially missing variables. The purpose of the tracking system review is to ensure these systems gather the data required to support future evaluation and allow program managers to monitor key aspects of program performance at regular intervals.

We conducted a review of the AIB Tracking database, exported on February 13, 2009. During this review, we looked at four main sections:

- Program Ally Data
- Participant Data
- Project Data
- Measure-Specific Data

Within these sections, we looked for percent of missing values and outliers within the data. Recommendations were made to AIU in a memo provided in early May 2009. Results are summarized in Section 4.1.2. The full review memo is provided in Appendix C.

Task 4 – Technical Reference Manual Review

We conducted a technical review of each measure in the AIU Act On Energy Technical Reference Manual (TRM)[9] to assess the reasonableness of underlying algorithms, technology assumptions, and calculated savings values. Our findings regarding individual assumptions and algorithms were categorized as follows:

1. ACCEPTABLE AS IS: assumption or algorithm is reasonable and appropriate.
2. REVISE OVER TIME: the assumption or algorithm is acceptable for the near term but should be analyzed over time through the evaluation process or changed based on program experience.
3. ERROR OR DISAGREEMENT: We believe the assumption or algorithm contains an error, or we disagree on the value or approach and refer the matter for follow-up discussion.
4. INSUFFICIENT DOCUMENTATION: A determination of the adequacy of the assumption or algorithm cannot be made because of insufficient documentation.

The preferred data sources for assumptions are recent local primary research; evaluation, measurement, and verification (EM&V); and program experience. Since those sources were generally not available in Illinois when AIU assembled documentation and developed default savings values, we understand that some assumptions must be drawn from data sources that involve a compromise between age, rigor, or location.

[9] Act On Energy Business Program-Program Year 1, June 2008 through May 2009, Technical Reference Manual (TRM), No. 2008-1, dated February 3, 2009.

The types of issues we considered in our review include:

Measure definition – Provides a description of the efficient technology, the required technology performance specifications, and the applications where the technology is eligible. There must be consistency between the TRM and the participant application form (official program rules) to ensure the default savings occur. Reviewed issues include:

- Does the description define the measure without ambiguity to ensure that only those measures that will achieve the default savings will be accepted into the program?
- Are the performance specifications complete to ensure the default savings will be achieved?
- Are the performance specifications independently rated or certified?
- Does the description define the eligible base case applications?

Measure Savings Engineering Analysis – Provides the algorithms used to calculate non-coincident demand reduction, coincident demand reduction, and annual energy savings for each measure. Reviewed issues include:

- Are the equations correct for the measure?
- Do the algorithms provide reasonable estimates for the range of applications and operating conditions of participants in the program?
- Are factors missing from the equation?

Measure Savings Assumptions – Documents the wattages, efficiency ratings, and operating assumptions for baseline and efficient equipment to calculate non-coincident demand reduction, coincident demand reduction, and annual energy savings. Reviewed issues include:

- Is the baseline equipment type and performance appropriate for the measure description?
- Does the assumed baseline reflect federal standards?
- Are the efficiency ratings and wattages appropriate for the range of full-load and part-load operating conditions expected of participants?
- Do the operating hour assumptions provide a reasonable representation for program participation?
- Are the load factors, HVAC interaction factors, and coincident factors reasonable?
- Are the assumptions documented?
- Are the data sources appropriate for program delivery territory?

Measure Savings Results – Presents the default values that are derived from the algorithms and assumptions. Potential issues include:

- Has the calculation been correctly performed to generate the default values (are there math errors)?

- Is the weighting or averaging of data to derive a single default value reasonable?
- Do individual default values cover too broad of a range?
- Are the units for the savings correct and clearly presented?

Other Observations (where noted, not identified for all measures)

- Priority areas for future research
- Pending federal standards and state/local regulations that may affect the measure
- Issues for evaluation or field verification

Results are summarized in Section 4.1.3. The full review memo is provided in Appendix D.

3.1.2 Impact Analysis

Gross Impacts

During our PY1 evaluation, we performed engineering review, engineering modeling, database and hardcopy verification, and CATI surveys. The evaluation plan included onsite surveys of up to nine sites. However, after reviewing the total population of measures, where the measures were installed, and our available budget, we found that little additional value would occur from these audits. We increased the number of desk reviews for the custom program to offset these audits.

Engineering Review and Modeling. This activity consists of an engineer reviewing written documentation around impacts and assessing whether the inputs are reasonable and in line with standard practice. We performed an engineering review of the Technical Reference Manual (TRM) for measures that have been implemented in PY1 through the programs (see memo in Appendix D) as well as all information associated with 20 custom projects (out of 68 total projects). Engineering modeling occurs when calculations of energy and/or demand impacts occur within a spreadsheet. These were straightforward calculations using data collected through the CATI survey. We used this approach for the standard prescriptive and standard revised measures installed in PY1. For the estimated energy impacts, engineers used the information from the telephone surveys and the program tracking database (AIB) to verify installation values and adjust project specific information, if needed. This was a careful review that varied by each end use as noted next.

Lighting Review: For the lighting end use (the majority of projects), the hours of operation were calculated using the telephone survey data as well as investigating each instance where the respondent indicated that the number of installations recorded in AIB (and verified over the phone) was not correct. There were two other flagged areas in which the engineers delved into the project specific information within AIB to determine if other adjustments were required. For example, if the respondent indicated that de-lamping occurred or the fixtures taken out appeared to have been efficient already, the multiple files and information within AIB were reviewed to determine if the appropriate base case and post case were used within the ex ante estimate of savings. After thoroughly probing close to 30 percent of the surveyed population, only one adjustment actually occurred within the lighting end use (at one site fewer fixtures were installed than within AIB). At times the

information within AIB clearly indicated a misunderstanding of the question by the respondent (e.g., one respondent indicated that 25 new fixtures were put in after de-lamping of 25 fixtures when the invoices and other paperwork plainly indicated that it was simply a retrofit of 25 fixtures). In other instances, though, there was no evidence one way or the other about the veracity of the respondent's statements. For example, a base case of 4 lamps with a post case of 2 lamps per fixture was indicated by a respondent with AIB showing a base case of 2 lamps and the de-lamped post case of 2 lamps per fixture. This somewhat small incentive project had no pre-inspection, the invoice made no mention of the base case, and neither did the application. In those few cases, no changes were made as we believed that there was no fair adjustment and the current AIB information tended to be the conservative choice. Once adjustments were made and the telephone survey hours of operation were included, an ex post gross impact was calculated from the surveyed group. A gross realization rate was calculated and applied to the entire population of lighting projects. The algorithms applied in the ex post estimate of energy impacts are shown in Appendix E.

The demand impact for this end use is a coincident peak value. This was calculated by applying a coincident diversity factor (CDF) by facility type. The CDF values are identical to those used by ComEd and appear to have originated in work performed within California.

Motors Review: The engineering review for motors was different than lighting since there were only four projects paid out under PY1. We reviewed the calculations of each and adjusted all four in one way or another. In two cases, the ex ante demand was greatly reduced as the ex ante value had been multiplied by 12 to obtain an annual value; however, demand reduction is not multiplicative. For the other two cases, the ex ante value came from the TRM value within the tables based on the horsepower of the motor. However, as indicated in the write up of the TRM, the table values appeared to be from the 2005 DEER database and have errors. For the ex post assessment of impact, we calculated impacts using an engineering algorithm that reduced the savings from those shown in AIB. The algorithms are shown in Appendix E.

The motors demand is considered coincident peak demand. Of the four motors installed in PY1, three are on full time with a CDF of 1.0. The third applied a CDF of 0.74 based on information from the survey regarding when the motor was in use.

Refrigeration Review: Of the 30 refrigeration projects, all were either anti-sweat heater controls or electrically commutated motors (ECM) for reach in or walk in coolers. The engineering review consisted of reviewing projects and measures from the one decision maker reached in the survey. Although we only reached one person, this person was responsible for 74 of the 108 measures installed within the refrigeration end use. After using the information on the invoice to clarify that the value of 22 units provided in the survey was equal to the value of 300 in AIB (one is case doors, the other is lineal feet), no adjustments were made within the refrigeration end use.

HVAC Review: Because the savings assumptions in the TRM appeared very suspect based on the Task 4 review, we took the eight projects in PY1 and performed a careful engineering estimate of savings using algorithms and the bin method. Each project was reviewed through a careful look at the submitted information and calculations for consistency, accuracy and correct engineering principles. The reviewed projects can be broken down into two categories: VFD projects, and non-VFD projects.

The ex-ante methods of calculating the VFD savings were considered to be appropriate. However, all of the reviewed VFD projects had a common error: the motor horsepower was used for calculating the savings instead of the brake horse power (shaft power) of the fan or pump. Standard design practices oversize motor HP to account for potential system changes, in addition, due to discrete motor sizes, motors often need to be "sized up" to the next available size. For the ex post analysis, a 0.8 load factor correction was used. Additionally, it is important to consider drive and motor efficiencies. For the prescriptive VFD measure a motor efficiency was not used in the analysis, therefore, the motor efficiency provided in the project documentation was used in the ex post analysis. If no documentation was provided for the motor or drive, the motor efficiency or VFD efficiency used in the original analysis was also used in the ex post analysis.

The remainder of the projects were AC replacement projects. The savings for these projects were verified using two different methods. The first was an ASHRAE simplified bin method analysis. The bin analysis takes into account the outdoor air temperature throughout the year, the occupied hours of the facility, details of the conditioned space, and the existing and proposed system energy efficiency. The baseline case for the air conditioning projects was assumed to be equivalent to the new construction baseline set by the 2004 ASHRAE 90.1 standard. In addition to the bin analysis, the equivalent full load hours approach developed by ASHRAE was used. The 2007 ASHRAE Handbook lists the equivalent full load operating hours for air conditioning systems in St. Louis. These hours were assumed to be reasonable compared to those expected for the facilities under review. By taking the difference between the power required by the existing system to that required by the proposed system and multiplying it by the equivalent full load operating hours, the expected savings can be found. ASHRAE provides a range of hours for each type of facility. In the ex post analysis the average of this range was used. Just like the bin analysis, the baseline used for the equivalent full load hours method was the 2004 ASHRAE 90.1 standard. The results of the two analyses were then compared and used to evaluate the ex-ante savings.

Custom Review: We performed a desk review of 20 projects because of the variety of measures that were truly custom projects. The goal was to compare the inputs provided in the application to the assumptions used in the analysis, verify consistency in savings estimates throughout the project file, and to provide insight into the validity of the ex-ante energy savings. This was accomplished through the review of the submitted information and calculations for consistency, accuracy and correct engineering principles. There were a wide range of projects that fell into one of several categories; lighting projects, compressed air systems, variable frequency drives (VFDs), refrigeration projects, and miscellaneous. There were several projects where the savings could not be verified and one where the savings were eliminated. These projects are individually discussed further in the miscellaneous section of this summary.

The demand reduction within the custom review is non-coincident peak reduction.

Custom Lighting The lighting projects involved the lighting systems for commercial buildings, as well as refrigeration case lighting retrofits. For retrofit projects, the proposed system was compared to the existing system in order to determine the ex post savings. New construction projects were compared to the ASHRAE 90.1 2004 standard lighting power densities for the appropriate building type. In both cases, if the details about the fixture and bulb type were available, the ex post savings were calculated using the wattages supplied by Advanced

Lighting Guidelines instead of the nominal wattages. The Advanced Lighting Guide takes into account the energy consumption of the ballast as well as the bulb. This difference in wattage can play a significant role in the savings results. Additionally, for lighting projects dealing with refrigeration systems, reducing the energy output of the lights also reduces the refrigeration load. This was taken into account by dividing the lighting energy savings by the coefficient of performance (COP) of the refrigeration system to obtain the refrigeration savings. The COP provided in the documentation was used for this purpose, and if no COP was provided it was assumed to be 1.6 for freezers and 2.3 for refrigeration cases. The total savings are then the sum of the lighting savings and the refrigeration savings. The hours of operation for the lighting were compared to the hours of operation for the facility listed in the application.

Compressed Air Systems The compressed air systems involved replacing air dryers, compressor control sequencing, installing zero-loss drains, and adding compressed air storage. The ex post savings compared the original system to the proposed system for all of the projects evaluated. The details of the original and proposed systems were taken from the documentation available. These systems were then compared based on the types of controls and required cubic feet per minute outputs of the systems. Installing dryers and zero-loss drains reduces the amount of purge loss the compressed air system has to account for. Reducing the air demand reduces the load on the compressors and allows them to consume less energy. The control methods and their load control data is taken from the Compressed Air Challenge handbook. Sequencing the compressors or adding storage changes how the compressors are controlled, which impacts their performance at part load.

VFD The ex-ante methods of calculating the VFD savings were considered to be appropriate when the calculations were available. However, several of the reviewed VFD projects had a common error: the motor horsepower was used for calculating the savings instead of the brake horse power (shaft power) of the fan or pump. Standard design practices oversize motor HP to account for potential system changes. In addition, due to discrete motor sizes, motors often need to be "sized up" to the next available size. For the ex post analysis, a 0.8 load factor correction was suggested whenever motor horsepower was used. Additionally, it is important to consider drive and motor efficiencies. For the prescriptive VFD measure a motor efficiency was not used in the analysis, therefore, the motor efficiency provided in the project documentation was used in the ex post analysis. If no documentation was provided for the motor or drive, the motor efficiency or VFD efficiency used in the original analysis was also used in the ex post analysis. For project A, no original calculation or motor information was available. It was assumed that the original savings were calculated using the full motor horsepower, and therefore, the original savings were reduced by 20% to account for the 80% load factor on the motor.

Refrigeration Systems Two of the projects dealt with installing anti-sweat heater controls in refrigeration and freezer cases. It was assumed that the anti-sweat heater control reduced the heater usage by 50%, which is typical for freezers but conservative for refrigeration cases. Additionally, it was assumed that 50% of the heater output must be removed by the refrigeration system. The COP of the refrigeration system was taken from the documentation or assumed to be 1.6 for freezers and 2.3 for refrigeration cases.

Miscellaneous The remaining projects fell into the miscellaneous category. Many of them required custom calculations geared toward that specific project. Also included in this

section are the projects that could not be verified. Project B is a new construction project for a grocery store. The project included three measures; the first was a lighting retrofit that didn't meet the ASHRAE 90.1 2004 standard lighting power densities maximum of 1.7 watts per square foot, and the second and third measures not verified were due to lack of documentation. For this project, the lighting savings were set to zero while the savings from the second and third measures appeared reasonable and the ex post estimate was set to equal the ex ante value. Project C is a liquid nitrogen plant pipe replacement that could not be verified because no specs on the replacement pipes were provided in the documentation. Project D is a VFD install at a store, which could not be verified because no documentation on the size of the VFD, or the equipment it was installed on, was provided. For projects C and D the available documentation was assessed for plausibility and found feasible. As such, for these two projects, the ex post estimate was set to equal the ex ante estimate of savings. Finally, project E was a lighting controls project for the customer where a controller was being installed to switch the lights off during the third shift, which had recently been cut. This was a difficult project for the ex post estimates as the calculations were correct, but the baseline was in question. There is already a procedure for manual control in place to turn the lights off on the weekends when no one is at the facility. As such, there was the potential that this procedure could have been put in place on a daily basis. There was no evidence that this was the plan and there was the possibility that the procedure was onerous on a daily basis. In light of these confounding areas, the ex post value was given full value.

One item to keep in mind for these and other desk reviews is that the evaluation budget was relatively slim and the ability to track down and clarify areas of ambiguity that arose during the review was not present. This issue will be somewhat alleviated in PY2 and PY3 when the budgets are somewhat larger.

Net Impacts

The determination of net impacts used a net-to-gross-ratio (NTGR) based on self-reported information from the CATI surveys. NTGRs were calculated for both the prescriptive program and the custom program separately as the customer was required to meet the custom requirements for all projects, even those that were standard revised projects (that were very similar to projects in the prescriptive program). The differences in the incentive amount (the value was sometimes lower in the custom program) and the additional paperwork required for the custom projects pointed to the need for separate NTGRs by program.

All standard and standard revised projects used the basic NTGR algorithm to calculate reductions due to free ridership.[10] This algorithm is based on the self-report method used in California and is identical to that used by the ComEd C&I evaluators with the exact same questions. The algorithm is provided in Appendix E.

A NTGR, weighted by the ex post kWh of the surveyed projects, was applied to the population gross impact to obtain a net impact of the program before any spillover was included.

[10] The free ridership concept reduces the gross impacts by removing part of the impacts from the portfolio of customers who would have implemented the projects in the absence of the program.

Spillover was found in five prescriptive lighting customers. To calculate the additional impacts due to spillover, the average ex post kWh and kW from the program participants by measure group was calculated and applied by project. For example, if the customer installed fluorescent tube fixtures outside of the program, but was influenced by the program,[11] the average ex post fluorescent tube per project value was applied as additional impacts for that customer. No spillover was found in prescriptive measures other than lighting or in the custom program.

The lighting spillover was added as a single value to the net impacts[12] and increased the original NTGR that had been based on free ridership alone by 0.02.

3.2 Sample Design and Completed Surveys

The CATI surveys attempted to reach every decision maker in the Prescriptive and Custom programs. See Table 2 for the population values and completed surveys.[13]

Table 2. Completed Survey Points

End-Use	AIB Population	Sample Frame Population		Completed Surveys*
	Projects	Contacts	Projects	
Prescriptive Program				
Lighting	49	27	49	15
HVAC	4	3	4	-
Refrigeration	30	2	30	1
Motors	2	2	2	1
Total	*85*	*34*	*85*	*17*
Custom Program				
Lighting	142	106	141	40
HVAC	3	3	3	1
Refrigeration	15	2	12	-
Motors	1	1	1	1
Custom	68	34	65	14
Total	*229*	*146*	*222*	*56*

Note: Project counts in the Sample Frame Population differ from those in the AIB population due to contacts with multiple projects. We assigned each unique contact into the Sample Frame Population for either the Prescriptive or the Custom Program, thus decreasing the possible number of projects in a few specific sample frames.

*Each contact only completed the survey for one project. Therefore, the count of completed surveys by contact and by project is the same.

Below we outline our PY1 sampling by program.

[11] As indicated by giving a rating of seven or higher on a ten point scale when asked about the influence of the program on the installation.

[12] Spillover was 304,078 kWh and 44.8 kW.

[13] The data are as of the AIB exported file provided to the evaluation team on June 5, 2009. Projects included were those with a value of approved, pre-approved, or check cut.

3.2.1 C&I Prescriptive Incentive Program

We attempted to survey all decision makers in the prescriptive program. As such, the questions regarding the NTGR are considered to have no sampling error and therefore, no confidence intervals are applied to the NTGR (i.e., no precision values).

Sampling occurred within the lighting and refrigeration end uses, however, within those decision makers with more than one project; it was considered too high a respondent burden to attempt to ask questions about more than one project. Of the 133 unique contacts within our lighting survey (which included customers from both prescriptive and custom programs), 21 had more than one project. For those customers with more than one project, we randomly assigned one of the multiple projects for which to collect data through the survey. This sampling created a minimal bias at 1.04 (i.e., bias=sampled mean kWh / population mean kWh), indicating that our sample contained slightly more of the larger energy saving projects from the population.

The sample design provides statistically valid impact results at the 90% confidence level +/- 18.8% error for the prescriptive program overall on a kWh basis. The confidence interval (error) is larger than desired due to the large variation in energy savings within the lighting program among those sampled, but was the best possible taking into consideration customer burden and the difficulties associated with gathering information regarding multiple projects from one decision maker via the telephone.

3.2.2 C&I Custom Incentive Program

This program has two groups – those projects that are custom projects and those that are standard revised projects (i.e., prescriptive-like projects incented under the custom program after the prescriptive program became oversubscribed; see also Section 4.2). Energy and demand impacts associated with the custom program were determined based on a detailed engineering desk review of completed projects.

The projected level of program activity was such that the planned evaluation approach included a desk review assessment of a census of customer projects within the available evaluation budget. The evaluation approach was modified when the total number of custom projects in Program Year 1 exceeded the number that could be assessed within the current budget. As a result, we assessed a sample of custom projects. Based on the available budget, we assessed a total of 20 custom projects (out of 68 possible projects).

Similar to the prescriptive program, we attempted to complete a telephone survey with all decision makers in the custom program. The survey was used to verify the installation of the program measure, gather data to support the estimation of the NTGR and collect other information useful for the process evaluation. As we attempted to gather data from a census of program participants installing custom measures, the questions regarding the NTGR have no sampling error; therefore, no confidence intervals are applied to the NTGR (i.e., no precision values).

The prescriptive-like projects (i.e., those under the lighting, HVAC, refrigeration, or motors end use) were surveyed using the same survey as the prescriptive customers and were analyzed as indicated in the section above.

The sample of 20 projects selected for engineering desk review was chosen using a stratified random sample design. The largest 12 projects were in one stratum and sampled with certainty (i.e., all were reviewed). The next stratum contained the remainder of the population with 8 projects chosen randomly for review.

The sample design provides statistically valid impact results at the 90% confidence level +/- 3.3% for the custom program overall. The confidence interval (error) is smaller than the prescriptive program due to the relatively larger number of completed surveys included and a lower variation in kWh. Additionally, the stratified random sample design for the custom projects helped to reduce variation for those projects.

4. RESULTS AND FINDINGS

4.1 Task Specific Results

4.1.1 Establish Verification & Due Diligence Procedures for Implementer (Task 2)

Overall, AIU's quality assurance and verification procedures for the Act On Energy Prescriptive and Custom Incentive Programs are rigorous and ensure high quality projects and tracking data. In particular, the programs are strongest in the areas of post-inspection, verification of project documentation, and assessment of customer satisfaction. Suggested improvements focus on refining sampling practices as shown in Table 3 under pre and post inspections and formalizing the program ally network.

Table 3 summarizes the quality assurance and verification activities currently carried out by the Prescriptive and Custom Incentive Programs. It also presents recommended changes to current procedures, as well as suggestions regarding additional activities that AIU could implement to enhance current quality assurance and verification.

Table 3. Summary of Quality Assurance Activities in Place and Recommendations

QA Activities in Place	Recommended Change
• Eligibility checks	• None
• Engineering review	• None
• Pre and post inspections	• Develop pre-inspection guidelines • Inspect the first project from a new contractor
• Customer satisfaction survey	• None
	Additional recommended activities: • Screen contractors/program allies

Full results are provided in Appendix B.

4.1.2 Review Implementer's Tracking Systems and Program Theories (Task 3)

At the time of the review, the database seemed to be well populated and contain the information that we need for our evaluation. As we used the information within the database for our impact assessment, we found that the additional information provided within AIB (that was not part of our initial review) to be present and helpful most of the time. There were only a few instances when a file was not present that may have helped in a decision made within the impact analysis (e.g., an Excel file with the calculations was not present or did not have complete information). The AIB program tracking database was easy to use and was an invaluable tool during the impact assessment as the ability to access so much specific information by project for each and every project was unprecedented for our team.

We commend AIU and their implementer for their efforts in creating and maintaining this database.

There are no program logic models for the programs under assessment in PY1. While we believe that discussion and development of a sound program theory and logic model can benefit the program, given the limited evaluation resources available this activity was not included in the PY1 evaluation plan. We explored elements of the underlying program theory during depth interviews with program staff and implementers. Information gleaned from these discussions informed the overall process evaluation effort.

Full results are provided in Appendix C.

4.1.3 Technical Reference Manual Review Results (Task 4)

Within the review of the technical reference manual (TRM), a number of cross-cutting issues were identified for each end use. This section provides a high-level summary of these issues. Detailed findings are presented in Appendix D.

As explained in more detail below, the definitions, assumptions, and algorithms for multiple measures as documented in the TRM require revision. However, given the evaluation objectives required by statute, the evaluation budget did not permit an evaluation approach which includes the research required to revise these assumptions. In finalizing the evaluation plans for PY2 the Opinion Dynamics team will work with AUI to establish a hierarchy of evaluation objectives, including the development of updated TRM values. We will work to balance these priorities within the available budget. Additionally, in PY2, we will review other evaluations currently underway in Illinois to see if additional data is available.

Lighting

- AIU should identify savings units in the TRM (e.g., per lamp, per fixture, per watt reduced, etc.) when presenting tables of results. AIU also needs to note whether kW savings is coincident or noncoincident.
- AIU should remove redundant terms, such as DI and WHF, as well as EI and WHF_e from default lighting calculations.
- When offering a single default value to represent multiple baseline and measure options, AIU should provide documentation of the base wattage and replacement wattage, as well as the weighting approach used to generate a single value.
- There are a number of potential issues related to the mapping of 2005 DEER market sectors to the AIU TRM and Prescriptive application including the use of simple averaging when combining multiple DEER market sectors into one facility type.
- The TRM does not sufficiently document noncoincident kW to confirm that Appendix D (Appendix D in the TRM) hours are used consistently in all measures.
- It is not clear how AIU is using the information in Appendix D from the TRM.

- It is not clear how AIU is handling coincidence factors when reporting savings in the TRM. The TRM does not sufficiently document noncoincident kW to confirm which coincidence factors are used and whether they are used consistently in all measures.
- The TRM does not sufficiently document noncoincident kW to confirm that HVAC interactive factors are used consistently in all measures. We recommend a set of HVAC interaction factors that are specific to Illinois be developed.

HVAC Systems

- For each measure type, AIU should only list algorithms actually used by the measure.
- If AIU is claiming heating season savings, we would need to see documentation of base case efficiency, heat pump efficiency, and heating season full load operating hours.
- AIU's three sets of algorithms are set up to provide absolute impacts, rather than per unit impacts. Cooling equipment performance values are usually set for a size range.
- AIU should include both a coincidence and redundancy factor in HVAC algorithms.
- AIU should use the 2006 IECC code as its baseline and can modify efficiency levels over time based on the evaluation process.
- Building operating hours should not be used for cooling full load hours.
- AIU should be very diligent to label units in all default savings values presented, and distinguish between coincident and noncoincident kW demand savings.
- The application of DEER weather sensitive HVAC data to Illinois is problematic, but acceptable until other values can be determined.

Motors

- The review did not identify any cross-cutting issues for motors.

Refrigeration

- With the exception of Ice Makers, the AIU default savings values for Refrigeration measures are acceptable for the near term but should be updated over time through the evaluation process, market research, or program experience.
- When using default values from secondary sources, AIU should document the source and any adjustments or averaging of data to create the default savings values.
- The application of DEER weather sensitive data to Illinois is problematic, but acceptable until other values can be determined.
- The measure descriptions are not complete and need to include all relevant details on the efficiency measure, the baseline, and application notes that are associated with the savings values.

- AIU has pasted an algorithm for anti-sweat heater controls into every refrigeration measure. This needs to be revised so that staff and evaluators referring to the TRM do not get confused.
- It is critical that AIU identify the units for the savings in the TRM (e.g., per motor, per square foot, per machine, etc.) when presenting tables of results. AIU should also note whether kW savings is coincident or noncoincident.

4.2 Process Results

The prescriptive and custom programs are handled by the same program manager within AIU and have the same implementer. In addition, the two programs share most design and process elements. As a result, it was logical to present the information across both programs rather than in separate sections.

4.2.1 Program Challenges

The oversubscription of the prescriptive incentive program in September 2008, presented a significant challenge to the Act On Energy Business Incentive Programs and was handled well by the program staff. Due to the oversubscription, customers could go through the custom program to apply for incentives towards standard measures, although the applications were evaluated based on the custom project criteria (i.e., payback period, incremental cost, operating hours). Despite the procedural impact of this change, few participants knew about it. In fact, 64% of participants were unaware that the prescriptive program was oversubscribed in the first program year.

Among those who knew of the program change, 45% heard about it from their Key Account Executive. Further, 71% of those that knew about the oversubscription did not feel it impacted their participation in the program, suggesting the program staff did a good job of making customers aware that the program would continue to offer program benefits through the custom program. In a small number of cases where participation was impacted (less than 10 percent of all participants), the result was that some customers participated in the custom program instead, some slowed the purchase of their equipment, and others were forced to re-budget their project.

4.2.2 Program Participation

Customers

The customers participating in both the prescriptive and custom incentive programs come mainly from the manufacturing and industrial (38%), retail and service (15%), and warehousing and distribution (12%) sectors. The majority own and occupy the facility in which they implemented the program measures (85%) and all are responsible for paying the electric bill.

There is a relatively even distribution of small (33%), medium (37%), and large (29%) companies that participate in the Act On Energy Business Program.[14] However, participants in the custom program are more likely to be large (46%) than participants in the prescriptive program (13%). In addition, more than half of the facilities receiving an incentive for energy efficiency measures (69%) are one of multiple locations operated by the participating customer. Participating facilities range in age, as well as in terms of the number of staff members they employ.

Program Allies

As of May 2009, the Act On Energy Business Program had 184 registered Program Allies. The program currently offers a search function on the program website so that customers can locate a service provider for their project based on that contractor's specialties, areas served, and type of customer served. Plans are also underway to enhance this search feature making it easier for customers to find the information they need.

Of the 184 Program Allies that registered with the Program in Program Year 1, 42% participated in an incentivized project that was completed. On-going research activities (within PY2) in this area include in-depth interviews with registered Program Allies as well as contractors that have completed projects through the program, but are not registered as Program Allies. During these interviews, we will explore a number of issues, including program satisfaction and awareness, and why contractors have not participated in the program.

4.2.3 Program Awareness

Program Outreach

The program outreach was effective in increasing awareness of the program as shown by the responses from the customers. Both the medium used to educate costumers and the content of program messaging was well received. In particular, direct customer communication and interaction with AIU Key Account Executives and both affiliated and unaffiliated contractors was a valuable strategy in disseminating program information.

Customer Outreach

Marketing of the Act On Energy Business Incentive Programs was limited in Program Year 1 and did not include any mass marketing efforts.[15] Nevertheless, AIU employed a number of outreach strategies during the first Program Year. At the outset, most customers first learned about the program from a contractor (21%), a Key Account Executive (KAE) (12%), the AIU website (10%), or a bill insert (10%). However, it is not surprising that not all approaches are equally effective for all parts of the customer base. In particular, for custom participants, KAEs play an important role in providing information about the program though even for this group contractors remain the most important source of information.

[14] Company size is based on company's perception of themselves relative to other companies.

[15] However, mass marketing of the residential program may have been seen by C&I customers and may have had an impact on their general awareness of Act On Energy.

Table 4. How Participants First Hear about the Program

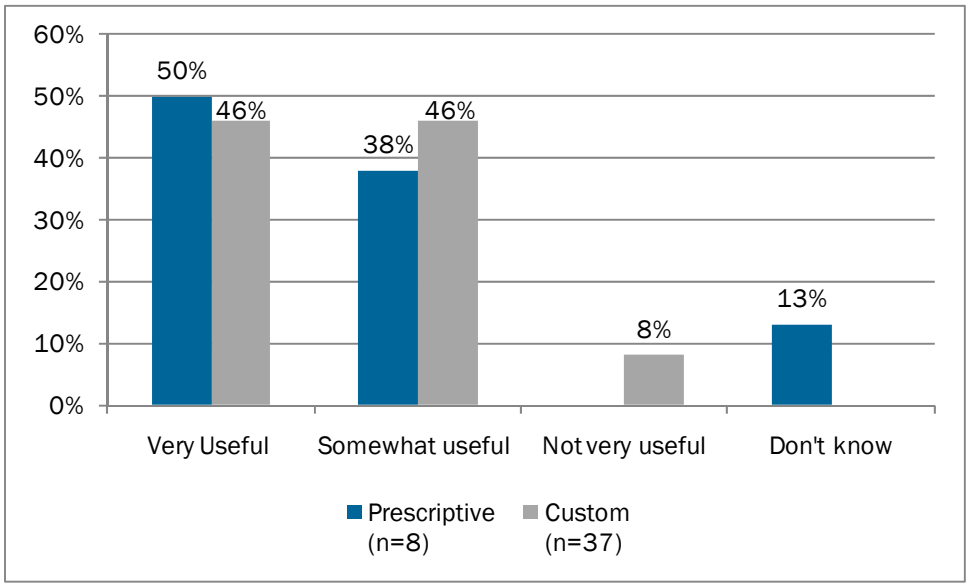
Information Source	Prescriptive (n=17)	Custom (n=56)
Contractor/program ally	24%	20%
AIU website	12%	9%
AIU Key Account Executive	6%	14%
Bill insert	6%	11%
Workshop	6%	5%
Distributor	6%	4%
Friend/colleague/word of mouth	-	11%

Recall and Usefulness of Messages

In terms of sustained marketing of the program, more than half of prescriptive (62%) and custom (66%) participants recall seeing or receiving marketing materials. Participants in both programs generally remember the same types of materials, with the largest percentage citing email (42%), brochures (29%), bill inserts (20%), and television advertising (13%).

Overall, participants in both programs find the Act On Energy Business Program marketing materials useful. Eighty-eight percent of prescriptive participants and 92% of custom participants consider the materials "very useful" or "somewhat useful."

Figure 1. Usefulness of Marketing Materials



Participant preferences for receiving information somewhat mirror how they currently report receiving information. Across both programs, participants would most like to receive program information via email (41%) followed by flyers or mailings (26%), bill inserts (15%), key account executives (12%), program allies or contractors (10%), and webinars, roundtables or other events (8%).

Program Allies and Contractors

The Act on Energy Business Program used a more tailored approach to reach out to contractors during the first year of the program. The main activity for educating this group about this program was a series of rollout events. After presenting information to program allies in this manner, the Act on Energy Business Program Call Center was used to conduct continuous outreach through follow-up calls and emails to non-registered contractors.

According to program staff, when marketing the Program Ally network, the main benefits touted are contractor access to advance information related to program changes, free advertising through the Service Provider Search, the ability to lower their bid as a result of the incentive, and the opportunity for them to partner with AIU.

4.2.4 Program Processes

Participation Process and Requirements

The program processes were effective in smoothly providing incentives to customers. The program process was stated to be clear, questions were answered within a few business days, and customers were satisfied with the program. This is commendable for a first year program.

Project Specification and Identification of Incentive

In both the prescriptive and custom programs, the participant (34%) or a contractor (34%) is the most influential in specifying the details of the project they completed through the Act On Energy Business Program. Distributors also take on this key role in a number of cases (17%). The same actors also typically identify the opportunity for the program incentive. Most often the participant identifies the incentive in both the prescriptive (35%) and custom (43%) programs followed by a contractor (18% prescriptive and 19% custom) and distributors (18% prescriptive and 12% custom).

Initial Application

Almost all participants submitted an initial application for pre-approval regardless of the program in which they participated. In addition, a majority of participants in both the prescriptive (77%) and custom (78%) programs filled out the initial application for pre-approval themselves. Participants responded favorably to the application materials developed by AIU. All prescriptive program participants (100%) and 91% of custom participants that filled out the paperwork themselves reported that the form clearly explained the program requirements, as well as how to participate.

In situations where the participating customer opts not to complete the paperwork themselves, contractors (67%) most frequently fill that role. Other actors involved in this process vary by program. For example, only custom participants noted the involvement of program allies (18%) and consultants (9%) while a quarter of prescriptive participants said an engineer filled out the initial application.

Final Paperwork

While in the majority of cases, participants in the Act On Energy Business Program also complete their own final paperwork (71%), prescriptive participants are slightly less likely to do so (59%) than custom participants (75%). When assistance is sought in completing this documentation, contractors are again the favored actor (42%), although there is variation by program. Prescriptive participants more frequently use consultants (17%) and engineers (17%) than custom participants (8% and none, respectively). Individual custom participants also report having a program ally, manufacturer, distributor, or someone else at their company complete this paperwork.

Overall Application Process

In general, participants in both programs find the application process easy to understand and complete.

Table 5. Participant Mean Ratings on the Ease of Program Processes

How would you rate the…	Prescriptive	Custom
Initial application process	8.2 *(n=13)*	7.4 *(n=43)*
Process for submitting final paperwork	8.6 *(n=10)*	8.3 *(n=42)*

Note: Mean ratings are based on a scale from 0 to 10 where 0 is "very difficult" and 10 is "very easy."

Program Responsiveness

Participants are utilizing the Act On Energy Business Call Center and technical review staff at moderate levels and generally report that technical review staff respond promptly to their inquires. As illustrated in Table 6, participants in the custom program are more likely to contact their reviewer with specific questions (50%) than participants in the prescriptive program (29%). However, both have taken advantage of the Call Center to a similar degree.

Table 6. Participant Utilization of Support Services

Action Taken	Prescriptive (n=17)	Custom (n=56)
Placed a call to the Call Center	41%	46%
Asked questions of the technical reviewer	29%	50%
Response time to questions by Technical Review Staff	Prescriptive (n=5)	Custom (n=28)
Within the same business day	20%	68%
1-2 business days	40%	21%
3-5 business days	-	4%
1-2 weeks	40%	-
Don't know	-	7%

Overall, participants in both programs receive answers to their questions either the same day or within 1-2 days. However, some prescriptive participants (40%) experienced much longer wait times, which may reflect the fact that the program was operational only at the beginning of the program year when program staff had less experience and the processes were new.

Customer Satisfaction

Program Administration

Satisfaction with the program and its components is extremely high. Positive perception of program staff, the program offerings, and the overall program is shared almost equally by participants in both the prescriptive and custom programs as indicated in Table 7 below.

Table 7. Participant Mean Satisfaction Ratings for Various Program Elements

How would you rate your satisfaction with…?	Prescriptive	Custom
The call center's ability to answer your questions	8.3 *(n=7)*	9.0 *(n=26)*
The program's technical review staff	8.6 *(n=17)*	8.8 *(n=56)*
The measures offered	8.3 *(n=17)*	8.4 *(n=42)*
The incentive amount	8.0 *(n=17)*	8.5 *(n=56)*
Act On Energy Business Program overall	8.8 *(n=17)*	8.7 *(n=56)*
AIU	8.1 *(n=17)*	8.4 *(n=56)*

Note: Scale is from 0 to 10 where 0 is "very dissatisfied" and 10 is "very satisfied."

One point of divergence across these rating is in the satisfaction of various business sectors with the measures offered. In particular, those in the retail and service sector are more likely to give a high satisfaction rating (i.e., a score of 7 or higher on a scale from 0 to 10) with the measures offered through the program (100%) than participants in manufacturing (82%) or warehouse and distribution (67%).

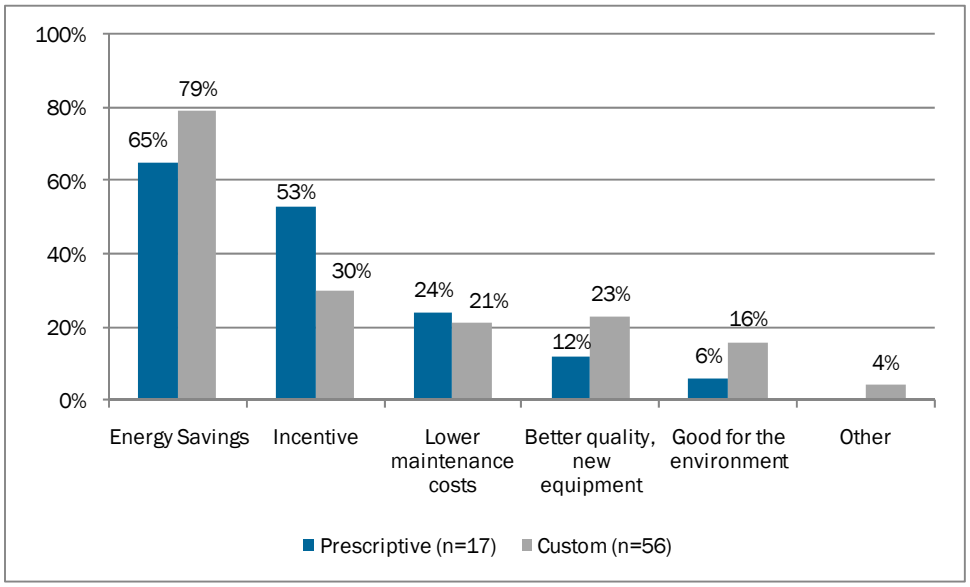
Only 5% of participants (four respondents: one in the prescriptive program and three in the custom program) experienced any problems during their participation. These issues appear to be isolated instances of unreturned phone calls or delays in processing.

Likely as a result of high levels of participant satisfaction, there is significant potential for repeat participation in the program. Sixty-six percent of participants plan to participate again, and another 26% say they may participate. Those who already completed multiple projects (81%) are more likely to say they will participate again compared to those who did one project (61%).

Program Benefits

Overwhelmingly, the main benefit cited is energy savings followed by the incentive. As a result, messaging that stresses the monetary and energy savings achieved through the Program has the potential to resonate with potential participants.

Figure 2. Main Benefits to Participating in the Program
(Multiple Response)



Program Ally and Contractor Performance and Recognition

Almost three quarters of participants (73%) used a contractor for their project, and all of those participants would recommend them to other companies. This stands to benefit the program in its efforts to recruit additional contractors to the program ally network from its existing pool of non-registered, but participating firms.

However, most participants are not familiar with the term "program ally" (76%), and there are slight differences in familiarity levels across programs. For example, those in the prescriptive program are more likely to be unfamiliar with the term (88%) than those in the Custom program (72%). Limited participant knowledge of the Act On Energy Business Program Ally is also reflected by the fact that 32% of participants that used a contractor for their project do not know if that contractor is affiliated with the Act On Energy program.

Participant attitudes about contractor affiliation with the program are mixed. While about a quarter of participants (23%) think it is very important for their contractor to be affiliated with Act On Energy, 23% think it is not at all important (mean=5.0 on a scale from 0 to 10). This may signal a lack of customer awareness about the benefits of using an affiliated program ally and an opportunity to market the Program Ally Network to potential participants.

Potential Barriers to Participation

A substantial percentage of participants in both the prescriptive (76%) and custom (68%) programs do not see any drawbacks to participating in the program. Those who did identify drawbacks cited the paperwork burden (12% of prescriptive program participants and 7% of custom program participants) and the amount of effort required relative to the incentive amount (6% and 7%, respectively). Only custom participants mentioned the cost of the equipment installed (7%).

When customer were asked why others are not participating, a lack of program awareness (55%) and financial reasons or a lack of resources (27%) were cited as the greatest reasons why similar companies probably do not participate in the program.

Utility and Implementer Interaction

Interviews with program staff at AIU, SAIC and GDS Associates reveal satisfaction with the working relationship between the utility and its implementation partners. Similarly, interviews with Key Account Executives (KAE) indicate general contentment with the level of communication from others at AIU, as well as SAIC. All but one of the KAEs with whom the Evaluation Team spoke felt they had sufficient information about the program to promote it to their customers, as well as direct them to additional web-based resources and SAIC staff.

More generally, the group of KAEs interviewed report working collaboratively with program staff from SAIC whether by setting up joint customer meetings to introduce the program or directing technical questions to staff members on their customer's behalf. The interviewed KAEs also recall the presence of both AIU and SAIC program staff at quarterly KAE meetings and other sessions where they took an active role in explaining the program.

Customer Indicated Areas for Improvement

The most commonly mentioned recommendations for improving the program are offering higher incentives (31%), publicizing the program more widely (19%), and offering more measures (14%). These suggestions were equally supported by participants in the prescriptive and custom programs.

4.3 Impact Results

While the program may be having impacts in areas such as trade ally knowledge or availability of energy efficient equipment, our results focus only on the energy and demand impacts associated with program activities. Gross impacts are defined as the change in energy (or demand) consumption that results directly from program-related actions taken by program participants, regardless of why those actions were taken. Net impacts are defined as the impacts that can be fully attributed to the program. Net impacts may be lower than total program gross impacts due to energy savings that would have occurred in the absence of the program (free riders). Conversely, the net impacts may be higher than total program gross impacts due to energy impacts that occurred because of the program, but were not incented by the program (spillover). The evaluation team included both free rider and spillover adjustments to create the net impacts.

4.3.1 C&I Prescriptive Program

Our impact analysis activities yielded ex post gross kWh impact estimates that exceed the ex ante estimates, while evaluated gross kW impacts are lower than the projected ex ante values. (Table 8)

Table 8. Gross Impacts – Prescriptive Program

Gross Impacts					
	N	Ex Ante		Ex Post	
End Use	Projects	kW	kWh	kW	kWh
HVAC	4	11	109,397	4	111,771
Lighting	49	2,664	16,224,906	2,422	19,570,043
Motors	2	4	24,929	1	4,409
Refrigeration	30	157	2,346,633	157	2,346,633
Total	**85**	**2,837**	**18,705,865**	**2,584**	**22,032,856**
Gross Realization Rate				0.91	1.18

Note: Realization Rate = Ex Post Value / Ex Ante Value

- The ex post HVAC demand impacts were lower due to the addition of a motor loss factor in the ex post savings algorithm.
- For the ex post HVAC energy impacts, one project had more ex post savings than expected, which brought the end use close to the ex ante value. This was despite having one project disallowed due to too low a SEER value for the installation, and the other two projects coming in under their respective ex ante values.
- The ex post lighting demand values are lower due to the application of the coincident demand factors by building type in the ex post analysis.
- The ex post lighting measures tended to have higher hours of operation found through the survey than used in the ex ante calculations (Figure 3), driving up the ex post kWh values.
- The estimated energy impact for one motor was reduced due to fewer operating hours indicated by the customer than within the ex ante estimate (1,456 hours of operation versus 7,488). The demand impacts are lower due to the ex post calculation using the Technical Reference Manual (TRM) input assumptions versus the 2005 DEER calculation used in the ex ante estimate.[16] This decrease in kW impact carried through to the energy impacts as well.
- Refrigeration had no ex post adjustments as the installed number from AIB and our survey had no differences and the ex ante per unit value was not assessed (as per the evaluation plan).[17]

[16] See the discussion within the TRM memo regarding motors for why the DEER values are considered high.

[17] While the plan did not call for per-unit assessment of motors or HVAC measures either, the TRM review indicated difficulties in both these end uses and the evaluation team chose to review these two other end uses more closely.

Figure 3. Prescriptive Lighting Hours of Operation (by measure)

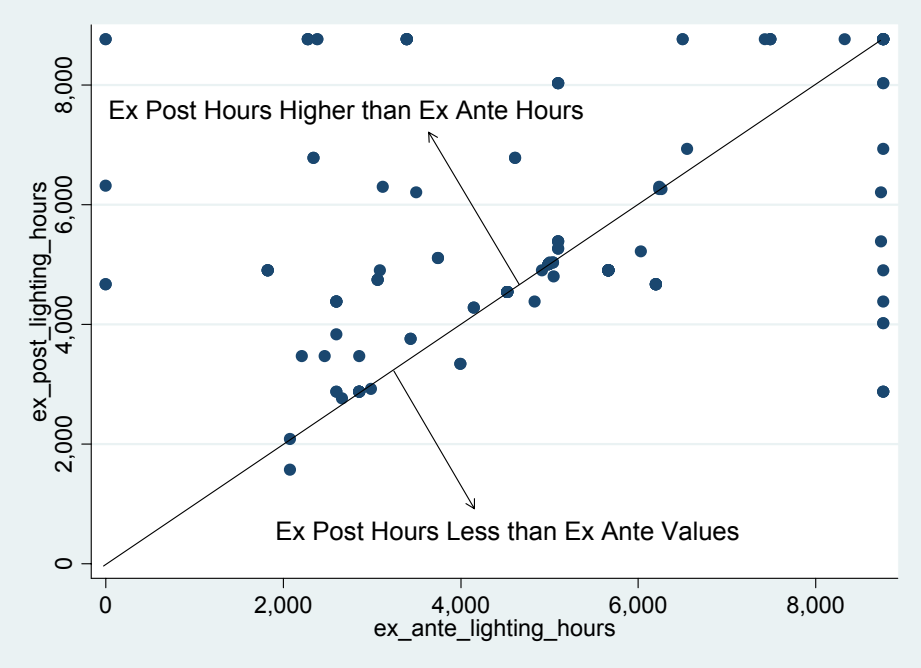


Table 10 below presents the estimated NTGR by measure, and program level net energy and demand impacts attributable to the prescriptive program.

Table 9. Net Impacts – Prescriptive Program

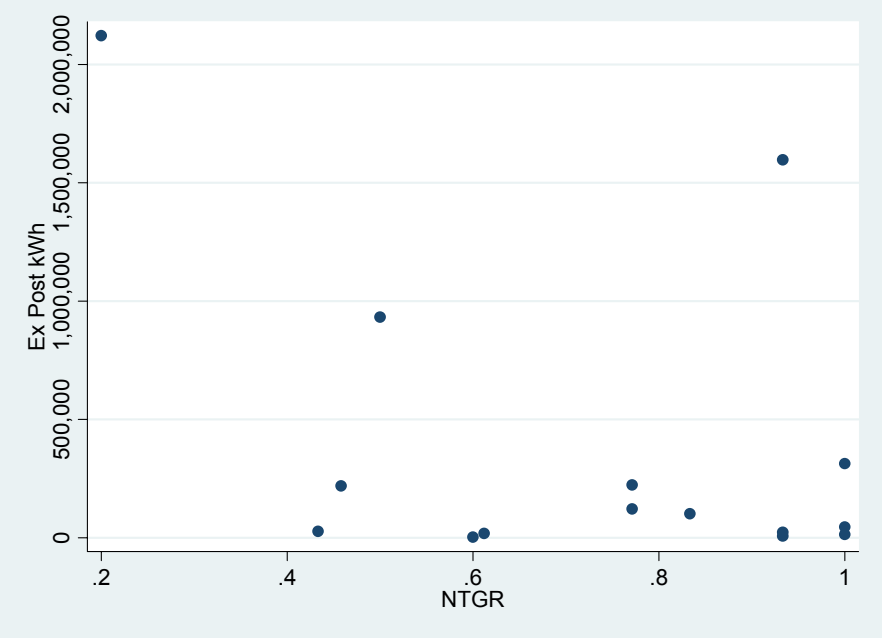
NTGR					
End Use		Ex Ante		Ex Post	
HVAC		1		0.80	
Lighting		1		0.58	
Motors		1		0.43	
Refrigeration		1		0.95	
Net Impacts					
		Ex Ante		Ex Post	
End Use	N Projects	kW	kWh	kW	kWh
HVAC	4	11	109,397	3	89,417
Lighting	49	2,664	16,224,906	1,413	11,356,171
Motors	2	4	24,929	0.4	1,910
Refrigeration	30	157	2,346,633	149	2,229,301
Total	**85**	**2,837**	**18,705,865**	**1,565**	**13,676,800**
Net Realization Rate				0.55	0.73

Note: Realization Rate = Ex Post Value / Ex Ante Value

The evaluation revealed relatively higher free ridership among customers installing lighting and motors. Because the lighting end use is responsible for approximately 85% of the

overall impacts for the program, the 0.58 NTGR[18] for this end use substantially affects the overall net impacts. The reason for this is shown in Figure 4. As the NTGR is weighted by the ex post kWh values, one very large site drives the NTGR for the entire program (i.e., the data point in the top left corner of the figure). The information from this site was closely reviewed to assure that our analysis was appropriately capturing the degree to which savings associated with the incented lighting measures can be attributed to the program.

Figure 4. Prescriptive Lighting Projects NTGR



4.3.2 C&I Custom Program

Our impact analysis yielded ex post estimates that were very similar to ex ante estimates for gross kWh and kW impacts. However, there was variation by end use. (Table 10)

Table 10. Gross Impacts – Custom Program

Gross Impacts					
	N	Ex Ante		Ex Post	
End Use	Projects	kW	kWh	kW	kWh
HVAC	3	75	444,734	27	186,423
Lighting	142	4,821	32,526,914	4,971	33,537,981
Motors	1	130	94,658	11	94,658
Refrigeration	15	23	217,961	23	217,961
Custom	68	2,448	18,402,462	2,496	17,073,542
Total	**229**	**7,496**	**51,686,729**	**7,528**	**51,110,565**
Gross Realization Rate				1.00	0.99

[18] 0.58 NTGR includes spillover.

Note: Realization Rate = Ex Post Value / Ex Ante Value

- The ex post estimates for the HVAC end use were substantially lower due several factors:
  - One site was disallowed as not meeting the program standards (i.e., the efficiency was not as required for the size of the unit)
  - Two sites had not included a load factor in the fan calculation. This was added, reducing the estimated savings.
  - The packaged roof top unit for one site was adjusted downward based on engineering analysis. The ex ante site included cooling in the winter months, which was not included in the ex post analysis.
- Lighting was higher ex post than ex ante for the same reasons as the prescriptive program (i.e., higher hours of operation).
- There was no energy ex post adjustment required for refrigeration or motors. However, the one motor site had multiplied the demand reduction by 12 (for each month of the year). Demand reduction is not multiplicative and the ex ante estimate was reduced.

Table 12 below presents the estimated NTGR by measure, and program level net energy and demand impacts attributable to the custom program. There was no spillover found in custom program customers.

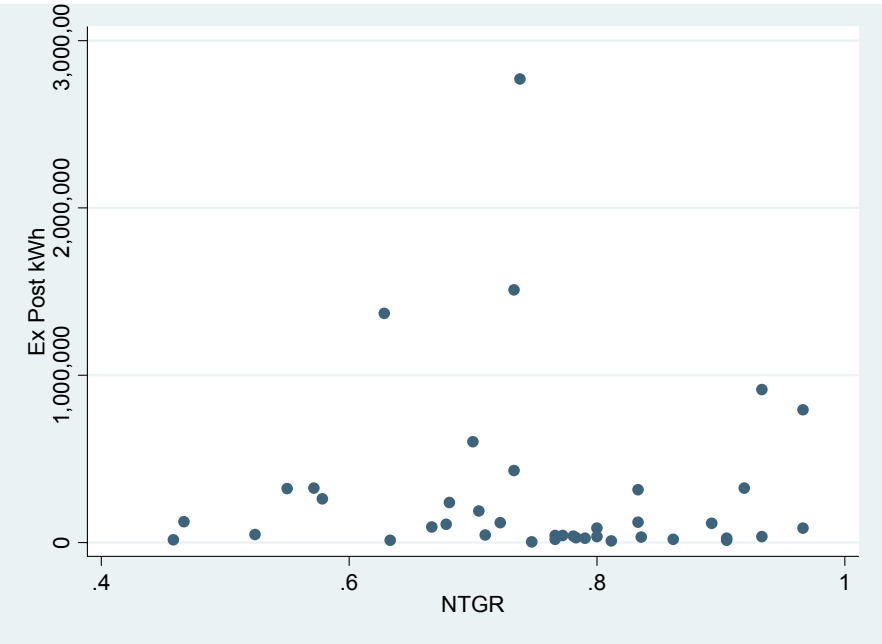
Table 11. Net Impacts – Custom Program

NTGR					
End Use		Ex Ante		Ex Post	
HVAC		1		0.62	
Lighting		1		0.75	
Motors		1		0.99	
Refrigeration		1		0.95	
Custom		1		0.77	
Net Impacts					
End Use	N Projects	Ex Ante		Ex Post	
		kW	kWh	kW	kWh
HVAC	3	75	444,734	17	115,582
Lighting	142	4,821	32,526,914	3,714	25,059,052
Motors	1	130	94,658	11	93,306
Refrigeration	15	23	217,961	22	207,063
Custom	68	2,448	18,402,462	1,918	13,120,675
Total	**229**	**7,496**	**51,686,729**	**5,682**	**38,595,678**
Net Realization Rate				0.76	0.75

Note: Realization Rate = Ex Post Value / Ex Ante Value

Similar to the prescriptive program, the lighting NTGR drove the net impacts. Figure 5 shows the variation in the NTGR for the lighting measures.

Figure 5. Custom Lighting Projects NTGR



The ex post net impacts will be used in the determination of the PY1 portfolio Total Resource Cost test (TRC). The TRC value will be included by AIU in their November report. Cadmus is providing the analysis of TRC values for both the residential and C&I programs. Our evaluation team is working closely with them to provide the needed values for the calculations. As such, we are using the ex ante incremental cost data as well as the ex ante effective useful life data found in the program tracking database.

5. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The C&I portfolio of programs in place for PY1 have been well received by customers. Satisfaction with specific program measures, processes, and the Act On Energy Business Program overall is high. For those programs included in the portfolio, there has also been good implementation fidelity (i.e., the programs are being implemented as originally planned).

Furthermore, AIU's quality assurance and verification procedures are rigorous and ensure high quality projects and tracking data. In particular, the programs are strongest in the areas of post-inspection, verification of project documentation, and assessment of customer satisfaction. The program tracking database (AIB) is well designed and was a very useful tool for the evaluation team during the impact analyses.

In contrast, the TRM has a number of issues that need to be addressed both immediately and over time to ensure the accurate calculation of energy savings estimates. The Evaluation Team identified areas of disagreement over lighting, HVAC and motor measure definitions, as well as lighting and HVAC assumptions and results.

Ex post gross impacts exceeded ex ante impacts, but net values were lower. This is not surprising as the ex ante values had no net to gross ratios (NTGR) applied (i.e., a NTGR=1.0). The ex post NTGRs in this evaluation are typical for C&I programs. For example, a review of 13 different C&I evaluations from multiple years within California and elsewhere of on-going programs with various assessment methods (i.e., self-report and discrete choice) indicated that lighting end uses averaged a NTGR of 0.74, with HVAC at 0.60, refrigeration at 0.74, and "other" end uses at 0.70.[19] A similar review performed close to 20 years ago in California found that commercial prescriptive programs had a NTGR of 0.60.

Impact Recommendations

Based on our assessment of impacts, we make the following recommendations:

- Update the TRM:
  - thoroughly document units, baselines, and algorithms;
  - clarify demand values as peak coincident or non-coincident;
  - provide a peak coincident value for all measures;
  - closely review motors and HVAC data to improve as deemed possible.

[19] Fagan J., Messenger, M., Rufo, M. Lai, P. "A Meta-Analysis of Net to Gross Estimates in California". AESP Proceedings. January 2009.

- Continue the practice of inputting multiple types of information into AIB. It has been a valuable resource during the impact evaluation.
- Update AIB to more easily pull needed data for the Total Resource Cost test for PY2 and PY3.

Process Recommendations

Key recommendations related to the program processes are:

Program Design and Processes

- Where possible, efforts should be made to create greater fluidity between program years. Although necessary for budgetary purposes, the ability to process applications for pre-approval during the crossover period would improve efficiency and keep potential participants engaged. In particular, customers could apply earlier for projects in the next program year and the need to communicate with customers about why the program is closed or not accepting applications on a temporary basis would cease.
- Despite the fact that participants found both of the program applications easy to understand and complete, AIU has already made a change to the prescriptive program application by providing a separate application for each end-use. Given the positive feedback received to date, program staff should continue to monitor customer feedback to ensure that the application process remains straightforward and easy to follow for participants.

Data Tracking

- Some key evaluation data fields related to program allies, such as contractor phone number, contact name and approval status, are not populated for all records in AIB. We recommend periodically reviewing the database to ensure that these fields are complete and to correct database entries where information has been entered inconsistently or incorrectly. For example, for some allies, the Allies Contact Name was entered in the Allies Company field while the company name was entered in the contact name field.
- Including a "Date Added or Approved" field for program allies would also be useful as the program matures. This information would enable the evaluation team and program staff to assess growth in the program ally network over time and during particular periods.

Marketing and Outreach

- The program should consider ways to draw upon the high levels of participant satisfaction with the program in future marketing and outreach efforts. While AIU is planning to develop case studies based on successful customer projects from Program Year 1, we recommend that the development of this collateral is prioritized and made a visible component of the marketing strategy for both programs.

Program Allies

- If a key benefit of joining the Program Ally Network is the exposure and free advertising available to participating contractors through the service provider listings on the Act On Energy Business Program Website, customers have to know that this information exists. Given the lack of participant awareness of even official "Program Allies", AIU should develop a strategy to raise awareness among and demonstrate the value of this program component to their customers. One option is to utilize findings from this evaluation, specifically the high use of contractors and customer satisfaction with them, to promote the ally listings.

A. DATA COLLECTION INSTRUMENTS

Provided as a separate file.

B. Due Diligence and Verification Memo

Provided as a separate file.

C. AIB DATABASE REVIEW MEMO

Provided as a separate file.

D. TECHNICAL REFERENCE MANUAL MEMO

Provided as a separate file.

E. ENGINEERING DETAILS

The engineering algorithms are presented in this appendix.

The estimated lighting end use impacts began by applying the set of algorithms shown below.

Appendix Figure 1. Ex Post Algorithms for Lighting End Use

$$Ex\ Post\ kW\ Non-Coincident\ Impact_p = Ex\ Ante\ kW_p * Ex\ Post\ Adj1_p * Ex\ Post\ Adj2_p$$

$$Ex\ Post\ kWh\ Impact_p = Ex\ Post\ kW\ Non-Coincident\ Impact_p * Ex\ Post\ Hours\ of\ Operation_p * Interactive\ Effects_p$$

Where p=project

The realization rate is calculated using only those surveyed projects as shown next

$$Prescriptive\ Program\ Gross\ Realization\ Rate = \frac{\sum_{p=1}^{15} Ex\ Post\ kWh_p}{\sum_{p=1}^{15} Ex\ Ante\ kWh_p}$$

And then applied back to the population of projects using the algorithm below.

$$Prescriptive\ Program\ Ex\ Post\ Population\ kWh\ Impact = \sum_{p=1}^{49} Ex\ Ante\ kWh_p * Prescriptive\ Program\ Gross\ Realization\ Rate$$

The custom program applied the same algorithms, except with different numbers.

$$Custom\ Program\ Gross\ Realization\ Rate = \frac{\sum_{p=1}^{p=40} Ex\ Post\ kWh_p}{\sum_{p=1}^{p=40} Ex\ Ante\ kWh_p}$$

$$Custom\ Program\ Lighting\ Gross\ Popluation\ kWh\ Impact = \sum_{p=1}^{p=142} Ex\ Ante\ kWh_p * Custom\ Program\ Gross\ Realization\ Rate$$

The ex post demand impact is for a coincident demand and is calculated as:

$$Ex\ Post\ kW_p = Ex\ Post\ Non-Coincident\ kW\ Impact_p * Coincident\ Diversity\ Factor_p * Demand\ Interactive\ Factor_p$$

A gross realization rate is calculated as shown for energy and applied identically.

The engineering estimate for the motors end use is shown below.

Appendix Figure 2. Ex Post Algorithms for Motors End Use

$$Ex\ Post\ kW\ per\ Motor_m = Horsepower_m * Load\ Factor_m * 0.746 * \left(\frac{1}{Base\ Efficiency_m} - \frac{1}{Post\ Efficiency_m}\right)$$

There were two motors in the prescriptive program and three in the custom program that are covered by the algorithms below (i.e., n=2 or n=3 depending on the program).

$$Ex\ Post\ kW\ Impact = \sum_{m=1}^{n} Ex\ Post\ kW\ per\ Motor_m * Number\ of\ Motors_m$$

$$Ex\ Post\ kWh\ Impact = \sum_{m=1}^{n} Ex\ Post\ kW\ per\ Motor_m * Number\ of\ Motors_m * Operating\ Hours_m$$

Where m=motor

The Net-to-gross factor was calculated as shown in the algorithm below. This was identical to how the basic NTGR was calculated for ComEd.

Appendix Figure 3. Basic Net to Gross Algorithm for Standard and Standard Revised Projects

$$NTGR = Average\ of\ Influence\ (Program\ components, no - program\ timining, and\ direct\ influence)$$

$$Influence\ of\ program\ components = Max\ value\ from\ 5\ components\ (1.available\ of\ the\ rebate, 2.information\ provided\ by\ audit\ or\ other\ technical\ assistance, 3.\ information\ from\ utilty\ or\ program\ marketing\ materials, 4.porgram\ staff\ recommendation, 5.recommendation\ by\ utility\ account\ representative)$$

$$Influence\ of\ Program\ Timing = prorated\ value\ based\ on\ indication\ of\ when\ measures\ may\ have\ been\ installed\ without\ the\ program$$

$$Dtrect\ Influence = Value\ from\ respondent\ that\ is\ cut\ in\ half\ if\ they\ indicate\ that\ they\ learned\ about\ the\ rebate\ after\ installing\ the\ measures$$

F. RETRO-COMMISSIONING PROGRAM

Program Description

Under the retro-commissioning program, AIU shares the cost of a facility study with customers interested in identifying low and no cost retro-commissioning opportunities in the areas of compressed air and health care more generally. The level of cost-sharing ranges from 50-80% depending on the cost effectiveness of the potential project and the level of expected energy savings. Upon completion of the facility study and agreement on an implementation plan, the participating customer is responsible for implementing the agreed upon energy efficiency measures or repairs.

During Program Year 1, the retro-commissioning program was introduced as a pilot program, and only one project was completed. Therefore, our evaluation is limited to high-level observations about the program processes and a review of the types of project data collected during the pilot phase. The latter activity is designed to determine whether sufficient information is currently collected to support future impact evaluation.

Process Results

Program Changes

The design and development phase for this program included research into retro-commissioning programs around the country, as well as the demographics of the AIU service territory. These activities led to a more tailored approach to retro-commissioning than initially outlined in the Energy Efficiency and Demand Response Plan filed in November 2007. As implemented, the retro-commissioning program has two areas of focus: compressed air and the healthcare sector.

This change in program design was well conceived and reflects an understanding of where the potential for retro-commissioning exists within the AIU service territory, which is unique in terms of the sectors where large facilities are located. For example, program staff found that the healthcare industry was the only sector with a population of facilities over 100,000 square feet. Likewise, according to program staff, within facilities of this size, compressed air systems are a reasonable choice for retro-commissioning.

Program Participation

In Program Year 1, the compressed air target was successfully reached and the single pilot participant completed air compressor leak reduction at their facility. The program ally that participated in the pilot project was a good fit with AIU expectations regarding the type of allies that could support the program based on the company's compressed air services, including audits, as well as their participation in a number of Act On Energy custom incentive projects. This ally was also a registered member of the Program Ally Network.

Program Outreach and Awareness

During the pilot program, the program implementer leveraged the relationships it developed through the custom and prescriptive incentive programs to alert the allies active in those programs that the retro-commissioning program would be coming online. Allies were also informed that participants were needed for the program and ultimately the pilot participant was selected based on an ally recommendation and introduction.

Given the small scale of the pilot program, further evaluation of program outreach will take place during Program Year 2 when there is a defined marketing and outreach strategy in place.

Program Processes

The process for participation entails a number of steps that while un-documented during the pilot phase are now presented to customers through a two-page program overview document. The process consists of application, technical review, survey or retro-commissioning study, implementation and verification phases. There are also additional steps for documentation of customer commitment and approval of final payment. Future evaluation efforts will examine participant perception of and satisfaction with each of these program components and the overall program.

The Opinion Dynamics team also conducted a review of all project documentation from the pilot participant in order to determine whether sufficient information is currently gathered to support impact evaluation, which will take place in later evaluation cycles. In general, the project documentation, particularly the final project report, provides a large amount of valuable information, but certain key energy related data is missing.

In terms of the present approach, the current strategy of ranking leaks as small, medium, large, or extra large for leak repair projects is appropriate. However, in addition to taking a meter reading before the leaks are fixed, measurements should be taken after the project is completed. The same is true for improvements in air distribution. As a result of these improvements, a reduction in air compressor pressure is expected and should be verified by monitoring pressure before and after the project. For the pilot project, only pre-project measurements of compressor pressure are documented.

Areas for Improvement

- Now that the program is fully operational, the program implementer should create a written program implementation plan that addresses any discrepancies between the implementation strategy presented in the Energy Efficiency and Demand Response Plan and the way the program is implemented. Documentation of this nature is essential particularly now that retro-commissioning service providers are a formal part of program delivery. It is also important given the potential for program growth and the associated changes in program management responsibilities that may occur in association with an expansion.
- Similarly, the technical review process should be formally outlined (as in Appendix A of the Technical Review Manual used for the Custom and Prescriptive Incentive Programs) so that the roles and responsibilities of program staff are clearly defined. In addition,

protocols for establishing the incentive or cost-sharing levels, for determining benchmarking and eligibility, and for customer recruitment should be documented.

- In order to evaluate the impact of the retro-commissioning program, additional information related to the air compressor equipment and systems in place is needed. For example, the evaluation team needs detailed control sequences, equipment specifications and part-load performance curves, preferably those specific to the equipment under consideration, but at a minimum generic ones. In addition, information is needed related to pre and post project compressor operations (i.e., what compressors are now operating? How will they be sequenced post-project? What is the metered kW for each compressor after the project?). This would allow the evaluation team to confirm compressor sequencing.

Impact Results

This pilot program only had one project completed in PY1. In line with the evaluation plan, because this site was a very small component of the overall PY1 estimated impacts, we did not perform any impact analysis for this project. The ex ante estimate of savings is:

kW Impact: 117

MWh Impact: 1,022

NTGR: 1.0

To help assure impact evaluability in the future, we reviewed the paperwork to determine if the program was capturing sufficient information for any future impact assessment, which is discussed above.