BizSavers Program Evaluation Report

January 2013 – December 2013

Prepared For:

Ameren Missouri

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Research Into Action

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1. Executive Summary

This report presents the impact and process evaluations of the BizSavers custom, standard, new construction, and retro-commissioning programs, which occurred during the 2013 calendar year, January through December. The ADM EM&V team includes ADM Associates and Research Into Action, which performed process evaluation of the programs. The primary evaluation activates are summarized below:

- Data for the study were collected through review of program materials, on-site inspections, end-use metering, and interviews with Ameren Missouri staff members, Lockheed Martin staff members, and participating customers and contractors.
- Samples were drawn for the custom and standard program components that provide savings estimates at the 90% confidence level. Two new construction projects and one retro-commissioning project were completed during the program year and analyzed in this report. A census of these projects had savings measured and verified. Table 1-1 shows different types of data collection employed for this study and their sample sizes for each program component.
- Field technicians made on-site visits to collect data for savings impact calculations, to verify measure installation, and to determine measure operating parameters. Equipment was installed on a majority of sites to accurately monitor the hours of operations of new lighting equipment and motors/VFDs. The 60 projects for which on-site measurements and verification data were collected accounts for approximately 21% of custom program gross ex ante kWh savings and 22% of the standard program gross ex ante kWh savings.
- Facility staff were interviewed to determine the operating hours of the installed system and to locate any additional benefits or shortcomings with the installed system.
- Customer surveys provided insight into the participants' decision-making processes, levels of satisfaction with the program, and tendencies to invest in energy efficiency in the future. The results informed the net-to-gross analysis, as well as, a portion of the process evaluation.
- Interviews with 202 customer decision makers, 77 trade allies, and other relevant contractors and program staff members provided additional information for the process evaluation.

Table 1-1 provides a summary a summary of the data collection efforts that are outlined above. The table lists the source of each data element, the outcome, the purpose, and timeline of each data collection activity.

Table 1-1 Summary of Data Collection Efforts

Data Source	Outcome	Purpose	Period of Data Collection
Impact Analysis			
On site M&V			
Pre- Install Site Visits*	7 Visits	Install monitoring equipment to establish project baseline	All Year - 2013
Post-Install Site Visits	39 Visits / 60 Projects	Verify project energy savings	All Year - 2013
Spillover Analysis			
Documentation Review	20 Projects	Identify measures that did not qualify for program incentives, but were installed	Oct - Dec
On-Line Survey	46 Responses	Identify customers that said they were "likely to buy efficiency equipment because of their experience with the program"	Oct - Dec
Phone Interview	30 Responses	Follow up with survey respondents to understand what they actually installed	Oct - Dec
Process Analysis			
Participants			
On-line Survey**	202 Responses	Collect data about customer satisfaction, free ridership, and spillover	May, April, Aug, Sept, Nov, Dec-2013
Near Participants			
In-Depth Interviews	5 Interviews	To investigate the reasons for discontinuation of the application and possibly prevent future lost savings opportunities	Oct - Dec-2013
Program Staff			
In-Depth Interviews	15 Interviews	To gain a full understanding of the program’s goals, implementation, and delivery for the current program cycle	Jan, May, June, July - 2013
Trade Allies			
In-Depth Interviews	77 Interviews	To better understand program awareness, benefits of the Trade Ally Network, training received, perceptions of program marketing, customer program awareness, promotion of energy efficiency, and program experience	Oct - Dec-2013
Training Events			
In-Person Survey	2 Events /18 Responses	To assess how well these events deliver program information to service providers and customers	Oct - Dec-2013

Data Source	Outcome	Purpose	Period of Data Collection
Cost Effectiveness Analysis			
Economic and Financial Assumptions	Delivered to MMP	Used to develop the economic model, these assumptions include Ameren MO's discount rate, line losses, avoided electric T&D	Dec-13
2013 Spending Data	Delivered to MMP	Financial data to be used as inputs for the Cost Effectiveness Analysis (program level)	Dec-13
DSMore Batch Tools	Delivered to MMP	Measure level EUL and incremental costs, to be input into the model	Dec-13
Aggregation Results	Delivered to ADM	Included the calculations for each cost test	Jan-14
Write up	Delivered to ADM	A summary document that provides a detailed account of the analysis	Jan-14

* 21 projects had both custom and standard measures; there were 60 total projects with on-site M&V visits
** 44 decision makers participated in both custom and standard program components; there were 202 total customer decision makers surveyed

The gross ex post energy savings of the BizSavers program during the 2013 calendar year are summarized by program in Table 1-2. During this period, the custom program's gross ex post energy savings totaled 47,420,812 kWh, while standard program's gross ex post energy savings totaled 25,081,134 kWh. The gross kWh savings realization rate for the custom program is 92%, while the gross kWh savings realization rate for the standard program is 105%. The new construction program's gross ex post energy savings totaled 217,614 kWh, while the retro-commissioning program's gross ex post savings totaled 335,638 kWh. The gross kWh savings realization rates are 129% and 106%, respectively.

Net savings are equal to gross savings, *minus* free ridership, *plus* participant spillovers, non-participant spillovers, and market effects. The evaluation of net savings presented in this report does not include assessment of non-participant spillovers or program-attributable market transformation. During this period, the custom program's ex post net energy savings totaled 43,875,548 kWh, while the standard program's ex post net energy savings totaled 23,899,394 kWh. The estimated net to gross ratio for the custom program is 93% and 95% for the standard program. The new construction program's ex post energy savings totaled 204,121 kWh, while the retro-commissioning program's ex post energy savings totaled 223,759 kWh. Their estimated net to gross ratios are 94% and 67%, respectively.

Table 1-2 also provides a summary of kWh savings for each BizSavers Program relative to Ameren Missouri's 2013 energy savings goals. Overall, the BizSavers Program portfolio ex post net energy savings (68,202,820 kWh), achieved 91% of its 2013 annual kWh savings goal (75,122,212 kWh). The ex post net kWh energy savings for new construction (204,121 kWh) and retro commissioning programs (223,759 kWh) met 8% and 10% of the program 2013 energy savings goals, respectively. The low program kWh savings, relative to the 2013 goals, is, at least in part, due to the suspension of these programs during the bridge year; furthermore, these types of projects take longer to approve, plan, and complete. The 2014 project pipeline for the new construction and retro commissioning programs already contains projects with ex ante savings well in excess of 2013 levels. The standard program achieved 111% of the program 2013 energy savings goal with 23,899,394 kWh in post net kWh savings, and the custom program achieved 90% of the program 2013 energy savings goal with 43,875,548 kWh in ex post net savings.

Table 1-2 Summary of kWh Savings for BizSavers Programs

Program Component	*Ameren Missouri kWh Savings Goals 2013*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross kWh Savings Realization Rate*	*Ex Post Net kWh Savings*	*Estimated Net to Gross Ratio*	*Percent of Goal Achieved*
Custom	48,682,732	51,535,015	47,420,812	92%	43,875,548	93%	90%
Standard	21,573,968	23,793,935	25,081,134	105%	23,899,394	95%	111%
New Construction	2,513,756	168,063	217,614	129%	204,121	94%	8%
RCx	2,351,756	316,031	335,638	106%	223,759	67%	10%
Total	75,122,212	75,813,044	73,055,198	96%	68,202,820	93%	91%

The gross ex post peak kW reductions during the 2013 calendar year are summarized by program in Table 1-3. The gross peak demand savings for the custom program totaled 10,253.51 kW, and 4,291.96 kW for the standard program. The gross ex post peak kW savings for the new construction program totaled 45.97 kW, and 72.58 kW for the retro-commissioning program. The ex post net peak demand savings for the custom program are 9,479.65 kW, while the ex post net peak demand savings for the standard program are 4,088.704 kW. The ex post net peak demand savings for the new construction and retro-commissioning programs totaled 43.12 kW and 48.39 kW, respectively. The BizSavers 2013 peak demand savings target (18,890 kW) was higher than the achieved ex post net peak demand savings (13,659.86 kW). Ex post peak demand savings fell short for each program component.

Table 1-3 Summary of Peak kW Savings for BizSavers Programs

Program Component	*Ameren Missouri Peak kW Savings Targets: 2013*	*Gross Ex Ante Peak kW Savings*	*Gross Ex Post Peak kW Savings*	*Gross kWh Savings Realization Rate*	*Ex Post Net Peak kW Savings*
Custom	13,022	10,301.60	10,253.51	100%	9,479.65
Standard	4,540	3,264.74	4,291.96	131%	4,088.70
New Construction	797	-	45.97	N/A	43.12
RCx	531	70.00	72.58	104%	48.39
Total	18,890	13,636.34	14,664.02	108%	13,659.86

The following section summarizes conclusions and recommendations that resulted from the evaluation activities. They are organized to present impact and process findings separately. Below is a list of conclusions that characterize key trends from the impact and cost effectiveness analyses.

- Program staff used a Heating and Cooling Interactive Factor (HCIF) of 1.00 to calculate energy savings for lighting projects, regardless of building type. This resulted in an underestimation of energy savings for several lighting projects. ADM analysts use HCIF's that are available in the TRM to calculate the gross ex post savings associated with lighting projects. HCIF will typically increase the gross kWh savings realization rate, by accounting for a decrease in HVAC cooling load due to lighting retrofits.
- The low gross realization rates for lighting control projects can be attributed an overestimation of operating hours that occurs during ex ante savings estimations. Currently, the implementation contractor, Lockheed Martin, uses a deemed savings value based on control type to calculate ex ante saving. The evaluation team uses models that reference a room type for every piece of lighting control equipment. Currently, customers are not required to provide information or documentation on where the controls are installed or to which fixtures they are connected. Lockheed Martin's approach to estimating gross ex ante energy savings for projects with lighting controls, results in savings estimates that are overestimated.
- The low gross kWh savings realization rate for cooler door retrofits can be attributed to the ex ante savings calculations not taking into account the interactive effects between the refrigerated case work and the HVAC system. In the baseline condition, the refrigerated cases have no doors, thus allowing refrigerated air to flow from the cases into the adjacent HVAC zone. This action reduces the overall cooling demand of the HVAC zone thus lowering HVAC energy usage. With the addition of the cooler doors, the infiltration to the zone is greatly reduced, therefore, increasing the overall load on the HVAC system and energy usage as it is not

receiving the cooling assistance from the refrigeration system. ADM utilized the DEER Grocery Store prototypical models to calculate the reported savings that were run using appropriate TMY3 weather data. The advantage of this type of analytical simulation is that the interactive effects are taken into consideration along with the effects that weather has on the overall efficiency of the refrigeration system and HVAC system.

- Fourteen linear fluorescent lighting projects, which were sampled in 2013, involved replacement of T-12 lighting with super-efficient T-8 lighting. ADM used the wattage associated with (non-super-efficient) T-8 lighting as the baseline for energy analyses of these projects. This practice is in accordance with the method used by the BizSavers Program.
- The cost effectiveness analysis provides a list of sixteen measures for both the custom and standard programs that were either not cost effective, with a TRC < 1, or were close to 1, with a TRC ≤ 1.25.

Based on the above conclusions, the evaluation team offers the following impact recommendations to be considered for planning future program cycles.

- ADM suggests that program staff apply the HCIFs by building type that are available in the TRM to more accurately estimate lighting project savings. Project documentation already requires the customer to indicate the building type; therefore, applying the HCIF should not require the collection of additional information.
- To improve realization rates for lighting control projects, ADM suggests estimating savings based on building and space type, which would require collecting additional documentation about where lighting controls are installed and to which fixtures they are connected. When ADM reached out to customers or their contractors to obtain this information, it was usually available. If Lockheed Martin would collect this documentation for all projects with lighting controls, they could more accurately estimate savings for these projects.
- Based on ADM's analysis of cooler door retrofits, the TRM-estimated energy savings appear to be high. ADM recommends that evaluation data collection for this measure be appropriately accounted for during future updates to the TRM.
- Ameren Missouri and Lockheed Martin should review the cost effectiveness of eligible measures. If measures are not cost effective, there is indication that funds could be better spent on measures that provide greater savings.
- Ameren Missouri and Lockheed Martin should consider standardizing the measure categories. The review process was very time intensive; standardizing the measure categories could improve the efficiency of the evaluation effort and associated evaluation budget.

The results of the process evaluation research are largely positive. Program participant and trade ally satisfaction was high across all program facets. However, the program fell short of meeting its goals by year-end. This report provides some recommendations to help the program to more effectively realize savings and reach its stated goals in the coming program year.

Below, conclusions and recommendations are organized according to the five regulatory research questions specified in 4 CSR 240-22.070(8). First is, what are the primary market imperfections; next, is the target market segment appropriately defined; then, do program measures reflect the target market's needs and available technologies; are communication and delivery channels and mechanisms appropriate; and finally, are there better ways to address market imperfections to increase adoption of program measures. The conclusions address the first four questions; the fifth question speaks to recommendations.

- **Research Question 1:** What are the primary market imperfections common to target market segment?

  ”Market imperfection” is a term typically used in finance to refer to limitations that reduce an actor's ability to sign and honor financial contracts. In the context of this process evaluation, we interpret this to mean any structural barriers that prevent Ameren Missouri customers from participating in the BizSavers programs. Overall, results suggest that the primary barrier, common to most energy efficiency programs, is lack of up-front capital. This disproportionately affects small businesses, which also appear to be less aware of BizSavers incentives, on average, than larger businesses. The small business sector is notoriously difficult to reach.[1]

- **Research Question 2:** Is target market segment appropriately defined, or does it need further subdivision or merging with other segments?
- Projects were distributed across a range of business types in rough proportion to the distribution of business types in the general population, suggesting that the program is effectively reaching the main segments of the target market. Projects were disproportionately concentrated in large buildings, and tended to be somewhat disproportionately concentrated in St. Louis and its suburbs. This initially low showing by these targets supports ongoing program plans for follow-up with these targets during 2014.
- **Research Question 3:** Do program measures reflect diversity of end-use needs and available technologies for target segment?

[1] Fisher, M., Moran, D., and Gogte, S. (2013). Engaging Small Customers: Maximizing the Direct-Install Hook. Presented at the Association of Energy Services Professionals 23rd National Conference, January 2013.

The range of equipment meets the needs of respondents. Equipment generally is delivered with little delay. Participants are largely satisfied with the range of program-qualified equipment, the quality of the installed equipment and the quality of installation. Standard program participants that decided not to pursue the custom option did so primarily because the standard option covers their equipment needs.

Program rules and requirements may be too stringent for the retro-commissioning market, as Retro-commissioning service providers (RSPs) found that program rules sometimes do not allow customers to capture custom project opportunities, which may prevent participation.

- **Research Question 4:** Are communication and delivery channels/mechanisms appropriate for the target market segment?
- The program is marketed through multiple channels and the implementer reports active outreach to end-use customers and service providers. The latter is important, as service providers are critical to program communication and delivery. However, many service providers who are not members of the trade ally network are not aware of its existence. Moreover, service provider reports suggest that program awareness could be increased in the general business population. Lack of clarity in application instructions may be a barrier to effective program delivery, creating delays in and possibly abandonment of project implementation.

  The BizSavers programs were primarily targeting higher energy-use customers during 2013, but program managers also reported outreach aimed at small businesses. The evaluation team compared those reported activities with several recently identified best practices for targeting the small business sector.[2] Based on staff reports, the BizSavers program uses many (but not all) of the identified best practices. Other program administrators and implementers have reported success with free direct install of low-cost measures – both as a source of savings and as a foot in the door for additional savings – and using market research to identify market segment for targeted marketing and outreach.[3,4,5]

- **Research Question 5:** Are there better ways to address market imperfections to increase adoption of each program measure?

[2] Mougne, Ti. (2013). The Playbook for Small Business Direct-Install Programs. Presented at the Association for Energy Services Professionals National Conference, Orlando, FL, 2013.

[3] Mougne, Ti. Op. cit.

[4] Garland, G. (2013). Successful Tactics for Improving Customer Satisfaction in Small and Unassigned Businesses through Energy Efficiency. Presented at the Association for Energy Services Professionals National Conference, Orlando, FL, 2013.

[5] Mazur-Stommen, S. and Herzer, B. (2014). Unmined Gold. Engaging Small Commercial Customers. Presented at the Bonneville Power Administration-Northwest Energy Efficiency Alliance Efficiency Exchange Conference, Kennewick, Washington, 2014.

Based on the above conclusions, the evaluation team offers the following process recommendations to improve program effectiveness and increase adoption of program measures.

- Lockheed Martin should continue working to expand the trade ally network and educate non-member service providers about program offerings and application processes.
- Lockheed Martin should continue to work to clarify application instructions, particularly for the custom program, and ensure that service providers and end-users know whom they can contact to get assistance with applications. To inform efforts to clarify instructions, Lockheed Martin should solicit feedback from customers and service providers on sources of confusion or difficulty.
- Ameren Missouri and Lockheed Martin staff should work together to formalize orientation materials for new service providers, possibly including a brief online orientation video. Such materials should stress that learning how to fill out the application correctly up front will save them time in the end.
- Lockheed Martin should re-examine the rules and incentives for custom measures in the Retro-commissioning program and possibly solicit feedback from retro-commissioning service providers on how the current rules limit customers' ability to capitalize on savings opportunities and possibly prevent participation.
- Lockheed Martin staff should continue to work to improve program penetration of the small business sector and should consider additional approaches that may include free direct install of low-cost measures to generate immediate cost-effective savings and generate interest in future projects. Staff should also consider conducting additional market research to provide information on specific needs and motives of small business segments. Further, Lockheed Martin staff should incorporate feedback from participants in the Distributor Partnership Program trial to determine the extent to which it enables the program to more effectively generate savings from hard-to-reach segments, including smaller businesses and service providers not otherwise engaged with the program.

2. Introduction

The following report has five primary chapters that provide a detailed impact assessment of the BizSavers Program. Ameren Missouri offers four unique programs to its business sector customers. This is the fifth program year of the custom and standard program components, while the retro-commissioning and new construction program components are returning after a one year hiatus. This report presents results for the custom, standard, new construction and retro-commissioning programs for activity during the 2013 calendar year.

2.1. Description of Program

The BizSavers Program was designed to help businesses identify and implement energy saving projects. The four program components evaluated in this report are described as follows:

- Standard incentives, which are payments for the installation or use of specific energy efficient equipment; and
- Custom incentives, which are payment for qualifying energy measures at a rate of $0.07/kWh for non-lighting measures and $0.06/kWh for lighting measures.
- RCx incentives have two components, an RCx study incentive and an implementation incentive. The study incentive rate is dependent on the project track type and the level of savings associated. The implementation incentive is paid ex ante energy savings calculated at a rate of $.07/kWh saved. The total customer incentive is the sum of both the study incentive and the implementation incentive.[6]
- New construction incentives are payments for purchase and installation of energy efficiency measures for new construction projects. Four primary types of incentives exist: whole building performance incentive, standard incentive, installed interior lighting incentive, and custom incentive. The whole building performance incentive is designed to encourage a holistic approach to energy design and provide a financial incentive for quantifying these design savings and is based on the total savings achieved as shown in Table 2-1 below. The other three incentive types depend on the measure installed and/or its performance, and are paid at a rate comparable to the standard and custom retrofit rates.

[6] https://www.ameren.com/sites/aue/UEfficiency/businessenergyefficiency/Documents/BizSavers/Retrocommissioning IncentiveGuidelines.pdf

Table 2-1 New Construction Program Incentives

From Baseline	*While Building (Design)*	*Custom (non-lighting)*	*Standard*
10-19% energy savings	$0.02/kWh	$0.07/kWh	See Schedule
20-29% energy savings	$0.03/kWh	$0.07/kWh	See Schedule
30% energy savings	$0.04/kWh	$0.07/kWh	See Schedule

Gross ex ante kWh savings by program are shown in Table 2-2. There were 620 custom projects during the 2013 calendar year with gross ex ante energy savings of 51,535,015 kWh. During the same period, there were 817 standard projects with gross ex ante savings of 23,793,935 kWh. There were two new construction projects completed with gross ex ante savings of 168,063 kWh, and one retro-commissioning project with gross ex ante savings of 316,031 kWh.

Table 2-2 Gross Ex Ante kWh Savings for BizSavers Programs

Program	*Number of Projects*	*Gross Ex Ante kWh Savings*	*Gross Ex Ante Peak kW Savings*
Custom	620	51,535,015	10,301.60
Standard	817	23,793,935	3,264.74
New Construction	2	168,063	-
RCx	1	316,031	70.00
Total	1,439	75,813,044	13,636.34

2.2. Program Processes

This section contains information about project processes from interviews with Ameren Missouri program staff.

The program offers four incentive tracks to meet customers' needs:

- *Standard*. The standard track provides defined incentives for prescriptive measures, which are listed on the program website.[7]
- *Custom*. The custom program offers customers a method for qualifying non-standard measures.
- *Retro-commissioning*. The retro-commissioning program motivates trade allies in the BizSavers Trade Ally Network to encourage customers to increase efficiency in buildings and systems.

[7] http://www.ameren.com/sites/AUE/UEfficiency/businessenergyefficiency/Documents/BizSavers/StandardIncentives2013.pdf

- *New Construction*. New construction program eligible projects include any of the following types:
  - New buildings where no structure or footprint currently exists,
  - Warm shell – new, unoccupied buildings that consist of the building envelope, central mechanical system, and core lighting,
  - Addition to or expansion of an existing building, and
  - Change of purpose of an existing building that involves complete replacement of energy-consuming systems.

Prior to application submittal, potential participants identify energy savings opportunities that match corresponding incentives. Program staff may conduct a walkthrough evaluation of the site or otherwise communicate with the customer to help them identify their options. The program also provides tools and calculators to help customers estimate incentives – information customers need to ensure that vendors' analyses maximize incentives.

The program does not allow fuel switching. Gas customers can coordinate with Ameren Missouri to receive energy saving incentives. Lockheed Martin's engineering group, trade allies, and Ameren Missouri customer service advisors and account representatives provide leads.

New construction staff members provide potential new construction customers a handbook to educate them about energy incentive opportunities that includes how to apply for them. The new construction program attempts to intervene early in the design phase to incorporate comprehensive and synergistic efficiencies throughout the design. Projects that have begun construction may qualify for standard or custom incentives using their design as the baseline.

The process for each incented project can be broken down into several stages. Lockheed Martin documents completion of each stage in the program database as a milestone achieved.

2.2.1. Project Initiation

Lockheed Martin receives an application from the customer or trade ally. The standard and custom program components use the same application form, while new construction and retro-commissioning program components each have their own form. Customers may download and print applications from the program website or download and complete them as fillable PDF or Excel forms on local devices. Lockheed Martin staff process PDF versions by transferring the information into Excel workbooks. Standard program applications must be submitted within 180 days of project installation.

Lockheed Martin project coordinators (PCs) verify and enter information from the applications into the project tracking system. Throughout the project processes, PCs interact with trade allies who are listed on project applications, copying them on all correspondence to the customer.

New construction and retro-commissioning program components have distinct application initiation processes.

After receipt of an application, Lockheed Martin staff schedule a meeting with the design team. Design team meetings occur only after the application has been received to document a customer’s intention to pursue a project. The meetings include the applicant or the applicant’s project team. A member of Lockheed Martin’s Business Development (BD) staff always attends the design team meeting; Lockheed Martin PCs and/or an engineer also may attend. At the initial design team meeting, Lockheed Martin staff explains the program, reviews design drawings, and collects information needed to estimate baseline energy use. Larger projects may have multiple meetings. After each meeting, Lockheed Martin sends meeting notes to all attendees, copying the entire design team on all general project-related correspondence. Offers are communicated only to the customers and the main members of their project team.

For retro-commissioning projects, once Lockheed Martin has processed an application, the PC sends the customer and the contracted customer the Retro-commissioning Service Provider (RSP) instructions for conducting a study. The RSP prepares a report that identifies potential upgrades and estimated costs and savings per identified measure. RSPs work independently and use their own savings calculation methods, so Lockheed Martin staff work with the RSP to ensure that they have estimated savings potentials correctly. Lockheed Martin staff do not dictate how RSPs conduct their calculations; as long as the RSP can show appropriate energy savings then Lockheed Martin will accept the RSP’s report. Retro-commissioning program projects may include standard and custom measures; those savings accrue to the retro-commissioning program component.

2.2.2. Application Review

Staff engineers review the application, using specification (spec) sheets as well as data and information provided by the customer to arrive at an incentive offer based on kWh savings. Engineers reviewing projects send requests for clarification to trade allies via e-mail, and consult with the trade ally coordinator as issues arise.

All applications get some level of review, depending on the value of qualifying incentives. For incentives under $1,000, one staff member reviews the application. For incentives from $1,000 to under $10,000, in addition to the initial review, the deputy program manager also reviews the application. For incentives of $10,000 or higher, the program manager provides the third and final application review.

Standard projects with incentives of $10,000 or higher and all custom, new construction, and retro-commissioning projects require pre-approval. As part of this process, Lockheed Martin staff conduct pre-inspections to reveal any discrepancies between stated assumptions in the application and the actual conditions at the customer site.

Retro-commissioning projects and new construction in the whole building performance track require a technical analysis study or engineering calculations to determine energy impacts and incentive amounts. For new construction whole building performance projects, modeling must be started before the design work is fully underway and approved by Lockheed Martin before the project may proceed.

Projects generally use ASHRAE 90.1 2007 standards for estimating the new construction project baseline, although the program may apply an older ASHRAE standard if there are no applicable building or energy codes in the region.

If modeling does not identify sufficient savings to qualify for new construction incentives, the applicant has the option of applying for standard or custom incentives. Standard incentives in new construction projects are the same as for the standard program, with the exception of lighting measures, for which Incentives are based on lighting power density savings. Total lighting wattage must be at least 10% below the baseline wattage to qualify.

2.2.3. Incentive Offer and Commitment

Within 10 business days after an application review is complete and documents are noted as accepted in the tracking system, a PC emails the incentive offer to the customer, who has 30 days to accept it. However, if a customer cannot accept the offer within the 30-day window, staff may make exceptions; in such cases, a PC checks on the customer’s progress as needed.

An estimated project completion date is included on the customer’s returned offer form. If needed, prior to the estimated completion date, Lockheed Martin staff email the applicant to remind them to send documentation of actual completion date and supporting invoices. There are two exceptions to this process: 1) the project has been discontinued for any reason; and 2) the project is placed “on hold” because of unforeseen delays.

2.2.4. Project Installation

After measures are installed, quality control processes appropriate for the project type. Lockheed Martin staff conduct post-installation inspections of all projects with incentives over $10,000 and all new construction and retro-commissioning projects, regardless of incentive amount. Staff also conduct follow-up inspections of a randomly selected sample of 25% of retro-commissioning projects to ensure that no changes occurred after the project was inspected. Staff engineers typically conduct these random follow-up visits at sites involving complex projects; Business Development staff may do follow-up inspections of less-complex projects (e.g., counting lights).

2.3. Program Trends in 2013

Figure 2-1 shows the custom program gross ex ante savings by measure start-up month, while Figure 2-2 shows the standard program gross ex ante savings by measure start-up month. The custom program accrued gross ex ante savings at a rate of about 5 million kWh a month until September; then held fairly constant at 50 million kWh until the end of the year. According to the data, the custom program was generating between 2 million and 8 million kWh savings per month until September when project activity began to steadily decline.

The standard program accrued gross ex ante savings at a higher rate later in the program year. This was because the standard program component, unlike the custom program component, continued to experience a high volume of activity through the 4th quarter.

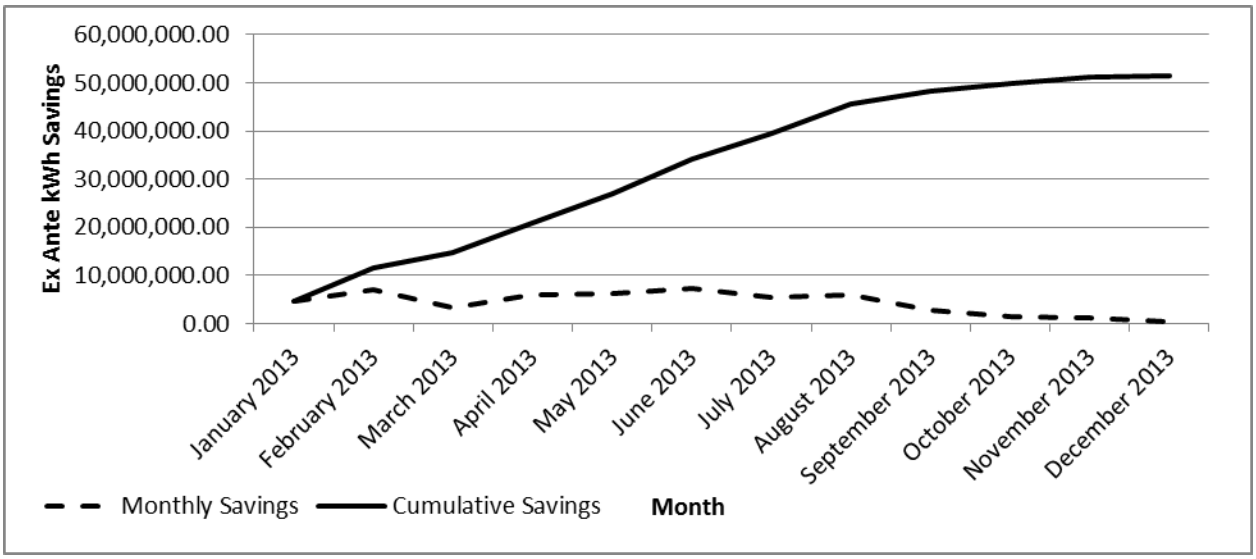


Figure 2-1 Custom Program Gross Ex Ante Savings by Measure Start-up Month

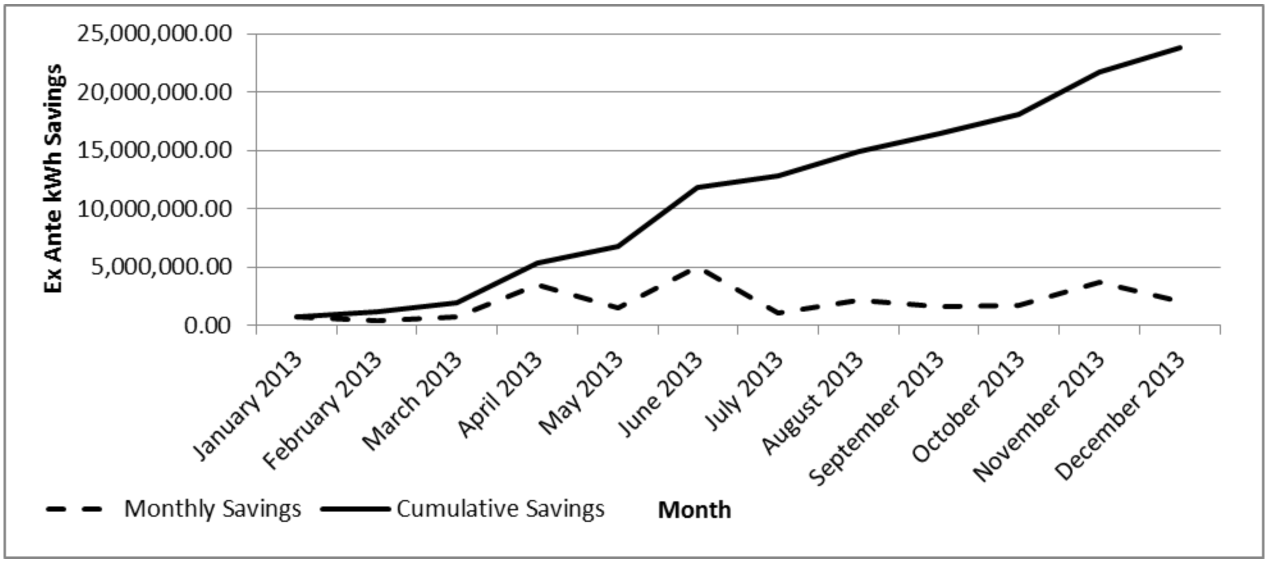


Figure 2-2 Standard Program Gross Ex Ante Savings by Measure Start-up Month

2.4. Overview of Evaluation Approach

The overall objective for the program impact evaluation is to determine the gross and net energy savings, and peak demand (kW) reductions resulting from all program activity during the 2013 calendar year.

The approach for the impact evaluation had the following main features.

- Analysts reviewed available documentation (e.g., audit reports, savings calculation work papers, etc.) from a sample set of projects, giving particular attention to the calculation procedures and evidence of savings estimates.
- Field technicians gathered on-site data for a sample of projects to provide the information needed for estimating annual energy savings and demand reductions. Extra monitoring at some sites, including from installed equipment, obtained accurate information on the hours of lighting operation, HVAC equipment, and motors/VFDs.
- Gross savings were estimated using proven techniques:
  - Analysts used ADM's custom-designed lighting evaluation model with system parameters (fixture wattage, operating characteristics, etc.) to analyze ex post energy savings for lighting projects. This lighting evaluation model uses parameters collected on-site or from industry standards.
  - ADM engineers and analysts reviewed and verified the original HVAC measure savings analyses, including the operating and structural parameters. To develop estimates of energy use and savings from the complex custom

measures installed, simulations with the DOE-2 energy analysis model were used

- ADM conducted a survey of program participants to assess customers' decision-making, their likes and dislikes of the program, and factors determining net-to-gross savings ratios for the program.

2.5. Organization of Report

This report on the impact and process evaluation of the program for the period January 2013 through December 2013 is organized as follows:

- Chapter 3 presents and discusses the methods used for and the results obtained from estimating gross savings.
- Chapter 4 presents and discusses the methods used for and results obtained from estimating net savings.
- Chapter 5 presents and discusses the methods used for and results obtained from the process evaluation.
- Chapter 6 presents and discusses the methods used for and results obtained from the cost effectiveness evaluation.
- Chapter 7 presents evaluation conclusions and recommendations.
- Appendix A provides project-level measurement and verification reports for each project for which data were collected on-site.
- Appendix B provides a copy of the program staff interview guide.
- Appendix C presents a copy of Trade Ally interview guide.
- Appendix D presents a copy of the Trade Ally training evaluation form.
- Appendix E presents a copy of the participant online survey.
- Appendix F presents a copy of the new construction program participant in-depth interview guide.
- Appendix G presents a copy of the retro-commissioning program participant in-depth interview guide.
- Appendix H presents a copy of the standard and custom program participant in-depth interview guide.

3. Estimation of Gross Ex Post kWh Savings

This chapter explains the estimation of gross ex post kWh savings and gross ex post peak kW savings for year 2013 program participants from measures installed in their facilities. Section 3.1 describes the methodology used for estimating gross ex post kWh savings. Section 3.2 presents the results from the effort to estimate savings for the sample of custom and standard projects, and all three completed new construction and retro commissioning projects.

This chapter details the general methodology for estimating gross ex post savings and the aggregate savings estimation results. Appendix A contains specific methodologies for estimating gross ex post savings and savings estimation results for each sample project.

3.1. Methodology for Estimating Gross Savings

The methodology used for estimating gross ex post kWh savings is described in this section.

3.1.1. Sampling Plan

Data developed by the implementation contractor showed that during the 2013 calendar year, there were 620 custom projects with gross ex ante savings of 51,535,015 kWh annually and 817 standard projects during the same period with gross ex ante savings of 23,793,935 kWh annually. There were two new construction projects with gross ex ante annual savings of 168,063 kWh, and there was one retro-commissioning project with gross ex ante annual savings of 316,031 kWh. Because of the larger numbers of completed custom projects (620) and standard projects (817), measured and verified (M&V) data from field technicians and monitoring equipment were used to estimate gross ex post kWh savings for a sample of these projects that were then statistically projected for the larger program population. Because of the smaller number of new construction (two) and retro-commissioning projects (one), ADM estimated the gross annual energy savings for the whole population of these two programs.

The distribution of gross ex post kWh savings for individual projects was positively skewed, with a relatively small number of projects accounting for a high percentage of the estimated savings. Estimation of savings for custom and standard programs is based on a ratio estimation procedure that allows the measured and verified (M&V) sample to have statistical precision requirements to accurately explain the annual gross ex ante savings for all completed projects. ADM selected a sample with a sufficient number of projects to estimate the population gross ex ante kWh savings with 10% relative precision at the 90% confidence level. The actual relative precision of the custom program sample precision is ±8.0%, and the actual relative precision of the standard program sample is ±8.2%. ADM calculated gross ex ante energy savings for all new construction and retro-commissioning projects because of their smaller population sizes; therefore, the confidence level of energy savings for these components is 100%.

The sample selection includes projects that were completed over different periods of the 2013 calendar year, as companies implemented them. ADM used a near real-time process whereby ADM selected a portion of the sample periodically as projects in the program were completed.

Table 3-1 shows the number of custom projects that fell into five energy-saving strata, their gross ex ante kWh savings boundaries, and the number of sample custom projects chosen from the stratum. Table 3-2 shows the number of standard projects that fell into five energy-saving strata, their gross ex ante kWh savings boundaries, and the number of sample standard projects chosen from the stratum.

Table 3-1 Population Statistics Used for Sample Design for Custom Program

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*Totals*
Strata boundaries (kWh)	28,273 <	28,274 - 76,124	76,125 - 206,737	206,738 - 678,918	678,919 - 1,395,134	
Number of projects	260	206	100	47	7	620
Total kWh savings	3,237,100	10,402,776	12,936,947	17,527,730	7,430,462	51,535,015
Average kWh Savings	12,450	50,499	129,369	372,930	1,061,495	83,121
Standard deviation of kWh savings	7,125	11,173	33,539	130,913	276,730	149,191
Coefficient of variation	0.57	0.22	0.26	0.35	0.26	1.79
Final design sample	6	11	9	8	5	39

Table 3-2 Population Statistics Used for Sample Design for Standard Program

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*Totals*
Strata boundaries (kWh)	15,637 <	15,638 - 38,192	38,193 - 80,592	80,593 - 297,455	297,456 - 1,041,425	
Number of projects	457	206	100	47	7	817
Total kWh savings	2,770,940	5,273,998	5,439,392	6,496,294	3,813,311	23,793,935
Average kWh Savings	6,063	25,602	54,394	138,219	544,759	29,124
Standard deviation of kWh savings	3,909	6,574	12,781	50,334	248,571	63,102
Coefficient of variation	0.64	0.26	0.23	0.36	0.46	2.17
Final design sample	12	6	6	10	5	39

The sample of custom projects, shown in Table 3-3, account for approximately 21% of the total custom program's gross ex ante kWh savings. The sample of standard projects, shown in Table 3-4, account for approximately 22% of the total standard program's gross ex ante kWh savings.

Table 3-3 Gross Ex Ante Savings for Custom Program Sampled Projects by Stratum

Stratum	*Sample Gross Ex Ante kWh Savings*	*Total Gross Ex Ante kWh Savings*	*Percentage of Gross Ex Ante Savings in Sample*
5	5,420,151	7,430,462	73%
4	3,580,354	17,527,730	20%
3	1,279,563	12,936,947	10%
2	551,638	10,402,776	5%
1	103,750	3,237,100	3%
Total	10,935,456	51,535,015	21%

Table 3-4 Gross Ex Ante Savings for Standard Program Sampled Projects by Stratum

Stratum	*Sample Gross Ex Ante kWh Savings*	*Total Gross Ex Ante kWh Savings*	*Percentage of Gross Ex Ante Savings in Sample*
5	3,073,018	3,813,311	81%
4	1,666,123	6,496,294	26%
3	339,363	5,439,392	6%
2	157,700	5,273,998	3%
1	75,895	2,770,940	3%
Total	5,312,099	23,793,935	22%

3.1.2. Review of Documentation

After the selection of sample projects, ADM obtained project documentation from the tracking database maintained by Ameren Missouri's program implementation contractor. ADM analysts then review this documentation and other program materials that were relevant to the evaluation effort.

The available documentation (e.g., audit reports, savings calculation work papers, etc.) for each rebated measure was reviewed, with particular attention given to the calculation procedures and documentation for ex ante energy saving estimates not performed by ADM. The reviewed documentation for all selected projects included program forms, databases, reports, billing system data, weather data, and any other potentially useful data. Each application was reviewed to determine whether the following types of information had been provided:

- Documentation for the equipment changed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information
- Documentation for the new equipment installed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information

- Information about the savings calculation methodology, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations

If there was uncertainty regarding a project or incomplete project documentation, then ADM staff contacted the implementation contractor to seek further information to ensure the development of an appropriate project-specific M&V plan.

3.1.3. On-Site Data Collection Procedures

Field technicians made on-site visits to collect data used in calculating accurate energy savings effects of the implemented measures. During the site visits of the sampled projects, field technicians collected primary data on the participants' facilities.

When projects were selected for the M&V sample, ADM notified Ameren Missouri in two ways:

1) ADM scheduled measurement and verification activities with Ameren Missouri Key Account Executives (KAE) by providing a list of all desired sites to visit. This list included the company name, the respective KAE for the customer, the site address or other premise identification, as well as the customer representatives' contact information with whom ADM intended to schedule an appointment.
2) ADM provided Ameren Missouri energy efficiency staff with a list of projects for which ADM planned to schedule M&V activities. This list included the company name, the project ID, the site address or other premise identification, and the customer representatives' contact information with whom ADM intended to schedule an appointment.

Typically, customers with KAEs received at least two weeks notification prior to ADM contacted customers to schedule M&V visits. Upon KAE request, ADM coordinated its scheduling and M&V activities with the KAE.

During an on-site visit, the field staff accomplished three major tasks:

- First, they verified the implementation status of all measures for which customers received incentives. They verified that the energy efficiency measures were indeed installed, that they were installed correctly, and that they still functioned properly.
- Second, they collected the physical data needed to analyze the ex post energy savings from the installed improvements and measures. Data were collected using a form that was prepared specifically for the project in question after an in-house review of the project file.
- Third, they interviewed the facilities' contact representatives to obtain additional information on the installed system to complement the data collected from other sources.

At some sites, field technicians monitored operating hours of the installed measures. Monitoring occurred where the data would be useful for further refinement and higher accuracy of savings calculations. Monitoring was not necessary for sites where project documentation allowed for sufficiently detailed calculations.

3.1.4. Procedures for Estimating Savings from Measures Installed through the Program

The method ADM employs to determine gross savings impacts depends on the types of measures being analyzed. Categories of measures include the following:

- Lighting;
- HVAC;
- Motors;
- VFDs;
- Compressed-Air;
- Refrigeration; and
- Process Improvements.

ADM uses a specific set of methods to determine gross ex post savings for projects that depend on the type of measure analyzed. The set of methods to determine gross savings for these listed projects are summarized in Table 3-5. Project-specific information on savings calculation is contained in Appendix A, which describes analytical strategies for projects for which the following strategies are not appropriate.

Table 3-5 Typical Methods to Determine Savings for Custom Measures

Type of Measure	*Method to Determine Savings*
Compressed Air Systems	Engineering analysis, with monitored data on load factor and schedule of operation
Lighting	Custom-designed lighting evaluation model, which uses data on wattages before and after installation of measures and hours-of-use data from field monitoring.
HVAC (including packaged units, chillers, cooling towers, controls/EMS)	eQUEST model using DOE-2 as its analytical engine for estimating HVAC loads and calibrated with site-level billing data to establish a benchmark.
Motors and VFDs	Measurements of power and run-time obtained through monitoring
Refrigeration	Simulations with eQUEST engineering analysis model, with monitored data
Process Improvements	Engineering analysis, with monitored data on load factor and schedule of operation

The activities specified in Table 3-5 produced two estimates of gross savings for each sample project: an gross ex ante kWh savings estimate (as reported in the project documentation and program tracking system) and the gross ex post savings estimate developed through the M&V procedures employed by ADM. ADM developed estimates of program-level gross savings by applying a ratio estimation procedure in which achieved savings rates estimated for the sample projects were statistically projected to the program-level gross ex ante savings.

Energy savings realization rates were calculated for each project for which on-site data collection and engineering analysis/building simulations were conducted. Sites with relatively high or low realization rates were further analyzed to determine the reasons for the discrepancy between ex ante and ex post energy savings. This information for such sites is included in site-level M&V analyses presented in Appendix A.

The following discussion describes the basic procedures used for estimating savings from various measure types. Project-specific information on savings calculation is contained in Appendix A.

3.1.4.1. Plan for Analyzing Savings from Lighting Measures

Lighting measures examined include retrofits of existing fixtures, lamps and/or ballasts with energy efficient fixtures, lamps and/or ballasts. These types of measures reduce demand, while not affecting operating hours. Any proposed lighting control strategies are examined that might include the addition of energy conserving control technologies such as motion sensors or daylighting controls. These measures typically involve a reduction in hours of operation and/or lower current passing through the fixtures.

Analyzing the savings from such lighting measures requires data for retrofitted fixtures on (1) wattages before and after retrofit and (2) hours of operation before and after the retrofit. Fixture wattages are taken from a table of standard wattages, with corrections made for non-operating fixtures. Hours of operation are determined from metered data collected after measure installation for a sample of fixtures.

As noted, ADM collects data to determine average operating hours for retrofitted fixtures by using Time-of-Use (TOU) data loggers to monitor a sample of “last points of control” for unique usage areas in the sites where lighting efficiency measures have been installed. Usage areas are areas within a facility that are expected to have comparable average operating hours. For industrial customers, expected usage areas include fabrication areas, clean rooms, office space, hallways/stairways, and storage areas. Typical usage areas are designated in the forms used for data collection.

ADM uses per-fixture baseline demand, retrofit demand, and appropriate post-retrofit operating hours to calculate peak capacity savings and annual energy savings for sampled fixtures of each usage type.

Post-retrofit kWh usage is calculated using the on-off profile and fixture wattages. Fixture demand is calculated by dividing the total kWh usage calculated during Ameren Missouri's peak period of the day by the number of hours in the peak period.

Peak period demand savings are calculated as the difference between peak period baseline demand and post-installation peak period demand of the effected lighting equipment, per the following formula:

$$Peak\ Capacity\ Savings = kW_{before} - kW_{after}$$

The baseline and post-installation average demands are calculated by dividing the total kWh usage during the peak period by the number of hours in the peak period.

ADM calculates annual energy savings for each sampled fixture per the following formula:

$$Annual\ Energy\ Savings = kWh_{before} - kWh_{after}$$

The values for insertion in this formula are determined through the following steps:

Results from the monitored sample are used to calculate the average operating hours of the metered lights in each costing period for every unique building type/usage area.

These average operating hours are then applied to the baseline and post-installation average demand for each usage area to calculate the respective energy usage and peak period demand for each usage area.

The annual baseline energy usage is the sum of the baseline kWh for each costing period for all of the usage areas. The post-retrofit energy usage is calculated similarly. The energy savings are calculated as the difference between baseline and post-installation energy usage.

Savings from lighting measures in conditioned spaces are factored by the region-specific, building type-specific heating cooling interaction factors (HCIF) in order to calculate total savings attributable to lighting measures, inclusive of impacts on HVAC operation.

3.1.4.2. Plan for Analyzing Savings for Motors

Estimates of the energy savings from use of high efficiency motors on HVAC and non-HVAC applications are derived through an "after-only" analysis. With this method, energy usage is measured only for the high efficiency motor and only after it has been installed. The data collected are then used in estimating what energy use would have been for the motor application if the high efficiency motor had not been installed. In effect, the after-only analysis is a reversal of the usual design calculation used to estimate the savings that would result from installing a high efficiency motor. That is, at the design stage, the question addressed is how would energy use change for an application if an high efficiency motor is installed, whereas the after-only analysis addresses what the level of energy use would have been had the high efficiency motor not been installed.

For the “after only” analysis, it is not possible to use a comparison of direct measurements to determine savings, since measured data are collected only for the high efficiency motor. However, savings attributable to installation of the high efficiency motor can be estimated using information on the efficiencies of the high efficiency motor and on the motor it replaced. In particular, demand and energy savings can be calculated as follows:

$$Demand\ Savings = kW_{peak}\ x\ (1/Eff_{old} – 1/Eff_{new})$$

where kW_{peak} = Volts x $Amps_{peak}$ x Power Factor, and $Amps_{peak}$ is the interval with the maximum recorded Amps during the monitoring period.

$$Energy\ Savings = kW_{ave}\ x\ (1/Eff_{olc} – 1/Eff_{new})\ x\ Hours\ Of\ Use$$

where kW_{ave} = Volts x Amp_{save} x Power Factor and Amp_{save} is the average measured Amps for the duration of the monitored period.

Annual Energy Savings = kW_{ave} x (1/Eff_{old} -1/Eff_{new}) x (days of operation per year/ days metered) x Annual Adjustment Factor

where kW_{ave} = Volts x $Amps_{ave}$ x Power Factor for the monitoring period, $Amps_{ave}$ is the average measured Amps for the duration of the monitored period, and use factor is determined from interviews with site personnel. Annual Adjustment Factor is 1 if the monitoring period is typical for the yearly operation, less than 1 if the monitoring period is expected to be higher use than typical for the rest of the year, and more than 1 if the monitoring period is expected to be lower than typical for the rest of the year. [8]

The information on motor efficiencies needed for the calculation of savings is obtained from different sources.

Data on the efficiencies of high efficiency motors installed under the program should be available from program records.

In some cases, the efficiencies of the replaced motors may also be noted in Ameren Missouri’s program records. Care must be taken using nameplate efficiency ratings of replaced motors, unless the company maintains good documentation of their equipment. If a motor has been rewound it may not operate as originally rated. However, if the efficiencies of the old motors are not directly available, the efficiency values can be imputed by using published data on average efficiency values for motors of given horsepower. If the motor replacement is for normal replacement, the baseline efficiency is established as the efficiency of a new, standard efficiency motor. However,

[8] Current year weather data were compared with the *Typical Meteorological Year* from the National Oceanic & Atmospheric Administration (NOAA)

in cases of early replacement, the efficiency of the old motor is used for the length of the remaining life.[9]

Because most motors monitored run only under full load conditions, some adjustments must be made from the "industry averages" of full load efficiencies. Motor efficiency curves of typical real motors that have the same full load efficiencies are used for determining part load efficiencies.

Like motor efficiency, the power factor varies with motor loading. Motor power factor curves of typical real motors that have the same full load power factor are used for determining part load power factor.

Another factor to consider in demand and energy savings comparisons of motor change out programs is the rotor slip. Full load RPM ratings of motors vary. For centrifugal loads such as fans and pumps, the power supplied is dependent on the speed of the driven equipment. The power is theoretically proportional to the cube of the speed, but in practice acts more like the square of the speed. In general high efficiency motors have slightly higher full load RPM ratings (lower slip) than standard motors. Where nameplate ratings of full load RPM are available for replaced motors, a de-rating factor can be applied. [10]

The data needed to carry out these plans for determining savings are collected from several sources.

- The first source of data is the information from each project's documentation. This information is expected to include aggregate energy used at a site, disaggregated energy usage data for certain targeted processes (if available), before (actual) and after (projected) data on production, scrap, and other key performance indicators, and final reports (which include process improvement recommendations, analyses, conclusions, performance targets, etc.).
- The second source of data is the energy use data that Ameren Missouri collects for these customers.
- The third source is information collected through on-site inspections of the facilities. ADM staff collect the data during on-site visits using a form that is comprehensive in addressing a facility's characteristics, its modes and schedules of operation, and its electrical and mechanical systems. The form also addresses various energy efficiency measures, including high efficiency lighting (both lamps and ballasts),

[9] Assumptions regarding measure expected useful life were taken from the most recent Database for Energy Efficiency Resources (DEER). See http://www.deeresources.com/.

[10] As an example, take the case where a new motor has a full load RPM rating of 1770 and the old motor had a full load RPM rating of 1760. The derating factor would be:

Derating factor = $(RPM_{old})^2 / (RPM_{new})^2 = 1760^2 / 1770^2 = 0.989$

lighting occupancy sensors, lighting dimmers and controls, air conditioning, high efficiency motors, etc.

- As a fourth source of data, selected end-use equipment are monitored to develop information on operating schedules and power draws.

3.1.4.3. Plan for Analyzing Savings from VFDs

A variable-frequency drive (VFD) is an electronic device that controls the speed of a motor by varying the magnitude of the voltage, current, or frequency of the electric power supplied to the motor. The factors that make a motor load a suitable application for a VFD are (1) variable speed requirements and (2) high annual operating hours. The interplay of these two factors can be summarized by information on the motor's duty cycle, which essentially shows the percentage of time during the year that the motor operates at different speeds. The duty cycle should show good variability in speed requirements, with the motor operating at reduced speed a high percentage of the time.

Potential energy savings from the use of VFDs are usually most significant with variable-torque loads, which have been estimated to account for 50% to 60% of total motor energy use in the non-residential sectors. Energy saving VFDs may be found on fans, centrifugal pumps, centrifugal blowers, and other centrifugal loads, most usually where the duty cycle of the process provided a wide range of speeds of operation.

ADM's approach to determining savings from installation of VFDs involves (1) making one-time measurements of voltage, current, and power factor of the VFD/motor and (2) conducting continuous measurements of amperage over a period of time in order to obtain the data needed to develop VFD load profiles and calculate demand and energy savings. VFDs are generally used in applications where motor loading changes with changes in motor speed. Consequently the true power drawn by a VFD is recorded in order to develop VFD load shapes. One-time measurements of power are made for different percent speed settings. Power and percent speed or frequency (depending on VFD display options) are recorded for as wide a range of speeds as the customer allows the process to be controlled; field staff attempt to obtain readings from 40 to 100% speed in 10 to 15% increments.

3.1.4.4. Plan for Analyzing Savings from Compressed Air Measures

Measures to improve the efficiency of a compressed air system include the reduction of air leaks, the resizing of compressors, installing more efficient compressors, improved controls, and a complete system redesign. Savings from such measures are evaluated through engineering analysis of compressor performance curves, supported by data collected through short-term metering.

ADM field staff obtain nameplate information for the pre-retrofit equipment either from the project file or during the on-site survey. Performance curve data are obtained from manufacturers. Engineering staff then conduct an engineering analysis of the performance characteristics of the pre-retrofit equipment. During the on-site survey, field staff inspect the as-built system equipment, take pressure and load readings, and interview the system operator to identify seasonal variations in load. Potential interactions with other compressors are assessed and it is verified that the rebated compressor is being operated as intended.

When appropriate, short-term measurements are performed to reduce the uncertainty in defining the load on the as-built system. These measurements may be taken either with a multi-channel logger, which can record true power for several compressors; with current loggers, which can provide average amperage values; or with motor loggers to record operating hours. The appropriate metering equipment is selected by taking into account variability in load and the cost of conducting the monitoring.

ADM used AirMaster+ to calculate the savings due to the energy efficiency measures installed within each compressed air system. The AirMaster+ as-built and baseline compressor types were inputted into the model using data points collected during on-site verification. The as-built model was then calibrated to a typical daily schedule, derived from at least two weeks of trending data. Project energy savings were calculated by subtracting the as-built from the baseline energy consumption.

3.1.4.5. Plan for Analyzing Savings from Refrigeration and Process Improvements

Analysis of savings from refrigeration and process improvements is inherently project-specific. Because of the specificity of processes, analyzing the processes through simulations is generally not feasible. Rather, reliance is made on engineering analysis of the process affected by the improvements. Major factors in ADM's engineering analysis of process savings are operating schedules and load factors. Information on these factors is developed through short-term monitoring of the affected equipment, be it pumps, heaters, compressors, etc. The monitoring is done after the process change, and the data gathered on operating hours and load factors are used in the engineering analysis to define "before" conditions for the analysis of savings.

3.2. Results of Gross Ex Post Savings Estimation

To estimate gross ex post kWh savings and gross peak ex post kW reductions for the custom and standard programs, data were collected and analyzed for samples of 39 custom projects and 39 standard projects. A sampling approach was not necessary for the new construction and retro-commissioning program components, because only three of these projects were completed. ADM analyzed these projects' data using the methods described in Section 3.1 estimate project energy savings, peak kW reductions, and determine gross kWh savings realization rates for program components. The results of that analysis are reported in this section.

3.2.1. Gross Ex Post kWh Savings

The gross ex post kWh savings for the custom program during the 2013 calendar year are summarized by sampling stratum in Table 3-6. Overall, gross ex post energy savings of 47,420,812 kWh were equal to 92% of the gross ex ante savings. Table 3-7 shows the ex ante and ex post custom program energy savings by sample project.

Table 3-6 Gross Ex Ante and Gross Ex Post Annual kWh Savings for Custom Program by Sample Stratum

Stratum	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross kWh Savings Realization Rate*
5	7,430,462	6,047,205	81%
4	17,527,730	17,641,957	101%
3	12,936,947	11,212,419	87%
2	10,402,776	8,696,582	84%
1	3,237,100	3,822,648	118%
Total	51,535,015	47,420,812	92%

Table 3-7 Gross Ex Ante and Gross Ex Post Annual kWh Savings for Custom Program by Project

ID	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross kWh Savings Realization Rate*
C-1	1,395,134	1,106,616	79%
C-2	1,392,956	971,015	70%
C-3	977,824	911,720	93%
C-4	902,251	723,655	80%
C-5	751,986	698,128	93%
C-6	678,918	681,342	100%
C-7	653,726	652,403	100%
C-8	488,883	350,531	72%
C-9	414,861	565,666	136%
C-10	385,234	489,649	127%
C-11	335,742	349,571	104%
C-12	331,720	317,209	96%
C-13	291,270	197,316	68%
C-14	188,100	241,478	128%
C-15	181,818	127,546	70%
C-16	176,899	154,069	87%
C-17	136,800	105,708	77%
C-18	127,150	99,561	78%
C-19	126,274	100,731	80%
C-20	122,554	123,060	100%
C-21	117,182	82,618	71%
C-22	102,786	74,223	72%
C-23	73,426	79,207	108%
C-24	62,547	33,224	53%
C-25	54,270	25,953	48%
C-26	54,270	26,965	50%
C-27	54,270	25,973	48%
C-28	54,270	26,754	49%
C-29	43,159	47,216	109%
C-30	42,191	55,261	131%
C-31	39,685	62,165	157%
C-32	38,166	49,496	130%
C-33	35,384	28,948	82%
C-34	24,855	25,101	101%
C-35	23,681	51,223	216%
C-36	21,615	18,257	84%
C-37	20,008	21,559	108%
C-38	11,769	5,918	50%
C-39	1,822	459	25%
All Non-Sample Projects	40,599,559	37,713,318	93%

ID	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross kWh Savings Realization Rate*
Total	51,535,015	47,420,812	92%

The gross kWh savings of the standard program during the 2013 calendar year are summarized by sampling stratum in Table 3-8. Overall, gross ex post kWh savings of 25,081,134 kWh were equal to 105% of the gross ex ante kWh savings. Table 3-9 shows the ex ante and ex post standard program annual energy savings by sample project.

Table 3-8 Gross Ex Ante and Gross Ex Post Annual kWh Savings for Standard Program by Sample Stratum

Stratum	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross kWh Savings Realization Rate*
5	3,813,311	3,699,383	97%
4	6,496,294	6,283,889	97%
3	5,439,392	6,704,645	123%
2	5,273,998	6,495,345	123%
1	2,770,940	1,897,872	68%
Total	23,793,935	25,081,134	105%

Table 3-9 Gross Ex Ante and Gross Ex Post Annual kWh Savings for Standard Program by Project

ID	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross kWh Savings Realization Rate*
S-1	1,041,425	950,699	91%
S-2	642,786	520,554	81%
S-3	565,896	625,881	111%
S-4	496,692	548,365	110%
S-5	326,219	335,708	103%
S-6	297,455	283,913	95%
S-7	236,417	215,821	91%
S-8	197,538	218,082	110%
S-9	197,442	227,622	115%
S-10	192,229	218,757	114%
S-11	152,078	70,073	46%
S-12	124,830	134,424	108%
S-13	92,008	98,640	107%
S-14	91,212	19,855	22%
S-15	84,914	124,460	147%
S-16	79,678	57,709	72%
S-17	58,549	33,303	57%
S-18	57,904	49,659	86%
S-19	50,650	126,904	251%
S-20	50,078	133,659	267%
S-21	42,504	17,068	40%
S-22	32,622	101,615	311%
S-23	28,198	27,736	98%
S-24	27,147	6,663	25%
S-25	26,941	22,370	83%
S-26	24,303	33,764	139%
S-27	18,489	2,072	11%
S-28	14,642	7,583	52%
S-29	10,420	1,585	15%
S-30	9,608	5,542	58%
S-31	8,247	8,865	107%
S-32	7,709	122	2%
S-33	5,646	3,237	57%
S-34	5,466	12,637	231%
S-35	3,861	2,774	72%
S-36	2,574	2,622	102%
S-37	2,574	2,470	96%
S-38	2,574	2,611	101%
S-39	2,574	1,934	75%
All Non-Sample	18,481,836	19,823,776	107%
Total	23,793,935	25,081,134	105%

The new construction program's gross ex post savings of 217,614 kWh were equal to 129% of gross ex ante savings; while the retro-commissioning program's gross ex post savings of 335,638 kWh were equal to 106% of gross ex ante savings.

Gross ex post kWh savings of the custom and standard programs during the 2013 calendar year are shown by building type in Table 3-10. Among discrete building types, large retail and industrial facilities account for the largest percentages of custom program activity, 12.3% and 11.2%. While large schools account for the largest percentage of standard program activity, 24.6%.

Table 3-10 Gross Ex Post kWh Savings for BizSavers Program by Building Type

Building Type	*Program Component*				
	Custom Incentives	*Standard Incentives*	*New Construction Incentives*	*RCx Incentives*	*Total*
All Other	26.6%	27.3%	0.0%	0.0%	26.7%
Fast Food Restaurant	0.0%	0.5%	0.0%	0.0%	0.2%
Full Service Restaurant	0.3%	2.7%	0.0%	0.0%	1.0%
Grocery and Convenience	4.4%	2.8%	0.0%	0.0%	3.9%
Large Industrial	11.2%	2.3%	0.0%	0.0%	8.3%
Large Office	8.7%	3.5%	0.0%	0.0%	7.0%
Large Retail	12.3%	6.6%	0.0%	0.0%	10.4%
Large School	7.4%	24.6%	0.0%	0.0%	12.8%
Lodging	0.5%	13.2%	0.0%	0.0%	4.5%
Other Industrial	8.8%	2.1%	93.8%	100.0%	7.3%
Other Office	4.3%	2.9%	0.0%	0.0%	3.9%
Other Retail	5.4%	7.1%	0.0%	0.0%	5.9%
Other School	2.5%	1.4%	0.0%	0.0%	2.1%
Warehouse	7.5%	3.1%	6.2%	0.0%	6.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

3.2.2. Gross Ex Post Peak kW Savings

The gross ex post peak kW reductions of the custom, standard, new construction, and retro-commissioning programs during the 2013 calendar year are shown in Table 3-11. The gross ex post peak savings are 10,253.51 kW for the custom program, 4,291.96 kW for the standard program, 45.97 kW for the new construction program, and 72.58 kW for the retro-commissioning program.

Table 3-11 Gross Ex Ante and Gross Ex Post Peak kW Savings for BizSavers Programs

Program	*Gross Ex Ante Peak kW Savings*	*Gross Ex Post Peak kW Savings*	*Gross kWh Savings Realization Rate*
Custom	10,301.60	10,253.51	100%
Standard	3,264.74	4,291.96	131%
New Construction	-	45.97	N/A
RCx	70.00	72.58	104%
Total	13,636.34	14,664.02	108%

3.2.3. Discussion of Gross Savings Analysis

ADM analysts reviewed project gross kWh savings realization rates to assess whether there were factors that caused systematic differences in the gross kWh savings realization rates.

Sample custom project gross kWh savings realization rates and gross ex ante kWh savings are plotted in Figure 3-1. There is no strong association between gross kWh savings realization rates and gross ex ante kWh savings. Figure 3-2 plots the custom projects' ex post energy savings against the ex ante energy savings for each sample point.

Similarly, for the standard projects, sample project gross kWh savings realization rates and gross ex ante kWh savings are plotted in Figure 3-3. There is not a strong association between gross kWh savings realization rates and gross ex ante kWh savings. Figure 3-4 plots the standard projects' ex post energy savings against the ex ante energy savings for each sample point.

Case-by-case examination showed that project-specific factors were more likely to cause gross ex post kWh savings to differ from gross ex ante savings. Project-specific factors include type of measure implemented, building type, facility operating schedule, and other parameters that may affect energy efficiency measure savings.

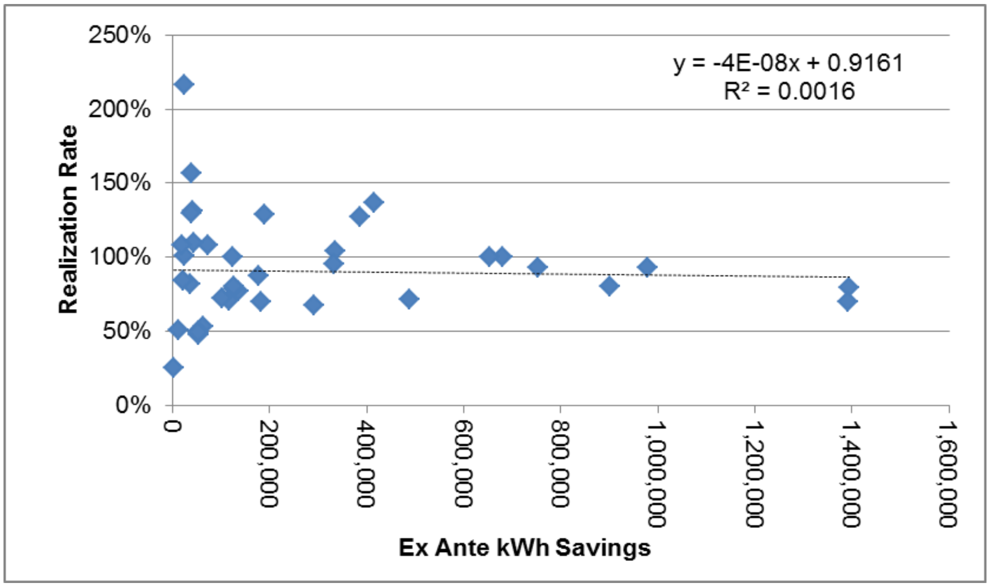


Figure 3-1 Custom Program Sample Project Gross kWh Savings Realization Rate Versus Gross Ex Ante kWh Savings

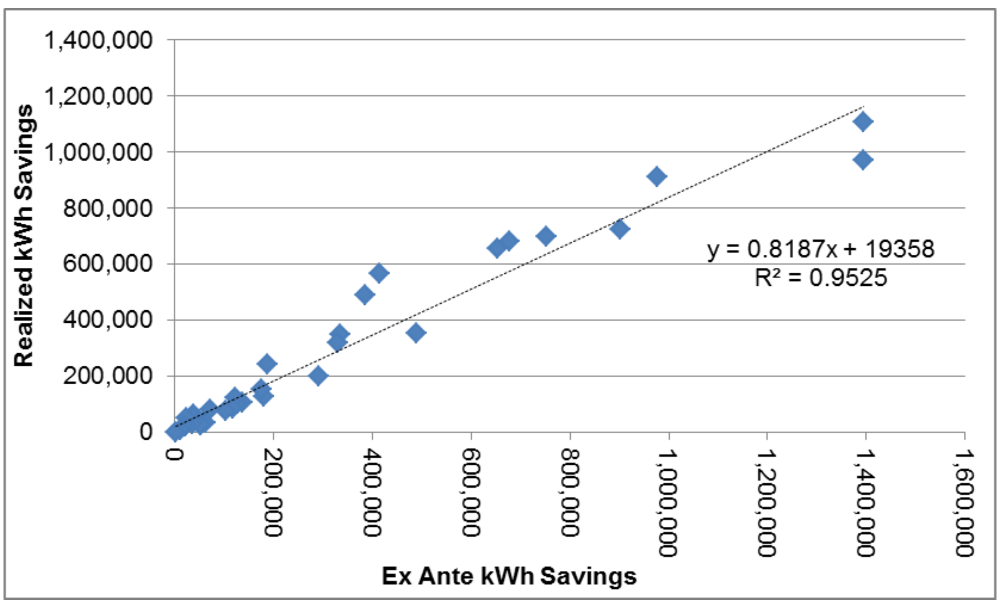


Figure 3-2 Custom Program Sample Project Gross Ex Post kWh Savings versus Gross Ex Ante kWh Savings

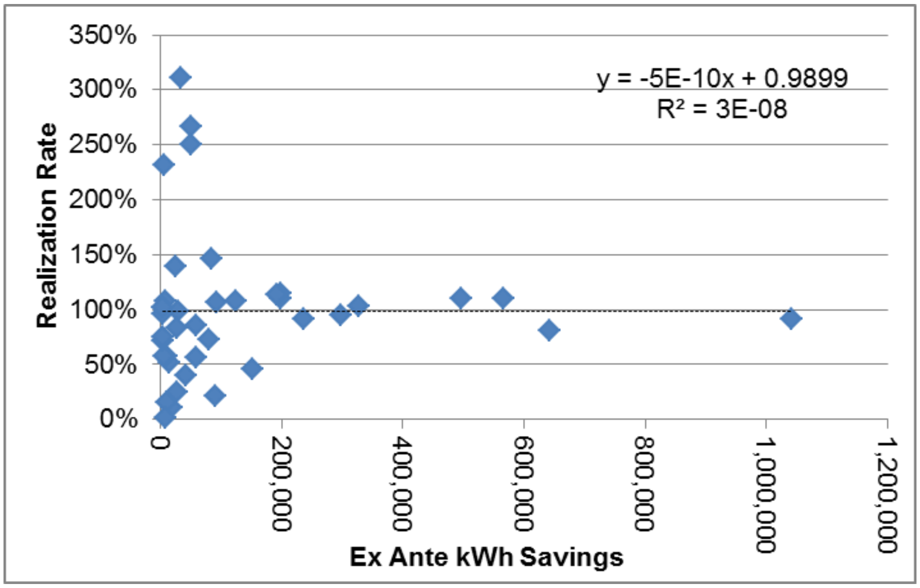


Figure 3-3 Standard Program Sample Project Gross kWh Savings Realization Rate versus Gross Ex Ante kWh Savings

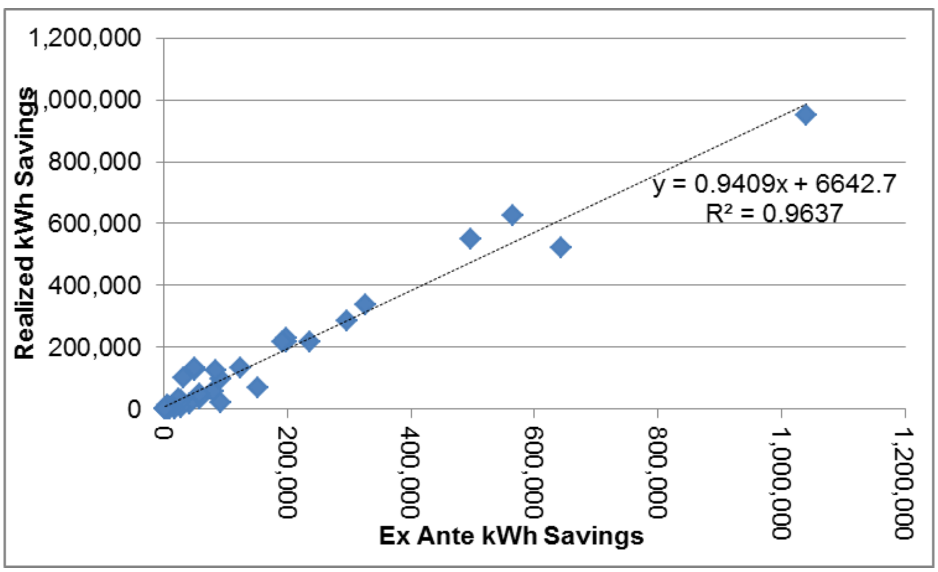


Figure 3-4 Standard Program Sample Project Gross Ex Post kWh Savings versus Gross Ex Ante kWh Savings

4. Estimation of Net Ex Post Savings

This chapter reports the results from estimating the net impacts of the program during calendar year 2013, where net ex post savings represents the portion of gross ex post savings by program participants that can be attributed to the effects of the program. Net savings equal gross savings, *minus* free ridership, *plus* participant spillovers, non-participant spillovers, and market effects. The evaluation of net savings presented in this report does not include assessment of non-participant spillovers or program-attributable market transformation.

4.1. Procedures Used to Estimate Net Savings

The procedures used to estimate net savings for all four of the programs are the same. The savings induced by the program are the "net" savings that are attributable to the program.

Free riders are those participants that would have installed the same energy efficiency measures without the program incentives. Net savings may be less than gross savings because of free ridership impacts, which arise to the extent that participants in a program would have adopted energy efficiency measures and achieved the observed energy changes even in the absence of the program. Conversely, net savings may be greater than gross savings due to energy savings spillovers attributable to the program. Participants or non-participants may implement energy efficiency measures due to the influence of the program, without receiving program incentives for implemented measures.

A survey of a sample of program participants collected information used for the net-to-gross analysis. Appendix E provides a copy of the survey instrument. Based on review of this information, the preponderance of evidence regarding free ridership inclinations was used to attribute a customer's savings to free ridership.

Several criteria determine which portion of a participant's savings should be attributed to free ridership. The first criterion comes from the response to the question: "Would you have been financially able to install the equipment or measures without the financial incentive from the BizSavers Program?" If a customer answered "No" to this question, a free ridership score of 0 was assigned to the project. That is, if a customer required financial assistance from the program to undertake a project, then that customer was not deemed a free-rider.

For decision makers who indicated that they could undertake energy efficiency projects without financial assistance from the program, three additional factors determined what percentage of savings might be attributed to free ridership. The three factors are:

- Plans and intentions of firm to install a measure even without support from the program;
- Influence that the program had on the decision to install a measure; and
- A firm's previous experience with a measure installed under the program.

For each of these factors, rules were applied to develop binary variables indicating whether a participant showed free ridership behavior. Responses to the decision-maker questionnaire helped to develop the rules for the free ridership indicator variables. (A copy of the questionnaire is provided as Appendix E.)

The first required step is to determine if a participant stated that his or her intention was to install an energy efficiency measure without the help of the program incentive. The survey respondents' answers to a combination of questions, then a set of rules determine whether a participant's behavior indicated likely free ridership. Two binary variables were constructed to account for customer plans and intentions: one, based on a more restrictive set of criteria that may describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that may describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

- The respondent answered "yes" to the following two questions: "Did you have plans to install the measure before participating in the program?" and "Would you have gone ahead with this planned installation of the measure even if you had not participated in the BizSavers Program?"
- The respondent answered "definitely would have installed" to the following question: "If the financial incentive from the BizSavers Program had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?"
- The respondent answered "did not affect timing of purchase and installation" to the following question: "How did the availability of information and financial incentives through the BizSavers Program affect the timing of your purchase and installation of [Equipment/Measure]?"
- The respondent answered "no, the program did not affect level of efficiency that we chose for equipment" in response to the following question: "How did the availability of information and financial incentives through the BizSavers Program affect the level of energy efficiency you chose for [Equipment/Measure]?

The second, less restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

- The respondent answered “yes” to the following two questions: “Did you have plans to install the measure before participating in the program?” and “Would you have gone ahead with this planned installation of the measure even if you had not participated in the BizSavers Program?”
- Either the respondent answered “definitely would have installed” or “probably would have installed” to the following question: “If the financial incentive from the BizSavers Program had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?”
- Either the respondent answered “did not affect timing of purchase and installation” to the following question: “How did the availability of information and financial incentives through the BizSavers Program affect the timing of your purchase and installation of [Equipment/Measure]?” or the respondent indicated that while program information and financial incentives did affect the timing of equipment purchase and installation, in the absence of the program they would have purchased and installed the equipment within the next two years.
- The respondent answered “no, the program did not affect level of efficiency that we chose for equipment” in response to the following question: “How did the availability of information and financial incentives through the BizSavers Program affect the level of energy efficiency you chose for [Equipment/Measure]?

The second required factor is determining if a customer reported that a recommendation from a program representative or past experience with the program was influential in the decision to install a particular piece of equipment or measure.

This criterion indicates that the program’s influence may lower the likelihood of free ridership when either of the following conditions are true:

- The respondent answered “very important” to the following question: “How important was previous experience with the BizSavers Program in making your decision to install [Equipment/Measure]?
- The respondent answered “yes” to the following question: “Did a representative of the BizSavers Program recommend that you install [Equipment/Measure]?”

The third required factor is determining if a participant in the program indicated that he or she had previously installed an energy efficiency measure similar to one that they installed under the program without an energy efficiency program incentive during the last three years. A participant indicating that he or she had installed a similar measure is more considered to have a likelihood of free ridership.

The criteria indicating that previous experience may signify a higher likelihood of free ridership are as follows:

- The respondent answered “yes” to the following question: “Before participating in the BizSavers Program, had you installed any equipment or measure similar to [Rebated Equipment/Measure] at your facility?”
- The respondent answered “yes, purchased energy efficient equipment but did not apply for financial incentive.” to the following question: “Has your organization purchased any energy efficient equipment in the last three years for which you did not apply for a financial incentive through the BizSavers Program?”

The four sets of rules just described were used to construct four different indicator variables that address free ridership behavior. For each customer, a free ridership value was assigned based on the combination of variables. With the four indicator variables, there were 11 applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 4-1 shows these values.

Table 4-1 Free Ridership Scores for Combinations of Indicator Variable Responses

Indicator Variables				*Free Ridership Score*
Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 1)	*Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 2)*	*BizSavers Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	
Y	N/A	Y	Y	100%
Y	N/A	N	N	100%
Y	N/A	N	Y	100%
Y	N/A	Y	N	67%
N	Y	N	Y	67%
N	Y	Y	Y	33%
N	N	N	Y	33%
N	Y	N	N	33%
N	Y	Y	N	0%
N	N	N	N	0%
N	N	Y	N	0%
N	N	Y	Y	0%

4.2. Results of Net Savings Estimation

The procedures described in the preceding section were used to estimate free ridership, spillovers, and net-to-gross ratios for the BizSavers Program for the period January 2013 through December 2013.

4.2.1. Results of Estimation of Free Ridership

The data used to assign free ridership scores were collected through a customer survey of 246 customer decision makers for projects completed during the 2013 calendar year.

Individual free ridership rates were estimated for all four programs.

As discussed in Section 4.1, the first criteria in determining a project's proportion of energy savings assigned to free ridership was whether a participant was financially able to undertake the project without financial assistance from the BizSavers Program. If a decision maker respondent answered "No" to the question of "Would you have been financially able to install the equipment or measures without the financial incentive from the BizSavers Program?" a free ridership score of 0 was assigned to the project. That is, if a participant required financial assistance from the program to undertake a project, then that participant was judged to not be a free rider.

Under this criterion, the other free ridership scoring criteria were applied only to projects for participants who answered "Yes" to the question: "Would you have been financially able to install the equipment or measures without the financial incentive from the BizSavers Program?" However, respondents who answered "No" to this question would be judged to have zero free ridership even if the other free ridership criteria were applied, due to the nature of their specific survey responses.

Table 4-2 shows the percentage of survey respondents who relayed the following: They had plans and intentions to install the measures without any program incentive (under two alternative definitions as described in the preceding section), that the program influenced their decision to install the measure, or that they previously installed a similar energy efficiency measure without an energy efficiency program incentive during the last three years. Percentages reported are averages weighted by the projects' gross ex post savings.

Table 4-2 Weighted Average Indicator Variable Values

Program Component	*Had Financial Ability*	*Had Plans and Intentions to Install Measure without BizSavers Program (Definition 1)*	*Had Plans and Intentions to Install Measure without BizSavers Program (Definition 2)*	*BizSavers Program had influence on Decision to Install Measure*	*Had Previous Experience with Measure*
Custom	50%	6%	10%	41%	15%
Standard	30%	3%	8%	39%	54%

Table 4-3 shows percentages of total gross ex post custom program energy savings associated with different combinations of free ridership indicator variable values. Fifty percent of the savings are associated with respondents who indicated that they were financially unable to implement the project in the absence of the program incentive.

Table 4-3 Estimated Free-ridership for kWh Savings from Custom Program Projects

Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 1)	*Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 2)*	*BizSavers Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Gross ex post kWh Savings*	*Free Ridership Score*
N	N	N	N	33.53%	0.00%
N	N	N	Y	1.39%	33.33%
N	N	Y	N	5.77%	0.00%
N	N	Y	Y	0.07%	0.00%
N	Y	N	N	2.57%	33.33%
N	Y	N	Y	0.25%	66.67%
N	Y	Y	N	0.25%	0.00%
Y	Y	N	N	1.29%	100.00%
Y	Y	N	Y	5.10%	100.00%
Required program incentive to implement measures.				49.78%	0.00%
Total				100.00%	7.88%

Table 4-4 shows percentages of total gross ex post standard program energy savings associated with different combinations of free ridership indicator variable values. Seventy percent of the savings are associated with respondents who indicated that they were financially unable to implement the project in the absence of the program incentive.

Table 4-4 Estimated Free-ridership for kWh Savings from Standard Program Projects

Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 1)	*Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 2)*	*BizSavers Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Gross ex post kWh Savings*	*Free Ridership Score*
N	N	N	N	12.17%	0.00%
N	N	N	Y	1.33%	33.33%
N	N	Y	N	6.05%	0.00%
N	N	Y	Y	2.29%	0.00%
N	Y	N	N	2.09%	33.33%
N	Y	N	Y	0.40%	66.67%
N	Y	Y	N	2.15%	0.00%
Y	Y	N	N	1.13%	100.00%
Y	Y	N	Y	2.25%	100.00%
Required program incentive to implement measures.				70.13%	0.00%
Total				100.00%	4.79%

4.2.2. Results of Estimation of Spillovers

ADM used two data sources for calculation of program spillover: 1) Lockheed Martin project documentation, and 2) participant interviews and survey data. During the review of LM project documentation, ADM staff identified 20 projects associated with spillover energy impacts. These projects included measures that the program did not incent, generally because the measures achieved payback too quickly to qualify for an incentive under program guidelines. Generally, the non-incented measures were small components of a broader project comprised of incentivized measures. ADM identifies these implemented, non-incented measures as program activity spillovers. Spillover energy impacts were calculated by factoring the expected impacts for such measures by the product of the applicable project-level gross kWh savings realization rate and net-to-gross ratio (excluding the impact of spillovers).[11]

A battery of spillover-related questions was administered to all participant survey respondents. Forty-six customer survey respondents indicated that they were “likely to buy efficiency equipment because of the experience with the program.” In January, 2014, ADM performed a follow-up telephone survey with this subset of program participants to assess whether or not program spillovers occurred among this participant segment since administration of the customer survey. ADM surveyed 30 of these 46

[11] For instance, if the project including a “spillover measure” was implemented by a decision maker indicating free ridership, then the “spillover” is not countable.

participant decision makers, the majority of whom had completed lighting projects under the program.

For example, one respondent indicated installing 25 unincented high bay LEDs as a result of program participation. The respondent stated that no incentive was obtained because program funds were unavailable.

4.2.3. Net Ex Post kWh Savings

The net ex post energy savings of the four programs during the 2013 calendar year are summarized by program in Table 4-5. During this period, net ex post energy savings for the custom program totaled 43,875,548 kWh, while net ex post savings for the standard program totaled 23,899,394 kWh. The estimated net to gross ratio for the custom program is 93%, 95% for the standard program, 94% for the new construction program, and 67% for the retro-commissioning program.

Table 4-5 Summary of Free Ridership, Spillovers, and Net kWh Savings by Program

Program	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Estimated Free Ridership*	*Spillovers*	*Net Ex Post kWh Savings*	*Estimated Net to Gross Ratio*
Custom	51,535,015	47,420,812	3,737,823	192,559	43,875,548	93%
Standard	23,793,935	25,081,134	1,200,864	19,124	23,899,394	95%
New Construction	168,063	217,614	13,493	-	204,121	94%
RCx	316,031	335,638	111,879	-	223,759	67%
Total	75,813,044	73,055,198	5,064,060	211,683	68,202,820	93%

The net ex post energy savings of the custom, standard, new construction and retro-commissioning programs are summarized by measure type in Table 4-6, *Measure Type*	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Compressed Air	14	7,011	3,009,245	2,804,740	2,583,663
Food Service	1	23	34,548	28,882	26,605
HVAC	22	1,361	6,257,995	5,813,220	5,355,008
IT	1	80	266,800	268,539	247,372
Lghtg Ctls	112	476	2,234,232	2,091,934	1,931,346
Lighting	550	86,349	31,573,807	29,407,212	27,277,520
Miscellaneous	4	4	56,640	66,885	61,613
Motors	75	202	1,078,441	933,105	859,555
Refrigeration	87	189	3,795,061	3,146,173	2,898,184
VFD	15	1,624	3,228,246	2,860,122	2,634,680
Total*	620	97,319	51,535,015	47,420,812	43,875,548

*Total represents the total number of projects in the sample, not the sum of each line item above it

Table 4-7, *Measure Type*	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Food Service	32	46	606,688	698,613	665,164
HVAC	4	47	3,798	3,624	3,450
IT	16	3,046	1,379,758	1,267,399	1,206,717
Lghtg Ctls	219	11,595	5,534,541	6,206,621	5,910,333
Lighting	657	59,387	15,751,609	16,451,440	15,682,001
Motors	89	15	140,054	110,317	105,036
Refrigeration	109	85	377,487	343,120	326,692
Total*	817	74,221	23,793,935	25,081,134	23,899,394

, and *Total represents the total number of projects in the sample, not the sum of each line item above it

Table 4-8 New Construction Program Net kWh Savings by Measure Type

Measure Type	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Lghtg Ctls	1	4	2,027	2,664	2,499
Lighting	2	34	166,036	214,950	201,622
Total*	2	38	168,063	217,614	204,121

, respectively.

Table 4-6 Custom Program Net kWh Savings by Measure Type

Measure Type	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Compressed Air	14	7,011	3,009,245	2,804,740	2,583,663
Food Service	1	23	34,548	28,882	26,605
HVAC	22	1,361	6,257,995	5,813,220	5,355,008
IT	1	80	266,800	268,539	247,372
Lghtg Ctls	112	476	2,234,232	2,091,934	1,931,346
Lighting	550	86,349	31,573,807	29,407,212	27,277,520
Miscellaneous	4	4	56,640	66,885	61,613
Motors	75	202	1,078,441	933,105	859,555
Refrigeration	87	189	3,795,061	3,146,173	2,898,184
VFD	15	1,624	3,228,246	2,860,122	2,634,680
Total*	620	97,319	51,535,015	47,420,812	43,875,548

*Total represents the total number of projects in the sample, not the sum of each line item above it

Table 4-7 Standard Program Net kWh Savings by Measure Type

Measure Type	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Food Service	32	46	606,688	698,613	665,164
HVAC	4	47	3,798	3,624	3,450
IT	16	3,046	1,379,758	1,267,399	1,206,717
Lghtg Ctls	219	11,595	5,534,541	6,206,621	5,910,333
Lighting	657	59,387	15,751,609	16,451,440	15,682,001
Motors	89	15	140,054	110,317	105,036
Refrigeration	109	85	377,487	343,120	326,692
Total*	817	74,221	23,793,935	25,081,134	23,899,394

*Total represents the total number of projects in the sample, not the sum of each line item above it

Table 4-8 New Construction Program Net kWh Savings by Measure Type

Measure Type	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Lghtg Ctls	1	4	2,027	2,664	2,499
Lighting	2	34	166,036	214,950	201,622
Total*	2	38	168,063	217,614	204,121

*Total represents the total number of projects in the sample, not the sum of each line item above it

Table 4-9 Retro-commissioning Program Net kWh Savings by Measure Type

Measure Type	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Compressed Air	1	1	316,031	335,638	223,759

Measure Type	*Projects*	*Units*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*
Total	1	1	316,031	335,638	223,759

4.2.4. Net Ex Post Peak kW Savings

The net ex post peak kW savings of the program during the 2013 calendar year are summarized by program in Table 4-10. The net ex post peak savings for the custom program are 8,308.06 kW, while the net ex post peak savings for the standard program are 3,902.34 kW. The net ex post peak savings for the new construction program are 44.93 kW, while the net ex post peak savings for the retro-commissioning program are 19.50 kW.

Table 4-10 Summary of Free Ridership, Spillovers, and Net Peak kW Impacts by Program

Program	*Gross Ex Ante Peak kW Savings*	*Gross Ex Post Peak kW Savings*	*Estimated Free Ridership*	*Spillovers*	*Net Ex Post Peak kW Savings*	*Estimated Net to Gross Ratio*
Custom	10,301.60	10,253.51	808.21	34.35	9,479.65	92%
Standard	3,264.74	4,291.96	205.50	2.23	4,088.70	95%
New Construction	-	45.97	2.85	-	43.12	94%
RCx	70.00	72.58	24.19	-	48.39	67%
Total	13,636.34	14,664.02	1,040.75	36.58	13,659.86	93%

5. Process Evaluation

This chapter presents the results of the process evaluation of the Ameren Missouri BizSavers Programs during 2013. The purposes of this process evaluation are to assess the effectiveness of Ameren Missouri's 2013-2015 BizSavers Programs in delivering appropriate energy efficiency technologies to the business sector served by Ameren Missouri and to identify ways to improve the BizSavers Programs and inform future program design. The evaluation has been guided by five regulatory research questions specified in 4 CSR 240-22.070(8): to identify the primary market imperfections; to investigate whether the target market segment is appropriately defined, program measures reflect the target market's needs and available technologies, and communication and delivery channels and mechanisms are appropriate; and to investigate whether there are better ways to address market imperfections to increase adoption of program measures.

The remainder of this chapter is organized into eight main sections. The first section presents a summary of evaluation data sources and high-level summaries of process findings by data source.

5.1. Summary of Evaluation Sources and Findings

The research team collected or analyzed both qualitative and quantitative data to understand program process and outcomes. Specifically, the team interviewed or surveyed 15 staff members of Ameren Missouri and its implementation contactor, Lockheed Martin; 236 program participants and near-participants; 77 service providers (including both members and non-members of the Ameren Missouri Trade Ally Network); and 18 attendees (trade allies, other service providers, and business customers) of program educational events. The team also reviewed program documentation to gain a full understanding of plans (e.g., marketing plan) and processes and analyzed the program database to characterize the population of program participants and review data quality.

The evaluation data collection activities are summarized in Table 5-1. High-level findings follow. In some cases, findings from different sources are grouped as they address common topics.

Table 5-1 Evaluation Data Collection Activities

*Data Source**	*Method*	*Dates*	*Key Research Topics*	*Analytic Techniques*
Program staff (15) Ameren Missouri (5) Lockheed Martin (10)	In-depth interview	January to July 2013	Program function; communication; tracking and reporting; quality control	Qualitative, thematic analysis
Program documentation	Document review	January to December 2013	Program function; tracking and reporting; quality control	Qualitative, thematic analysis
Database analysis (587)	Database review	December 2013	Number of projects; project type and details; data quality	Quantitative, univariate and bivariate frequencies
Service providers (77)	Telephone semi-structured interviews	November to December 2013	Trade Ally Network; program awareness; program marketing; program processes; promotion of energy efficiency; satisfaction	Quantitative, univariate and bivariate frequencies and qualitative, thematic analysis
Event attendees (18)	Paper survey	December 2013	Event satisfaction; experience with training; Intention to work with BizSavers; firmographics	Qualitative, thematic analysis
Participants, Standard and Custom programs (229)	Online survey	January 2014	Program experiences; installed equipment; satisfaction with program	Quantitative, univariate and bivariate frequencies
Participants, New Construction and Retro-commissioning programs (2)	In-depth Interview	December 2013	Program experiences; installed equipment; satisfaction with program	Qualitative, thematic analysis
Near-participants, Standard and Custom programs (5)	In-depth Interview	December 2013 to January 2014	Program awareness; reason for program withdrawal; other energy efficiency activities; satisfaction with program	Qualitative, thematic analysis

* For interviews and surveys, sample sizes are shown in parentheses.

5.1.1. Program Staff and Documentation Review

Interviewed Ameren Missouri staff were experienced with the utility's programs, while about half of Lockheed Martin's program staff were new to the Ameren Missouri BizSavers programs in the current program cycle. Contacts reported that continuing staff provided continuity through relationships with customers and trade allies. All staff reported that communication within and between the two organizations was going well overall.

The program's marketing plan calls for raising program awareness among a wide range of business types through a diversity of channels. Using two brands ("ActOnEnergy" and "BizSavers") the 2013 marketing plan focused on high-usage customers and prior participants, but also potential customers for newly incented measures. Although program awareness was reportedly complete among key account customers by mid-2013, barriers to further market penetration included difficulty reaching decision-makers, marketing to lower-usage customers, and identifying savings opportunities for large industrial customers who resist sharing processes with outsiders.

Program staff reported efforts to rebuild the Trade Ally Network by encouraging re-enrollment of previously participating allies, conducting numerous presentations and launch events to recruit new ones, refreshing the trade ally website, and introducing a "tier" system to recognize more-active trade allies.

During the first half of the year, Lockheed Martin staff reported that results in terms of outreach and applications were on track, if not slightly better than anticipated.

5.1.2. Database Analysis

The analysis of the program database revealed that the distribution of projects across a range of business types is consistent with the distribution in the general population, suggesting that the program is effectively reaching the main segments of the target market. Other analyses indicated that nearly all completed projects were from the standard or custom incentive paths, well distributed between the two types. Projects were disproportionately concentrated in large buildings, reflecting the implementer's strategy of focusing on high-usage customers. Projects also tended to be somewhat disproportionately concentrated in St. Louis and its suburbs.

5.1.3. Program Participants and Near-Participants

The results of the participant survey suggest that the program is generally proceeding well in terms of meeting the needs of participants with standard and custom projects. There are not yet enough new construction and retro-commissioning projects to assess the success of those programs.

Survey respondents were most likely to learn about the program through non-utility sources, mainly vendors and contractors. Majorities reported company energy-saving policies and proactivity in program participation, indicating an inclination to save energy. Among all outside actors, vendors had the greatest influence on the decision to install efficient equipment.

Most respondents reported their own staff at least helped install their equipment, which usually arrived within two weeks, and they were largely satisfied with the range of program-qualified equipment and the quality of both the equipment and the installation. Somewhat less than half of standard-only participants were aware of the custom option but did not pursue it primarily because the standard program option covered their equipment needs.

Customer satisfaction was high across all program facets, including interactions with program staff, and incentives generally were at least as much as the amount expected.

The 180-day timeframe does not limit the types of standard projects that participants might consider proposing.

The greatest challenges were with the application instructions. Those who were directly involved in completing the application were equally likely to report the instructions lacked clarity as to report they were clear (two-fifths provided no opinion), and more than one-quarter of custom participants had to resubmit their application or provide additional supporting documentation.

5.1.4. Program Near-Participants

Near-participant reports of program awareness and the roles of contractors and vendors were consistent with results from the participant survey. Interviewees reported discontinuing their application for program incentives because of delays in application processing, the difficulty of preparing the required calculations, or equipment incompatibility.

5.1.5. Service Providers

Awareness of the Ameren Missouri Trade Ally Network was moderate among service members who were not members of the network. Membership in the network, and the co-branding it provided, reportedly improved trade ally credibility with customers, resulting in a broadened customer base and increased sales.

In general, interviewed service providers (network members and non-members) were satisfied with all program elements. Interviewees were satisfied with program training events and program guidelines, although those that deal with equipment other than lighting were less satisfied with the coverage and clarity of information presented in program training.

Those with an opinion about program marketing generally reported favorable opinions. Their estimates of customer program awareness varied widely, however, averaging around 50%. Service provider responses suggested differences in awareness among customer types – lowest among small business owners and highest among educational customers.

Most service providers reported proposing incentives to most or all of their customers, who tend to follow their recommendation, although they reported relatively low use of the ActOnEnergy or BizSavers brands in promoting Ameren Missouri incentives. They generally reported that program rules did not limit the efficiency equipment they recommended, but rules had introduced major project delays for about a quarter of them.

Most interviewees had sought assistance from program staff, generally reporting satisfaction with the assistance provided.

5.2. Program Staff Feedback

To gain a full understanding of the program's goals, implementation, and delivery for the current program cycle, evaluation staff interviewed the Ameren Missouri BizSavers Program team and staff from Lockheed Martin, the program implementer. Interviews lasted approximately one hour each, and occurred during January, May, June, and July 2013. Evaluation staff interviewed the program manager in January 2014.

Evaluation staff interviewed included:

- Five members of Ameren Missouri's BizSavers management and support staff: the program manager, a program engineer, the new construction program lead, the supervisor for key account representatives, and a customer service advisor.
- Ten members of the Lockheed Martin program staff: the program manager, the deputy program manager, a program engineer, the lead project coordinator, a project coordinator, the data analyst, the marketing manager, the trade ally coordinator, and two business development leads.

The following sections include Lockheed Martin and Ameren Missouri staff perspectives on topics including roles and responsibilities; communications; working relations with trade allies, other program partners, and non-allied service providers; marketing and outreach activities; tracking and reporting; and process quality control.

5.2.1. Roles and Responsibilities

Program staff provide oversight and support to Lockheed Martin program implementation staff. Lockheed Martin is responsible for conducting all BEE program activities and actively managing the program to meet program goals. The roles of staff in each organization, and their interactions, are described in this section.

5.2.1.1. Ameren Missouri

Five of Ameren Missouri's 20 Energy Efficiency Demand and Response (EEDR) staff are assigned to program management. These include high-level staff who may dedicate as little as 10% to 20% of their time to BizSavers while contributing to other programs or portfolio-level management.

Four Program staff have direct reporting lines to the Business Energy Efficiency Program managing supervisor: the program manager, who is responsible for portfolio management activities such as program design and quality control; the retro-commissioning program supervisor; a program specialist who also serves as acting manager for new construction program; and a project management supervisor. At the time of our interviews, Ameren Missouri had not filled the new construction program manager position.

Other EEDR staff who support the program comprise a senior EM&V consultant in charge of program evaluation, marketing staff, field staff (including engineers, estimators and division personnel), contracts staff, key account representatives (KARs), customer service advisors (CSAs), and the Business and Community Affairs managing supervisor. KARs work with about 50 of the utility's largest commercial and industrial accounts; CSAs work within an assigned territory with a broad and diverse customer base.

All but one of the Interviewed Ameren Missouri staff had 20-to-30-year histories with Ameren Missouri, in portfolio and project management, internal and external reporting, management of specific incentive programs, and customer relations.

5.2.1.2. Lockheed Martin

Lockheed Martin's leadership team for the program comprises a program manager and deputy manager; team leads for marketing, business development, and engineering; and a development lead for the new construction program. Figure 5-1 shows all staff members and their reporting relationships.

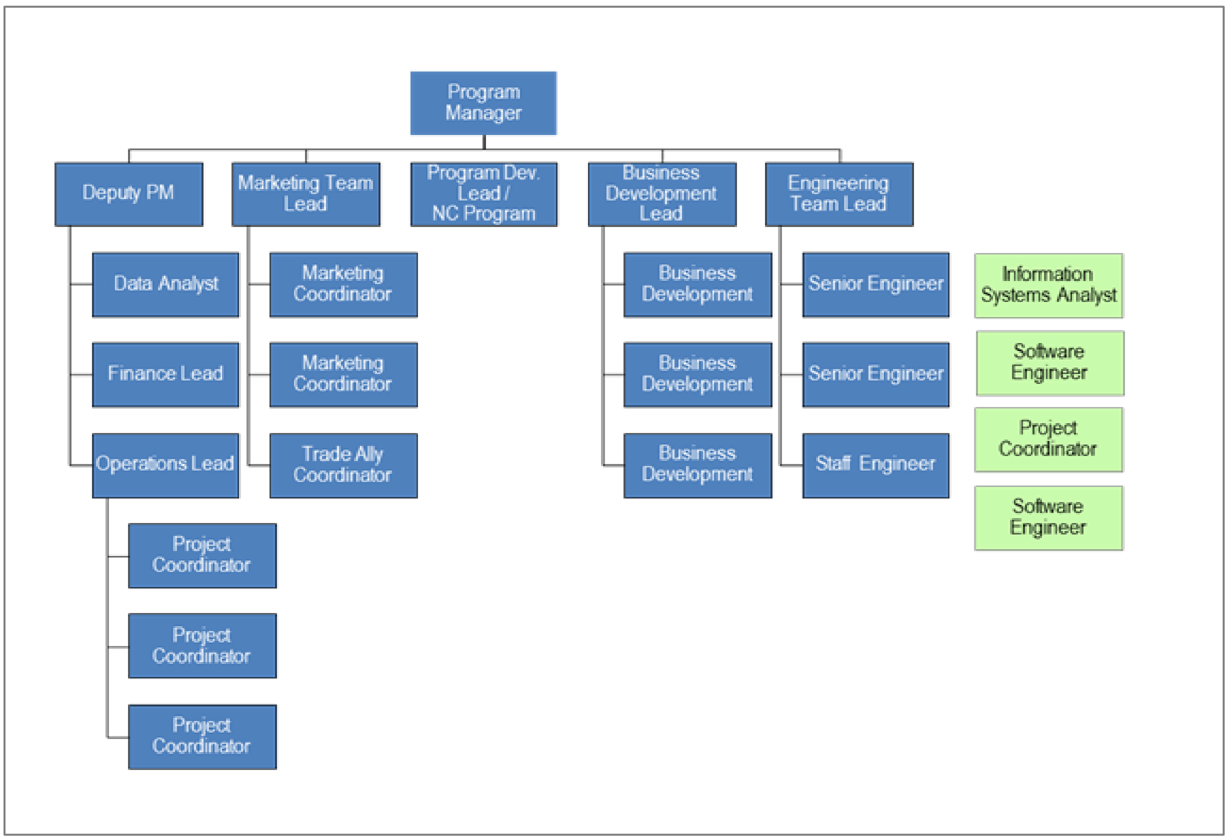


Figure 5-1 Lockheed Martin BizSavers Program Organizational Chart

The business development group is solely dedicated to Ameren Missouri's BizSavers Program; other staff are primarily dedicated to Ameren Missouri, but may also provide some support to other utility programs implemented by Lockheed Martin. Other Lockheed Martin staff (shown in green in Figure 5-1) are available as backups as needed to dedicated program staff (shown in blue).

BizSavers business development representatives (BDs), project coordinators (PCs), and engineers are organized into “triple teams” to see projects through from initial outreach through application and ultimately to payment of incentives. All three types of triple-team members have direct contact with Ameren Missouri business customers and service providers throughout the application process.

Individual BDs focus on direct outreach to customers in their own geographic territories. They identify leads with assistance from Lockheed Martin’s marketing team, Ameren Missouri program staff, and Ameren Missouri KARs and CSAs and through speaking engagements and training seminars with trade groups and large service provider firms.

Each PC manages the application process for a specific BD, verifying application information, entering data in the tracking system, and interacting with service providers throughout the project process.

Engineers support all of the BDs and project coordinators by reviewing the applications, fielding questions, signing off on the incentive offers, and conducting pre- and post-inspections when warranted. Under direction of the engineering staff, the deputy program manager, the operations (PC) lead and business development staff also may conduct pre-inspections for projects that involve straightforward review, such as confirmation of the types and numbers of lamps.

The marketing team includes the marketing team lead, plus a marketing coordinator and a trade ally coordinator. This structure has expanded from the initial program cycle, when there was only one marketing position. The person who held that position in Cycle 1 has returned as the marketing lead/manager. The marketing team works closely with Ameren Missouri staff and Lockheed Martin BDs to develop and implement strategies to support the program. See Section 5.2.3 for an in-depth discussion of program outreach and marketing.

About half of Lockheed Martin staff interviewed during 2013 also worked on the program during the initial program cycle, while others came from other Lockheed Martin program offices or other industry-related positions outside Lockheed Martin. Continuing staff reported that their relationships with customers and trade allies have helped to facilitate communications about program re-launch and changes since the initial program cycle. Some staff have been promoted, bringing with them an understanding of the nuts and bolts of how the program works.

The Lockheed Martin program manager reported that there are plans to add business development and engineering staff in 2014.

Going forward, some staff mentioned they would benefit from learning more about business energy efficiency industry technologies and measures, including CEA or CEM energy auditor certification. They said that pursuing certification could enhance their industry expertise, help them to identify deeper savings opportunities, and better address the needs and concerns of service providers and customers.

5.2.2. Program Communication

Both Ameren Missouri and Lockheed Martin staff report that communication within and between their respective organizations is going well overall. Perspectives from each group are described next.

5.2.2.1. Ameren Missouri Perspective

Ameren Missouri staff report that internal communications are open and functioning well. Twice-monthly meetings are keeping EEDR program managers informed of division activities and issues. Attendees include staff from integrated resource planning, residential, EM&V, and marketing. The managing supervisor and program supervisors meet weekly to collaborate on activities and any issues within and across the program.

Program supervisors and implementation staff, including marketing agency staff, meet weekly. Topics covered typically include progress updates and upcoming marketing events (such as Ameren Missouri's sustainability challenge to businesses). Ad hoc marketing meetings are scheduled as needed. Program staff reported that external communication is running smoothly with Lockheed Martin staff.

Utility and Lockheed Martin staff periodically meet with CSAs to share goal attainment updates and general program news and to encourage on-going communications among the working groups.

Internal and external communications are supported by the centralized access to program information via SharePoint. Postings include such information as meeting agendas, marketing materials, and current and past program status reports. One contact mentioned SharePoint's advantage over email for the sharing of documents across utility and Lockheed Martin staff.

Ameren Missouri staff reported one communication-related challenge: Lockheed Martin marketing staff were not initially aware that Ameren Missouri needed to review not only content changes to the trade ally section of the website, but formatting changes as well. Ameren Missouri also required more time to conduct the reviews than Lockheed Martin was. This issue has since been worked out to the utility's satisfaction, though a Lockheed Martin staff member indicated the turnaround time needed by utility staff was somewhat longer than ideal.

5.2.2.2. Lockheed Martin Perspective

Lockheed Martin staff also report that both internal and external communications are going smoothly.

Internally, Lockheed Martin staff have both function-specific and cross-functional meetings to keep everyone informed of program details and troubleshoot any issues as they arise. Monthly leadership team meetings with the program manager and senior staff are held to review program performance, stalled projects, and any other high-level issues. All team leads meet with the deputy program manager on a weekly basis to review program performance and review any issues. Project coordinators meet on a weekly basis to talk about projects and cover a rotating learning topic. A monthly all-hands staff meeting provides a time for everyone to come together.

Most of the interviewed staff reported that they learned about the new program rules and processes by attending special internal meetings and trainings, talking with other staff members, and reading documentation. The complete operations group met several times per month early in the program year to make sure everyone was familiar with the rules and processes. Project coordinators began the year by receiving in-depth training on the tracking tool from the data analyst who manages the tool.

Staff reported a generally open work environment where cross-talk and collaboration is encouraged. A move to a new office layout where staff sit in functional groups, with operations staff and engineers working adjacent to one another, helped in this regard.

Externally, Lockheed Martin managers' report having "very open communication lines" with Ameren Missouri program managers. PCs contact Ameren Missouri staff on a routine basis, often to obtain usage data for new projects when it is not possible to obtain the needed data from the database. PCs also may check with Ameren Missouri staff to ensure the utility has not already provided an incentive payment for a new project, particularly on measures like screw-in LEDs that might have received point-of-sale rebates through the residential program.

5.2.3. Program Outreach and Marketing

Marketing was a key focus of program activity during 2013, as both Ameren Missouri and Lockheed Martin implementer staff worked to spread the word that the program was back after a one year hiatus and that new incentives were available.

5.2.3.1. Marketing Goals

Program marketing efforts are guided by the 2013 Ameren Missouri Business Energy Efficiency Program Marketing and Communications Plan. Key marketing objectives listed in the plan are to 1) Market to past participants in a strategic manner, 2) market to non-participants, 3) collaborate with Ameren Missouri outreach staff, and 4) engage service providers. The marketing plan also calls for meeting the unique needs of a variety of specific business sectors.

5.2.3.2. Marketing Planning and Utility Oversight

Ameren Missouri and Lockheed Martin staff work closely together on marketing, but have distinct marketing roles. The utility is responsible for building consumer awareness and portfolio building; Lockheed Martin is responsible for designing and implementing detailed program marketing plans and materials to be used in all outreach, training and promotions. Lockheed Martin BD staff work closely with utility KARs and CSAs to manage effective one-on-one communications with individual customers and service providers.

“ActOnEnergy” is the corporate brand for Ameren Missouri’s efficiency programs in Missouri and Illinois. Ameren Missouri developed sub-brands for the overarching ActOnEnergy brand employing a “savers” theme, with the “BizSavers” program name for businesses. Consequently, the program website uses both brand names (ActOnEnergy and BizSavers) for its business energy efficiency programs.[12]

The utility has established guidelines around program name branding, and internal staff review the marketing plan as well as all Lockheed Martin-developed external-facing communications to ensure compliance with the guidelines. Utility program staff and those in Ameren Missouri’s Business and Communications (B&C) group review web, TV, and radio content before it is posted or aired, as well as messages delivered via multiple print media channels. Program staff reported the process works well most of the time, although the review process sometimes takes longer than expected when actors in all three groups (BizSavers, B&C, and Lockheed Martin) are busy at the same time.

5.2.3.3. Marketing Channels

Both Ameren Missouri and Lockheed Martin outreach staff use many communication channels to educate customers. Messages are delivered via in-person, phone and email direct communications with key targeted customers and trade allies. They are delivered more broadly via mass mailings, email blasts, fact sheets, the program website, radio, and newspaper advertising, and webinars.

5.2.3.4. Outreach Activities

In keeping with the Marketing Plan, initial outreach efforts during 2013 focused on high-usage customers and prior program participants; about half of targeted savings were expected to come from new projects with prior participants. Efforts also focused on

[12] http://www.ameren.com/sites/AUE/UEfficiency/businessenergyefficiency/Pages/BusinessEfficiency.aspx

identifying prospects for newly incented measures, including commercial kitchens and IT data centers. Lockheed Martin staff interviewed early in 2013 also mentioned the possibility of conducting a pilot aimed at grocery stores.

According to records shared by Lockheed Martin, outreach staff delivered nearly 100 group presentations to thousands of attendees from December 2012 through December 2013 (see Section 5.5 for detail). Efforts included monthly “Lunch ‘n Learn” events for customers and service providers, where experts (including trade allies, and manufacturers like Toshiba) shared information on the latest in energy efficiency topics like lighting control, and Lockheed Martin staff shared ways to take advantage of BizSavers incentives. Other presentations occurred at trade shows, trade association meetings, and program incentive check presentations. Lockheed Martin staff also conducted training workshops for large customers at their facilities upon request.

With several actors in the field promoting the BizSavers Program, B&C staff have taken steps to minimize potential customer confusion over whom they should contact. Lockheed Martin staff carry Ameren Missouri business cards to establish their relationship with the utility. Additionally, Lockheed Martin staff let key account staff know when they will be contacting key customers.

5.2.3.5. Efforts Targeting Small and Mid-Sized Customers

Program managers also conducted substantial outreach aimed at small and midsized businesses during the 2013 program year. Program staff conducted targeted outreach events, mailings, email blasts, bill inserts, and social media efforts to raise awareness with this target. Later in the year, the program launched a pilot program called the Distributor Partnership Program, which could further raise visibility with this target through showroom point-of-purchase materials and trade ally outreach. In addition, the implementer was in the process of introducing a new “Fast Track” user-friendly online application tool for standard incentives, which may make incentives more accessible to small customers.

5.2.3.6. Efforts Targeting Customers Outside St. Louis Metro Area

Program managers conducted outreach aimed at companies outside the St. Louis metro area during 2013. Efforts started with presentations during the first half of the program year to groups such as the Chamber of Commerce, service organizations, and trade groups in a variety of geographic locations throughout the state. Outreach to distributors through the Distributor Partnership Program also reached beyond the St. Louis metro area.

5.2.3.7. Role of Ameren Account and Customer Support Staff

Ameren Missouri KARs and CSAs use the program as a tool for educating customers about energy efficiency and the choices they may have regarding their utility bill. CSAs also distribute traditional marketing materials to key customers, for example, by forwarding monthly BizSavers Solution newsletters. They also respond to inbound calls and questions from customers, noting that some customers continued to call CSAs for Program updates during the bridge year.

CSA staff also have encouraged staff and customers to use social media to communicate. As one contact noted, social media channels may be of limited use in certain sectors since “Mom and pops do not tweet.”

5.2.3.8. Marketing Effectiveness

Despite losing momentum during the bridge year, CSAs and Lockheed Martin business development staff reported that outreach to customers was effective at increasing awareness of the program in the marketplace. One CSA staff member reported that 100% of key account customers knew about the program by mid-year 2013.

Staff credit their collaborative approach, both within Lockheed Martin and between utility and implementer staff, with generating ideas and opportunities to achieve program goals. Examples include collaborating to turn incentive payments into public relations opportunities in the form of a testimonial or case study and conducting specialized trade ally training on data centers.

Marketing methods that staff reported were most successful mid-year included:

- Email campaigns aimed at qualified decision-makers, targeting both past program participants and new customers that focuses on program benefits.
- Outreach to trade associations and industry groups through in-person presentations their members, sponsoring events, purchasing customer lists for email or mail campaigns, and advertising in their newsletters.
- Trade ally marketing and outreach.

While program marketing has been successful to a large degree, utility staff recognized several key barriers to uncovering energy savings opportunities in the target market:

- **Difficulty building a good qualified email list of customers** who haven’t participated in the program before. Lockheed Martin marketing and business development staff start with the Hoover database, but identifying names of actual decision-makers can be a time-consuming process involving one-on-one outreach to the target company or organization. Ameren Missouri customer databases typically include accounts payable contacts rather than energy efficiency purchase decision-makers. As a result, Lockheed Martin staff, with support from KARs and CSAs in their sectors, have worked to build their own lists.

- **Competitive concerns of customers and service providers**. Larger industrial customers are especially resistant to sharing their processes with outsiders, limiting the ability of program staff and trade allies to identify savings opportunities. Outreach events with service providers also make it difficult or awkward to have open discussion, as competitors do not want to reveal sensitive information about their methods or customers to their competitors.
- **Study cost requirements**, especially given no guarantee of savings.
- **Lack of a reporting mechanism accessible by KARs and CSA that supports effective, on-going customer relations after projects are completed**. A related issue is providing CSAs access to information about which customers receive which program newsletters, so they do not duplicate effort in re-sending those materials.
- **Difficulty targeting smaller electrical usage customers.** They may fall below the radar of key account representatives and CSAs, and can be hard to reach through mass media advertising. However, Ameren Missouri staff and implementer contacts reported outreach efforts to small and mid-sized customers that may help to overcome difficulties reaching that group (see also Section 5.2.3.5, above).

5.2.4. Marketing and Outreach to Service Providers

Lockheed Martin staff worked toward the goal of enrolling 200 service providers into the program's BizSavers Trade Ally Network by year-end. Lockheed Martin focused initially on contacting the 240 Trade Ally Network members who participated in the prior program cycle through email blasts, newsletters, and in-person presentations with trade groups, plus program-sponsored launch events. Staff also reached out directly to trade allies and other service providers via phone calls as needed. Staff also did similar outreach with electrical and mechanical contractors who had not previously participated in the program.

BD staff—working with the trade ally coordinator—prioritized the 30 to 40 historically active trade allies as well as equipment distributors for individual outreach and in-person meetings.

5.2.4.1. Trade Ally Network Application Requirements

A new requirement this year for membership in the BizSavers Trade Ally Network was to sign an agreement with a clause covering adhering to program co-branding guidelines. In the prior program cycle, some trade allies did not request program approval on each collateral piece. With the addition of staff marketing coordinators who can help co-create and approve materials, staff report the process of getting approval on co-branded collateral is working much more smoothly now. The trade ally coordinator reported trade allies were interested in putting their company logo on the Excel application tool, on brochures, their websites, proposals, and even on t-shirts.

In addition, re-enrolling trade allies must resubmit an updated application along with proof of insurance for the current program cycle. Trade allies who are new to the program are also required to provide customer references (renewing trade allies were not required to resubmit references).

Once trade allies are accepted into the BizSavers Trade Ally Network, Lockheed Martin staff respond to requests to conduct on-site trainings at the trade ally firms to walk through application requirements. However, staff noted that staff resources are not sufficient to do on-site orientation trainings with all registered trade allies; rather, they conduct them with the largest firms and with those that are new to the program, especially those in a position to promote newly incented measures, including data center IT incentives.

5.2.4.2. Trade Ally Website

Lockheed Martin staff refreshed the website dedicated to trade allies at www.tradeallynetwork.com as part of the program re-launch, working with a designer to improve the look and feel in addition to the content. Mid-year, the website added information about the new tiered trade ally structure, which is designed to encourage and reward Trade Ally Network member engagement. The site allows Ameren Missouri business customers to search for trade allies by region under the “Find a Contractor” link, and displays participating trade allies with a tier ranking that uses leaf icons to indicate the amount of energy savings that trade ally has generated through the program, with the highest-ranked firms displayed first (see Figure 5-2).

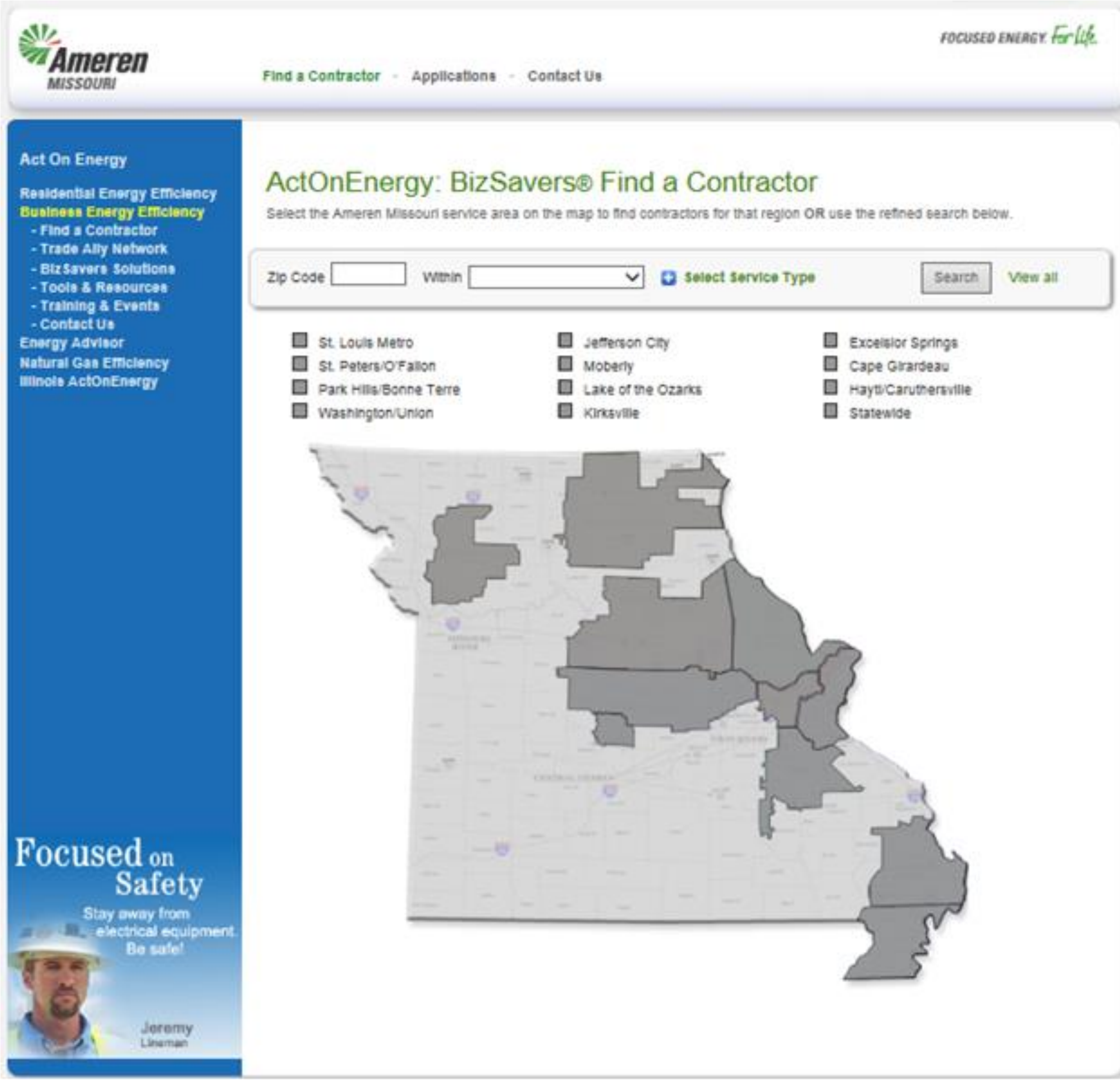


Figure 5-2 Tiered Trade Ally 'Find a Contractor" Website

5.2.4.3. Trade Ally Tiers

Trade allies enjoy more benefits as they improve their ranking, Figure 5-3. Top performers get to use window clings and vehicle magnets, co-sponsored events, and printed co-branded collateral. Other potential rewards mentioned by staff included recognition as trade ally of the quarter and at a year-end banquet. Program staff reported at the end of 2013 that the tiered structure was working well, and that the top tier is bringing in most of the projects.

Figure 5-3 BizSavers Network Trade Ally Benefits by Tier

The breakdown of active service provider firms by Trade Ally Network membership and energy savings for 2013 is shown in Table 5-2 . While only two-fifths (38%) of trade allies in the project tracking database were in the Trade Ally Network by year-end, these firms accounted for the large majority (82%) of savings. Platinum-level trade allies generated the most program savings—nearly 3 million kWh on average per trade ally firm over the course of the year.

Table 5-2 Trade Ally Network Membership and Energy Savings

Trade Ally Network Membership	*Count of Trade Ally Firms*	*Percent of Trade Ally Firms*	*kWh Savings**	*Percent of kWh Savings by Trade Ally Membership Type*	*Average kWh Savings Per Trade Ally Membership Type*
Network Member	93	38%	138,161,309	82%	1,485,605
Platinum	24	10%	71,450,614	43%	2,977,109
Gold	17	7%	32,400,896	19%	1,905,935
Silver	27	11%	16,346,591	10%	605,429
Not Tiered	25	10%	17,963,208	11%	718,528
Not Network Member	155	63%	29,545,902	18%	190,619
Total	248	100%	167,707,211	100%	676,239

*Data shown are for projects started during 2013 where a trade ally was listed in the project tracking database. Another 19,145,204 kWh of savings are not attributable to specific trade ally firms. Electric energy savings are comprised of both estimated and actual savings, depending on project completion status.

Overall, Lockheed Martin staff report they are trying to create an environment where trade allies believe the program is providing them with clear, up-to-date information and they are comfortable asking questions and providing feedback about the program. Ameren Missouri has instructed Lockheed Martin to respond to any trade ally inquiries within 24 hours, and Lockheed Martin staff report that that has been working well.

5.2.4.4. Trade Ally Requests

Staff reported that initial input from trade allies was centered on requests for simplifying the application process to make it more user-friendly and efficient. Early in the program year, Lockheed Martin staff said they were in discussions with the utility about how to best achieve this and were exploring options for designing an online application process that would replace the Excel-based application form. By year-end, staff reported that an online application form was undergoing testing, and they expected it to be available during the first quarter of 2014 for standard program applications.

Trade allies also occasionally contact Lockheed Martin staff engineers asking for advice about how they should approach a custom program project in order to maximize the cost-benefit ratio. For example, if a customer has a piece of equipment that is down or is beyond its useful life, the Lockheed Martin engineer will direct the trade ally to a baseline model and the efficiency level needed so that the project will qualify for an incentive

5.2.4.5. Trade Ally Marketing Effectiveness

From the perspective of Ameren Missouri Program staff, Lockheed Martin is doing a very good job of managing the program's trade ally relationships. Staff lauded Lockheed Martin's outreach efforts and the potential of the new tiered ranking system to motivate trade ally performance.

By May 2013, when evaluation staff interviewed the Trade Ally coordinator, enrollment was on track with 119 trade allies approved, including both new and re-enrolled. Exact numbers were unavailable, but staff had a sense that about 70% to 80% of former trade allies had reenrolled, and that these were the ones who were most active during Cycle 1. By year-end, 180 trade allies were officially enrolled in the network, according to the program database—just shy of the program's goal of 200.

5.2.5. Market Response

The Program for 2013 to 2015 has goals for kWh savings, as well as for Net Shared Benefits (NSB) as defined in the Missouri Energy Efficiency Investment Act (MEEIA) Stipulation agreement. The NSB goals, new this year, factor in costs—including avoided costs of new generation—bringing a renewed focus by Lockheed Martin staff on the bottom line. By contrast, during the prior program cycle, Ameren Missouri paid

Lockheed Martin on a time-and-materials basis. In addition, Lockheed Martin has goals for portfolio mix (lighting vs. non-lighting) and customer satisfaction.

During the first half of the year, Lockheed Martin staff reported that results in terms of outreach and applications were on track, if not slightly better than anticipated. Contacts suggested the good progress might be due to improving economic conditions combined with higher incentive rates compared to Cycle 1. By year-end, the project pipeline included more than 100 MWh of potential savings, with about 75 MWh of that savings realized in completed projects.

Senior staff at Lockheed Martin were anticipating getting a large number of applications for LED measures (which were newly added to standard program for 2013), and were prepared to scale back lighting incentive levels if needed.

5.2.6. Staff Perspectives on Process and Quality Control

Section 2.2 seen earlier in this report provided a description of program processes. The following section focuses on staff perspectives about how well those processes are working, and the quality control measures in place to ensure smooth process flow.

With the addition of Net Shared Benefits (NSB) goals to traditional kWh savings goals, program managers need to understand how cost and the useful life of different measures roll up to meet both goals. An Ameren Missouri staffer who was heavily involved with portfolio-level reporting mentioned that measure-level reports were being developed by the corporate planning group to keep managers informed of goal achievement throughout the program cycle.

Ameren Missouri Program staff members were satisfied with tracking reports, including graphics, provided to them by Lockheed Martin. For centralized access, Lockheed Martin posts current as well as past reports on SharePoint, as required by Ameren Missouri. Program staff reported that Lockheed Martin's standardized reports (weekly and monthly) are meeting most of their information needs. Upon request by utility staff, Lockheed Martin also filled requests for ad hoc information as needs arose during 2013. For example, one staff member reported timely provision of participation rates generated by Lockheed Martin staff and shared via email.

For utility staff, quality assurance is an ongoing process that includes review of program design and completed projects. They update quality control guidelines as issues come up, or when potential issues are identified. For example, program staff identified a risk that businesses might apply for incentives through the residential CFL program, and took steps to define procedures to prevent that from happening.

Lockheed Martin staff also reported processes for quality control have been working well. Given the current contract between Lockheed Martin and Ameren Missouri is based on performance, Lockheed Martin staff have ample incentive to ensure claimed savings are correct, and free ridership is avoided. Staff pointed to a number of relevant quality control efforts, including:

- **Marketing materials**. Language used in marketing materials, including the program website and newsletters, is carefully crafted to avoid free-ridership. The aim is to make it clear that the program defrays upfront costs, enabling customers to purchase more energy-efficient equipment than they might have done on their own, yielding ongoing savings on their energy bills.
- **Application review**. Lockheed Martin staff use the Payment Approval Checklist form to ensure applications are complete. This form includes a number of quality control checks, including confirmation that the customer has a valid Ameren Missouri account number and site address. This form is also referenced before issuing incentive payments.
- **Cost-benefit review**. Staff apply cost-benefit tests to individual project measures when reviewing applications. Measures that are not cost effective (expensive in relation to potential savings) do not receive an incentive. The program also scrutinizes applications for high-cost measures to further minimize free-ridership. In addition, measures with a payback period of less than 18 months do not receive incentives. Such short payback periods are considered cost-effective enough on their own, without program incentives. Therefore, incenting those measures would run the risk of promoting free-ridership.
- **Pre-approval**. Lockheed Martin staff conduct pre-inspections on projects with incentives of $10,000 or higher, to reveal any discrepancies between stated assumptions in the application and the reality at the customer site. For example, a parking garage application may indicate that all lights are on 24 hours a day, but there may actually be daylight sensors controlling when lights are used.
  - Some exceptions are made on a case-by-case basis when custom measures are obtained without pre-approval, if the customer can demonstrate that the purchase decision was driven by program incentives. However, these exceptions are only allowed one time for an individual customer.
- **Post-installation reviews**. Lockheed Martin staff make sure the date of the incentive application is earlier than the date of the related invoice. They also conduct verification and inspection after equipment is installed for standard and custom projects with incentives valued at $10,000 or more. Incentive levels may be adjusted based on findings. They conduct an additional follow-up inspection on 25% of all retro-commissioning projects chosen at random, and 10% of standard and custom projects with incentives less than $10,000, to make sure no changes have occurred after the project was inspected. Staff engineers typically conduct these random

follow-up visits at sites involving complex projects; Business Development staff may do follow-up inspections on less complex projects (e.g., counting lights).

In addition to these formal quality control procedures, Lockheed Martin staff said that sharing information electronically contributes to quality assurance. Key methods for electronic sharing include the Energy Savings Project tracker (ESP) and the SharePoint system.

The Energy Savings Project tracker (ESP) is designed to track project flow and the volume of process-oriented emails, while making project status easier to monitor. A key feature is the use of milestones to track project status relative to project estimated completion dates. In addition to getting alerts for individual projects that start to languish, it also allows staff to better forecast project volume and identify any systemic pinch points and reasons for projects being discontinued or put on hold. The tool uses a Twitter-style “What’s new” newsfeed to log phone calls and record comments, which others can see and add to, and cuts down on the need to manage large numbers of project-related emails.

Lockheed Martin staff said the ESP tool helps them improve the elapsed time between the application, the offer and project completion, and ultimately will enable them to increase throughput to handle more project volume. It also allows them to flag projects with unusual savings, such as retro-commissioning projects with more than 15% savings. In addition, at the beginning of the program year, customer usage data were available only in a separate MS Access database. Since then, a Lockheed Martin staff member developed a way to merge the data into the tracking tool to make this a smoother process and cut down on the back-and-forth communication with utility staff.

Online material sharing through the SharePoint system (between Lockheed Martin and utility staff) and on the program website is also making a difference in streamlining communication, particularly in helping trade allies quickly climb the program learning curve. A shared events calendar allows program staff to know when others are in the field, conducting presentations with customers and service providers, and helps ensure that materials will be available and ready to go.

Challenges with program processes mentioned by Lockheed Martin staff included a variety of issues, though none were reported as especially problematic or causing undue strain. They are highlighted in Figure 5-4.

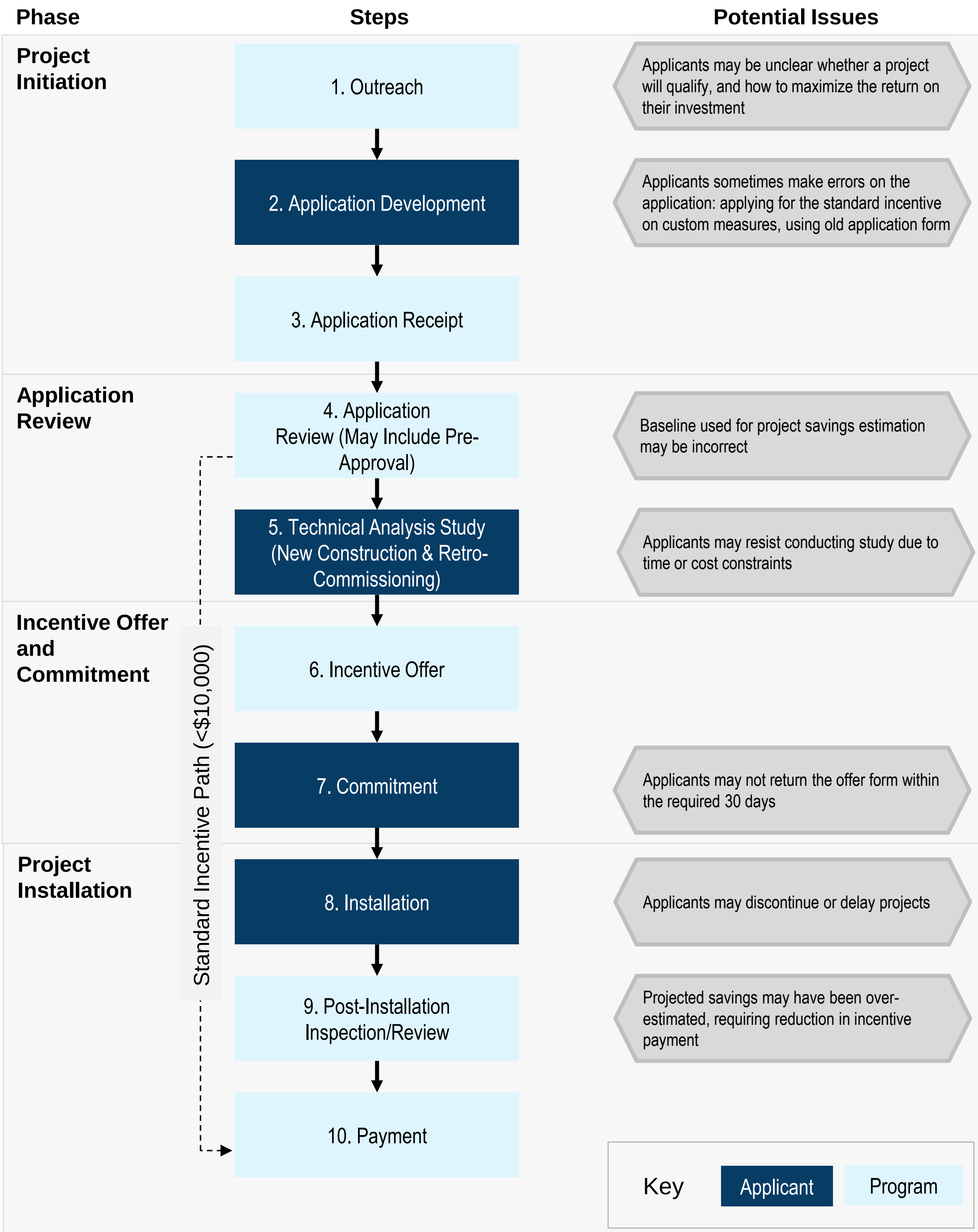


Figure 5-4 BizSavers Process Flow & Potential Issues

Key issues mentioned by staff were:

- **Helping applicants determine whether custom projects will qualify, and how cost-effective they will be**. Staff reported that service providers and customers contact them asking for help determining if their custom program project will qualify for incentives, and how to maximize the return on their investment. They want to factor the incentive into their calculations of cost-effectiveness, but have no way of knowing that up-front on custom projects. The application does not help them to easily determine if a custom program project will be approved, or what the alternatives might be.
- **Receiving incomplete or incorrectly completed incentive applications.** Both business customers and service providers (especially firms new to the program) can be prone to making mistakes on the incentive application. A common problem during Cycle 1 was that customers submitted applications for measures that were already installed but did not qualify for Standard incentives (and therefore fall under the custom program rules, requiring pre-approval). Staff were on alert for this issue early in the year, and indeed ran into it again early in 2013, though trade ally education efforts have helped to alleviate the problem. The problem persists primarily with individual customers who submit their own applications (rather than using a trade ally). Lockheed Martin pays an incentive to some of these applicants, on a case-by-case basis, if they can justify the purchase decision was driven by program incentives. However, these exceptions are only allowed one time for an individual customer. A related issue was making sure that service providers realize they always need to use a newly downloaded Excel application from the website, rather than just reusing an older version they may have used in the past.
- **Using the incorrect baseline for pre-approval.** By year-end, the program evaluation team also came upon a process issue during the pre-approval verification of energy savings on a new construction program project. The evaluator's review determined that the customer's engineer that did the initial model overstated the equipment's energy consumption and did not use the correct source (ASHRAE) for estimating the baseline, resulting in an inflated estimate of project savings. The Lockheed Martin staff review of the application did not catch these issues. The evaluation contractor estimated a substantially lower (nearly 75%) estimate of the project's estimated savings and recommended that the customer re-run its model with revised input. At the time of preparation of this report, the customer was still deciding whether or not to commit to the additional engineering expense of doing so.

Other quality-control related issues mentioned by staff were:

- **Tracking tool does not support Macintosh**. The Lockheed Martin marketing team lead did not have direct access to the tracking tool when evaluation staff spoke with her mid-year because she used an Apple Macintosh computer, and the tool did not support that platform.

- **Monitoring budgets.** Tracking budget performance became complicated by the fact that, unlike in Cycle 1, budgets are now mixed across the individual incentive programs – new construction, retro-commissioning, standard, and custom. This makes it a challenge to determine if the program is within budget, which is especially important as the program is now paid by performance.

5.3. Database Analysis

Evaluation staff carried out an analysis of the participant database to identify characteristics of the participants and the projects they have done. The main purpose of the analysis is to determine how well the participant survey sample represents the participant and project population.

5.3.1. Analysis of Completed Projects

As only two new construction and one retro-commissioning projects had been completed by the end of 2013, the following analysis covers only custom and standard projects and the participants with those projects. We identified 587 unique participants with completed custom or standard projects, where the identification of a unique participant was based on the Parent Company field in the program database. Those 587 participants collectively had completed 1,214 projects by the end of 2013. While a large majority of participants had a single completed project, those participants with multiple completed projects accounted for the majority of completed projects (Table 5-3).

Table 5-3 Participants with Single and Multiple Completed Projects

Participant Type	*Participants*		*Project*	
	Count	*Percent*	*Count*	*Percent*
Participants with a single completed project	444	76%	444	37%
Participants with multiple completed projects	143	24%	770	63%
Total	587	100%	1,214	100%

Completed standard projects were more common than custom projects at the project level but not the participant level, as shown in Table 5-4.Twenty percent of participants had projects that combined both types of measures, and those types of projects accounted for nearly one-fifth of all projects.

Table 5-4 Incentive Types of Participants and Completed Projects

Incentive Type	*Participants*		*Projects*	
	Count	*Percent*	*Count*	*Percent*
Custom only	297	51%	402	33%
Standard only	275	47%	593	49%
Custom and Standard	120	20%	219	18%
Custom (with or without Standard)	381	65%	621	51%
Standard (with or without Custom)	377	64%	812	67%
Total	587	100%	1214	100%

To shed light on how well *BizSavers* is covering various segments of the commercial building market, we examined project completions by building end-use type, building square footage, annual building kWh usage, and location (by zip code grouping), comparing the distribution of BizSavers participants and projects to population data when available. The population data are from the Commercial Buildings Energy Consumption Survey (CBECS), a nationwide survey of commercial buildings conducted by the U.S. Energy Information Administration.[13]

Since a participant may have had multiple projects at multiple sites, the participant-level analysis counts some participants more than once in these analyses. Therefore, the percentages of participants across, for example, incentive types or building types sum to greater than 100%.

5.3.1.1. Building End-Use Types

As shown in Table 5-5 the most common building end uses were office and retail. Together, those two end-use types made up about one-third of all projects. While the two types account for about the same percentage of participants, those with retail buildings tended to install more projects than those with office buildings and so retail buildings had nearly twice as many projects altogether than did office buildings.

[13] Source: http://www.eia.gov/consumption/commercial/data/archive/cbecs/cbecs2003/ detailed_tables_2003/. We were unable to identify appropriate Missouri-specific population data.

*Table 5-5 Building End-Use Types by Incentive Type *,***

Building End-Use Type	*All Participants*		*Projects*					
			All Projects		*Standard*		*Custom*	
	Count	*Percent*	*Count*	*Percent*	*Count*	*Percent*	*Count*	*Percent*
Office	111	19%	160	13%	98	12%	79	13%
Retail	105	18%	262	22%	212	26%	139	22%
Industrial	66	11%	79	7%	28	3%	67	11%
Warehouse	57	10%	66	5%	27	3%	58	9%
School	52	9%	247	20%	187	23%	111	18%
Restaurant	27	5%	40	3%	39	5%	5	1%
Lodging	24	4%	51	4%	45	6%	8	1%
Grocery / Convenience	19	3%	62	5%	33	4%	33	5%
All Other	149	25%	247	20%	143	18%	121	19%
Total	587	100%	1214	100%	812	100%	621	100%

*We included projects that included both Custom and Standard measures in both the Custom and Standard cross-tallies; therefore, the cell and column totals for Custom and Standard projects sum to more than the cell and column totals for all projects.

**Building type data is missing for three completed projects. These three sites are included in the “All Other” category.

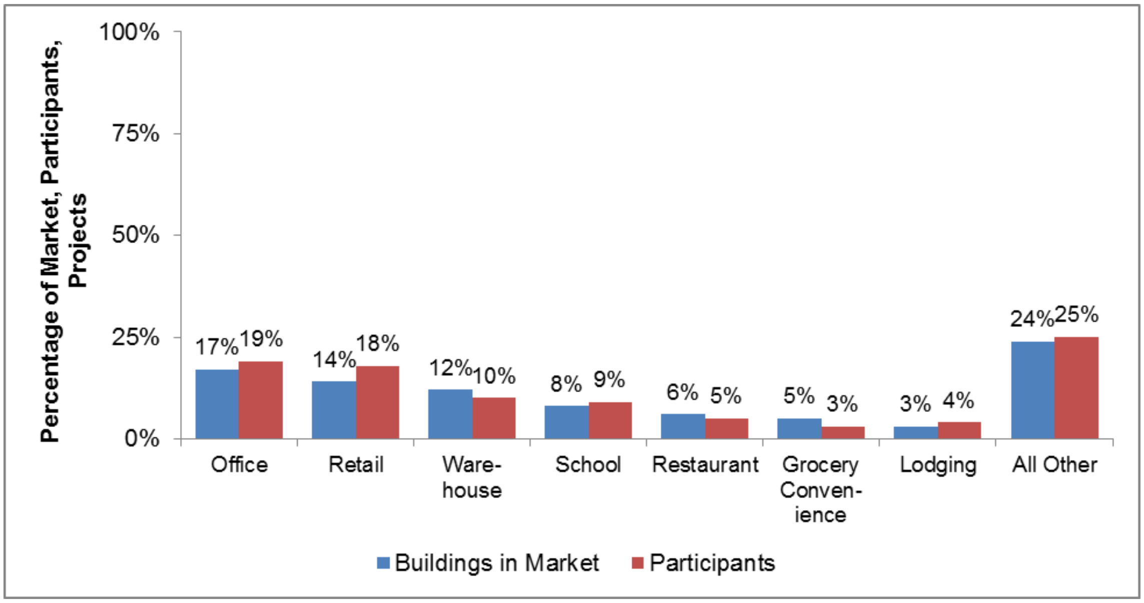


Figure 5-5 shows how the distributions of participants and projects compare to population data from CBECS. The distribution of participants across building end-use types mapped closely to the population data.

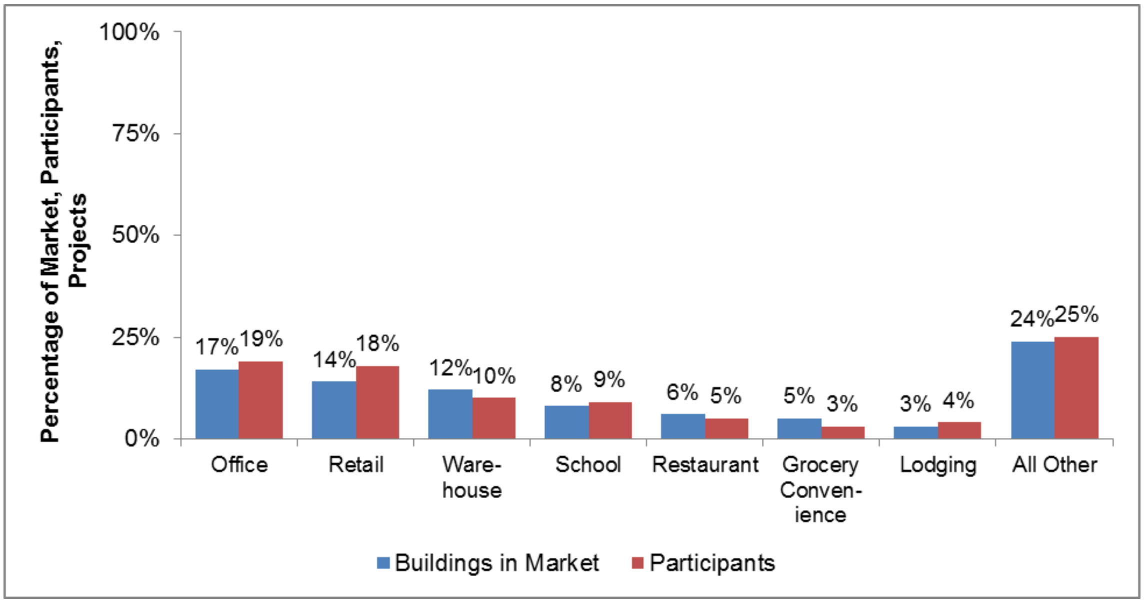


*Figure 5-5 Distribution of Participants by Building End-Use Types, Compared to Population Data**

* The population data are from the Commercial Buildings Energy Consumption Survey (CBECS). The "Industrial" end-use type is not shown as that type is not included in CBECS.

5.3.1.2. Building Size

We also examined how participants and projects are distributed by building size. A challenge for this analysis is that the participant database is missing square footage data for about one-quarter of both projects and participants. This was a challenge because missing square footage was more common in some building types than others[14] and some building types were larger, on average, than others. Therefore, the missing square footage must be accounted for to produce an accurate analysis.

We used linear regression analysis to calculate predicted square footage values for those projects missing square footage. We calculated separate regression equations for each building end-use type. Table 5-6 shows that the mean square footage by building end-use, with the predicted values replacing missing data, differed little from the mean square footage data for only those cases with non-missing data, validating this method of replacing missing data. The table also shows that mean square footage varies by building end-use type.

[14] The proportion varied from about one in seven projects in large retail buildings to nearly half of restaurant projects.

Table 5-6 Missing Square Footage Replacement by Building End-Use Type

Building End-Use Type	*Number of projects*	*Number projects missing SF*	*% Missing SF*	*Mean SF, Non-missing*	*Mean SF, Predicted SF Replacing Missing*	*% Difference*
Large School	191	49	26%	139,069	140,995	1%
Other Retail	154	35	23%	16,422	16,105	2%
Large Retail	108	15	14%	31,847	32,521	2%
Other Office	81	15	19%	122,239	117,132	4%
Large Office	79	16	20%	142,054	141,268	1%
Warehouse	67	16	24%	79,187	78,456	1%
Grocery and Convenience	62	29	47%	50,451	50,172	1%
Other School	56	10	18%	75,191	78,206	4%
Other Industrial	52	11	21%	109,235	100,580	9%
Lodging	51	11	22%	462,363	461,695	0%
Full Service Restaurant	34	15	44%	8,140	7,882	3%
Large Industrial	29	5	17%	114,035	113,010	1%
Fast Food Restaurant	6	3	50%	5,213	4,262	22%
All Other	244	63	26%	213,532	211,572	1%

We replaced missing square footage data with the predicted data when examining the distribution of participants and projects. Both participants and projects were reasonably distributed across a range of building sizes (Table 5-7). The general distribution of building size was similar for projects with standard and custom measures as well.

Table 5-7 Building Square Footage by Incentive Type,***

Building Square Footage	*All Participants*		*Projects*					
			All Projects		*Standard*		*Custom*	
	Count	*Percent*	*Count*	*Percent*	*Count*	*Percent*	*Count*	*Percent*
Up to 5,000	80	14%	100	8%	67	8%	43	7%
5,001 to 10,000	63	11%	77	6%	59	7%	29	5%
10,001 to 25,000	110	19%	229	19%	179	22%	143	23%
25,001 to 50,000	86	15%	131	11%	81	10%	73	12%
50,001 to 100,000	132	22%	280	23%	183	23%	126	20%
100,001 to 500,000	117	20%	208	17%	131	16%	114	18%
More than 500,000	76	13%	142	12%	81	10%	73	12%
Total	587	100%	1213	100%	812	100%	617	100%

*Projects that included both custom and standard measures were included in both the custom and standard cross-tallies; therefore, the cell and column totals for custom and standard projects sum to more than the cell and column totals for all projects.

**Some participants had multiple projects in buildings of differing sizes. Therefore, a given participant could be represented in more than one size category, and the participant counts at each size category do not sum to the total participant count.

We compared the distribution of projects and total savings by building size with available population data on number of buildings and total building square footage by size range. While buildings smaller than 10,000 square feet constitute nearly three-quarters of all commercial facilities, they accounted for about 15% of projects. Thus, large buildings have a much higher participation rate than do smaller ones. This is not surprising, as the small business sector is notoriously difficult to reach.[15]

Although facilities smaller than 10,000 square feet constitute nearly three-quarters of all commercial facilities, they account for only one-fifth of all commercial square footage. Therefore, we also examined the distribution of BizSaver savings across building size as it compares to the distribution of total commercial square footage in the population. Figure 5-6 shows the distribution of 2013 BizSavers projects and savings across building size as it compares to the distribution of total commercial building square footage in the broader population (from CBECS). The percentage of projects done in small buildings is consistent with their share of the total population building square

[15] Fisher, M., Moran, D., and Gogte, S. (2013). Engaging Small Customers: Maximizing the Direct-Install Hook. Presented at the Association of Energy Services Professionals 23rd National Conference, January 2013.

footage. However, small buildings account for a lower percentage of overall savings than would be expected solely from their share of total commercial building square footage.

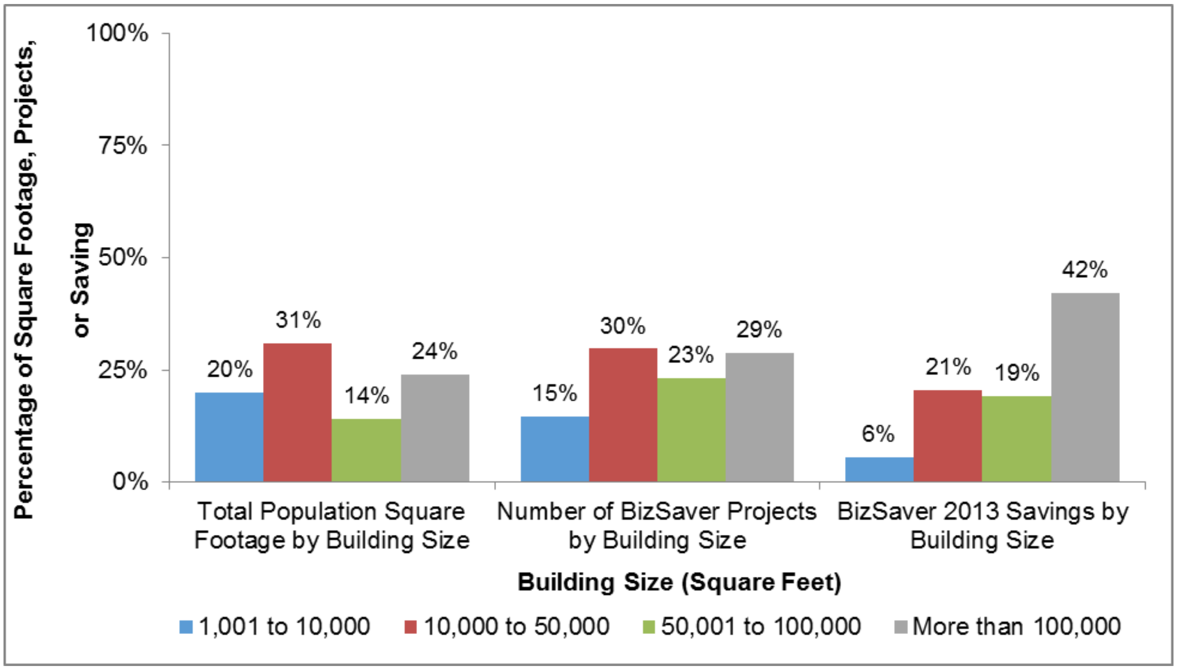


*Figure 5-6 Distribution of Participants by Size, Compared to Population Data**

* The population data are from the Commercial Buildings Energy Consumption Survey (CBECS), a nationwide survey of commercial buildings conducted by the U.S. Energy Information Administration.

We examined whether greater energy usage intensity in larger buildings than smaller ones could explain the above finding. However, when we repeated the above analysis with data on total electricity consumption instead of commercial building square footage, the results differed only marginally from above: the four building size tiers shown in the above graphic consume, respectively, 19%, 25%, 15%, and 27% of total electricity consumption.

5.3.1.1. Building Annual Energy Consumption

We also examined how participants and projects are distributed by building annual electricity consumption. The analysis of building annual consumption largely mirrors the analysis of building size (Table 5-8), with participants and projects reasonably distributed across usage levels up to the highest levels.

Table 5-8 Building Annual kWh by Incentive Type,***

Annual kWh Usage	*All Participants*		*Projects*					
			All Projects		*Standard*		*Custom*	
	Count	*Percent*	*Count*	*Percent*	*Count*	*Percent*	*Count*	*Percent*
Up to 50,000	73	14%	94	9%	64	9%	41	7%
50,001 to 100,000	62	12%	74	7%	51	7%	31	6%
100,001 to 500,000	187	36%	311	29%	207	29%	190	34%
500,001 to 1M	91	18%	218	20%	170	24%	113	20%
1,000,001 to 5M	109	21%	238	22%	149	21%	111	20%
More than 5M	62	12%	146	14%	82	11%	74	13%
Total	514	100%	1081	100%	723	100%	560	100%

*Projects that included both custom and standard measures were included in both the custom and standard cross-tallies; therefore, the cell and column totals for custom and standard projects sum to more than the cell and column totals for all projects.

**Eleven percent of completed projects had either no annual kWh value in the database (6%) or a value of zero (5%).

5.3.1.1. Building Location

About half of participants and projects were in St. Louis, and about another two-fifths were in the immediate suburban areas (see Table 5-9)**.** Thus, St. Louis and its suburbs constituted about 90% of participants and projects. These areas make up about 70% of the population of Missouri counties with zip codes within the ranges shown.

*Table 5-9 Distribution of Zip Codes of Completed Projects *,***

Zip Code Group	All Participants		Projects					
			All Projects		Standard		Custom	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
63000-63099****	178	30%	324	27%	195	24%	206	33%
63100-63199***	281	48%	625	52%	441	54%	274	44%
63300-63399****	91	16%	148	12%	102	13%	78	13%
63500-63599	2	<1%	2	<1%	2	<1%	0	0%
63600-63699	5	1%	6	<1%	3	<1%	4	1%
63700-63799	27	5%	35	3%	27	3%	12	2%
63800-63899	2	<1%	2	<1%	1	<1%	2	<1%
64000-64099	3	1%	5	<1%	5	1%	0	0%
64400-64499	2	<1%	2	<1%	2	<1%	2	<1%
64600-64699	1	<1%	1	<1%	1	<1%	1	<1%
65000-65099	19	3%	25	2%	10	1%	18	3%
65100-65199	15	3%	18	1%	10	1%	11	2%
65200-65299	12	2%	18	1%	11	1%	10	2%
65500-65599	1	<1%	1	<1%	0	0%	1	<1%
Total	587	100%	1212	100%	810		619	

Projects that included both custom and standard measures were included in both the custom and standard cross-tallies; therefore, the cell and column totals for custom and standard projects sum to more than the cell and column totals for all projects.
**Two projects were missing the parent site's zip code.
***St. Louis
****St. Louis suburb

5.3.2. Database Structural and Data-Entry Issues

In analyzing the participant database, we identified three common structural and data-entry issues that can complicate, limit, and even introduce error into those analyses: 1) the database may not associate building-specific data to project records in cases where a building is part of a multi-building site or campus; 2) inconsistently recorded information, which may make the same company or site appear as separate ones; and 3) an insufficient variety of building end-use codes, resulting in a large percentage of records coded as "other" building type. We also noted that the database includes a field that contains historical energy consumption data that appears not to be accurate for an undetermined percentage of projects.

The following subsections provide details on those issues.

5.3.2.1. Multiple Buildings at a Single Site

In the database, a unique project (e.g., 999999-COMPANY A) belongs to a parent site (e.g., COMPANY A LOCATION X), and this parent site belongs to a parent company (e.g., COMPANY A). Multiple projects may be associated with a single site, and multiple sites may be associated with a single company. It appears that a given Ameren Missouri account number may be uniquely associated with a given parent site.

This one-to-many relationship is sufficient to characterize cases where a given site consists of a single building or aggregate of buildings that are always treated as a single unit. However, it is less straightforward to characterize cases where a site has multiple buildings of varying sizes and end users. This is illustrated in the case of a particular participant. The Ameren Missouri database shows 15 projects associated with that entity. All 15 projects are associated with the same account number, but based on the content of the parent site field, those 15 projects are at 14 separate buildings within the broader parent site. This, in and of itself, is not necessarily a problem. However, it appears that some of the information associated with the individual site records may possibly pertain to the entity as a whole rather than the specific building. In particular, all 15 records have one of two very similar figures for annual kWh consumption, both of which are in the 92nd percentile of annual kWh figures for all projects. By contrast, building areas and annual hours of operation are distributed across the range for all projects.

If the annual consumption figures are in fact at the level of the larger aggregate (or "campus") of buildings at the parent site, then using these data would produce erroneous calculations of, say, mean annual consumption per project site (i.e., building) or mean savings as a percentage of consumption. This would not be a problem if the concern is only to examine aggregated savings across each parent site, but in cases where a parent site includes multiple building types, this would prevent accurate analyses of savings rates for various building types.

Introducing a building-specific identifier that would be related to the parent site field in a many-to-one relationship would not necessarily prevent situations like the above, but it may encourage the entry of building-specific data associated with each project, making such situations less likely.

5.3.2.2. Inconsistently Recorded Information

We found a very common issue, which is that information for a given company or site was entered in various formats. For example, Figure 5-7 shows, with relevant customer-identifying data anonymized, that a single address for 15 projects at a single location was recorded in five different ways: 1) One *Street Name* Dr.; 2) 1 *Street Name* Dr *City Name*; 3) #1 *Street Name* Dr; 4) 1 *Street Name* Drive; and 5) One *Street Name* Drive. Although the differences are subtle, they would prevent these records from showing up as all the same site.

Address1ParentSite
One Street Name Dr.
1 Street Name Drive City Name
#1 Street Name Drive
1 Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
One Street Name Drive
1 Street Name Drive

Figure 5-7 Inconsistent Address Formats

We observed some other consistencies as well. For example, among these 15 projects, two appeared to be at the same specific building , but the information was recorded differently for the two records.

The problem of inconsistent addresses can be addressed through structural database changes or by adopting data entry conventions. One possibility would be to structure the database with separate fields for each element of a street address (number, street name, type of street, unit number, and so forth) and limit the type of input in each field. For example, the street number field might accept only numeric, not text, entries. Street type could be recorded with a drop-down list (Street, Drive, Avenue, Boulevard, etc.). Absent structural changes, such variations as seen above could be avoided by adopting conventions to achieve the same ends – e.g., all street numbers written with numeric, not text, values; all street types recorded in a single acceptable method (written out in full or using a specific abbreviation); no punctuation; and so forth.

The problem of inconsistent entry of company or site names could be avoided or reduced by incorporating a function that shows possible field values from the database as the user begins data entry. If a particular company or site already exists in the database, the user would select that value to populate the field.

5.3.2.3. High Percentage of Records with "Other" Building End Use

Finally, we noted that the building end use type was coded as "other" for 20% of all projects, making that the second most common end use type. This continues to be the case. The "other" category may encompass a wide range of disparate end uses, thereby making end-use analyses of one-fifth of the projects meaningless. We suggest adding additional categories based on an analysis of the records coded as "other." In many cases, information on the type of site is found in the parent site field. At a minimum, additional categories may include parking lot and walkway.

5.3.2.4. Outdated or Inaccurate Consumption Data

As a quality assurance check, we calculated project savings as a percentage of each respective site's annual consumption as recorded in the database. We found that the savings percentage figure was unusually or even impossibly high in many cases (Table 5-9) According to the reported savings and consumption figures, 9% of projects produced annual savings greater than 40% of the total site annual consumption, and 3% produced annual savings greater than total site annual consumption. (In one case, the annual savings were more than seven times the annual consumption.)

Table 5-10 Distribution of Project Savings as a % of Annual kWh Consumption

Savings Percentage	*Number of Projects*	*Percent of All Projects*
Up to 1%	248	23%
More than 1% to 5%	284	26%
More than 5% to 10%	178	16%
More than 10% to 20%	174	16%
More than 20% to 40%	120	11%
More than 40% to 60%	33	3%
More than 60% to 100%	28	3%
More than 100%	16	1%
Total	1081	100%

The program implementation contractor confirmed that those kWh consumption figures may be old or incorrect figures imported from the Ameren Missouri customer database and that the contractor bases its estimation of energy savings on its own assessments of baseline building energy consumption.

5.4. Feedback from Trade Allies and Service Providers

Evaluation staff conducted semi-structured interviews with 77 service providers, including Ameren Missouri trade allies, Retro-commissioning Service Providers (RSPs), and non-allied contractors and vendors that had completed projects in the Ameren Missouri BizSavers standard, custom, new construction, and retro-commissioning programs. The interviews covered program awareness, awareness and benefits of the Ameren Missouri Trade Ally Network, training received, perceptions of program marketing, customer program awareness, promotion of energy efficiency, and program experience. For RSPs, questions about customer program awareness and program experiences focused on the retro-commissioning program; for trade allies and non-allied contractors and vendors that did new construction projects, those questions focused on the new construction program; otherwise, questions were general or addressed any equipment retrofit (standard or custom program) projects. Appendix C provides the full interview guide.

Overall, results indicate that such service providers play a significant role in marketing the program and energy efficiency to potential customers. Respondents reported low awareness among their customers of energy efficiency generally, and of the BizSavers programs, especially for small businesses. Those who were TAN members reported TAN membership and co-branding had benefits, including broadening their customer base and increasing sales. Respondents suggested improvements to processes and requirements for custom and retro-commissioning projects, and to the list of accepted standard measures. They also suggested increasing TAN awareness among new construction contractors and vendors.

5.4.1. Sampling and Data Collection Approach

The sampling goals were: 1) to complete interviews with contacts from a sample of 75 service provider firms, which is sufficient to achieve 95% confidence and 10% precision of estimates; 2) to achieve a distribution of respondents that reasonably reflects the types of projects done; and 3) to prioritize service providers that had undertaken large numbers of projects, and/or projects with high savings.

Unique service provider firms (“service providers”) served as the sampling unit. The population is defined as all firms that worked on at least one BizSavers project that began in 2013. The exact population size is not known as no service provider was listed for 156 projects (8% of all 2013 projects, most of which were discontinued or still in an early stage). However, in 2013 the BizSavers programs registered 180 members of the TAN, of whom 11 were RSPs, and the project database shows an additional 156 service providers outside the TAN, for a total of 336 service providers. The sample frame consisted of firms associated with project applications as of October 11th, 2013. Of those, the majority were associated with only standard and/or custom projects.

Evaluation staff allocated the sample among the service provider types as follows. Since the standard and custom programs accounted for the greatest number of projects by far, we targeted 67 interview completions with service providers that had done such projects, to achieve 90/10 confidence/precision. At the time the sample frame was defined, about two-thirds of the standard and custom projects had been done only with lighting measures, so we allocated two-thirds of the 67 interviews (45 interviews) to service providers that had done only lighting projects; we allocated the remaining third (22 interviews) to providers that had done both lighting and non-lighting measures.

We then allocated the remaining nine interviews across the three RSPs with at least one Retro-commissioning program project and the 18 service providers associated with new construction projects.[16] Table 5-11 summarizes the population, frame, target, and final number of completed interviews, and provides the resulting confidence and precision levels, for each group.

Table 5-11 Service Provider Population and Sampling Information, by Group

Group	*Population*	*Frame[a]*	*Target*	*Final*	*Confidence/ Precision*
Standard/Custom	>330	162	67	68[b]	95/10
Lighting only	~ 220+	110	45	45	> 85/10
Non-lighting	~110+	52	22	23	< 80/10
New Construction	>18	12	5	5	n/a
Retro-commissioning	11	3	3	4	n/a
Total	>330	177	75	77	95/10

a The sample frame was drawn in October 2013. At that time, 110 service providers had done only lighting projects. Of those, 10 went on to complete non-lighting projects before the end of the year and we reclassified them as non-lighting trade allies at that point.

b Includes two partial interviews, both with non-lighting service providers. Because of missing data from partial responses, the reported n varies across the analyses.

After conducting the survey, we discovered that one of the survey respondents was an RSP who also did standard and custom projects. At the time of the sample development, that respondent had not yet done any retro-commissioning projects, and therefore we had allocated him to the Standard/Custom group. As a result, we did not ask that respondent certain questions specific to the retro-commissioning program (see below). However, we did re-classify that respondent as an RSP after the fact for certain analyses, as noted below.

Evaluation staff weighted each trade ally in the sample frame to increase the chances of interviewing larger-volume or higher-savings service providers. To do that, staff first identified service providers that: 1) had started at least one project during 2013, and 2) had at least one measure associated with those projects. Each service provider was then assigned a random number (generated using the Mersenne Twister method[17]), which was then multiplied by a weight reflecting project volume and savings. The resulting call list of service providers was sorted so that firms with the highest weights were contacted first.

An experienced member of the research team called the service provider firms. The interviewer asked to speak with the individual at each firm with the highest number of

[16] Even though some RSPs and New Construction trade allies did Standard or Custom projects, we assigned all RSPs with Retro-commissioning projects to the RSP list and all New Construction trade allies to the New Construction list to ensure sufficient data on the Retro-Commissioning and New Construction programs.

[17] Heidelberger, Coutre, and L'Ecuyer. 1998. "Mersenne twister: a 623-dimensionally equidistributed uniform pseudo-random number generator." *ACM Transactions on Modeling and Computer Simulation* 8:3-30. Available at: http://dl.acm.org/citation.cfm?id=272995. Last accessed on January 27, 2014.

unique BizSavers projects (identified from the program database). If that person was unable or unwilling to complete the interview, the interviewer asked to speak with another contact associated with that firm. Calls continued until we achieved the targets for each group.[18] In total, the interviewer attempted contact with 169 service providers and completed interviews with 75 respondents, achieving a completion rate of 45%. Dispositions are listed in Table 5-12.

Table 5-12 Service Provider Interview Sample Dispositions

Disposition	Count
Frame	177
Not attempted	8
Not eligible or unable to contact	6
Quota reached before able to contact	2
Total number of attempts	369
Number of firms attempted	169
Not reached	84
Bad number	3
Refused	3
Duplicate contact	1
Left job	1
Partial Complete	2
Complete	75

5.4.2. Weighting Interview Responses

At the end of 2013, evaluation staff again counted the number of service providers in the program database, by project type, to compare to the sample frame developed in October. The new count showed 70 additional service providers, all with non-lighting projects. We also re-classified 10 of the sample frame's 110 lighting-only service providers as non-lighting because of non-lighting projects those firms added late in the year. As a result, the distribution of lighting-only to non-lighting service providers changed and the distribution in the sample was no longer proportional to the distribution in the database.

This meant that for any interview responses on which lighting-only and non-lighting service providers differed significantly, combined unweighted data would not accurately represent the population as represented by the year-end totals. Therefore, for any items that showed statistically significant differences between lighting-only and non-lighting, we report both weighted and unweighted counts and percentages for combined data. For lighting service providers, we calculated data weights as:

[18] Exceptions: we completed one more RSP interview than targeted and two more Standard/Custom trade ally interviews, but as noted two of the Standard/Custom trade ally interviews were partial interviews.

$$Weight_{light\_only} = (\eta_{total} / N_{total}) / (\eta_{lighingt\_only} / N_{lighting\_total})$$

Similarly, for non-lighting trade allies, we calculated the data weights as:

$$\mathrm{Weight}_{non\_lighting} = (\eta_{total} / N_{total}) / (n_{non\_lighting} / N_{non\_lighting})$$

Because the new construction program service providers and RSPs made up a very small percentage of the sample, we did not weight those respondents.

5.4.3. Description of Interviewed Service Providers

Interviewed service providers represented a diverse group in terms of program activity: two-thirds of standard and custom program service providers had experience only with lighting projects, about another one-fifth had experience only with non-lighting projects. As noted above, fewer had new construction or retro-commissioning program experience. Interviewed service providers worked on a minimum of one and a maximum of 66 BizSavers projects in 2013 (Table 5-13)

Table 5-13 Number of Ameren Missouri BizSavers Projects per Service Provider During 2013 (n = 77)

Number of Projects	*Count*	*Percent*
1	23	30%
2 to 10	37	48%
11 to 25	11	14%
26 or more	6	8%
Total	**77**	**100%**
Mean	9	
Median	4	

About three-fifths (57%) of the interviewed service providers were registered members of the TAN. This percentage is higher than the percentage of TAN members among all service providers that did 2013 projects (38%). As TAN membership likely suggests greater program commitment, it is not surprising that we obtained greater interview participation from TAN members. We did not find any statistically significant differences between TAN members and non-members in interview responses; therefore, there was no need to weight combined responses based on TAN membership.

Members of the TAN that have completed at least one project are assigned to one of three "tiers" based on number of project completions or kWh saved (see Section 4.2.4). Most (81%) of the interviewed TAN members were in one of the three tiers. Among those in a tier, the distribution across the three tiers was comparable to the distribution of all tiered trade allies identified in the program database.

Service provider firms ranged widely in size, with one reporting more than 300 locations; most (60%) had only one location. The number of employees also varied greatly, from 1 to 125,000, with a median of 25. Service providers reported serving all areas of Ameren Missouri's territory (Table 5-14).

Table 5-14 Areas Served by Service Providers
(n = 77, Multiple Responses Allowed)

Area Served	*Total (n = 77)*	
	Count	*Percent*
St. Louis Metro	71	92%
Western Suburbs	55	71%
Central Missouri	53	69%
Southeastern Missouri	48	62%
Kirksville	40	52%
Excelsior Springs	25	32%

Respondents worked for a wide range of customer types (Table 5-8), though industrial/manufacturers and offices were most commonly mentioned.

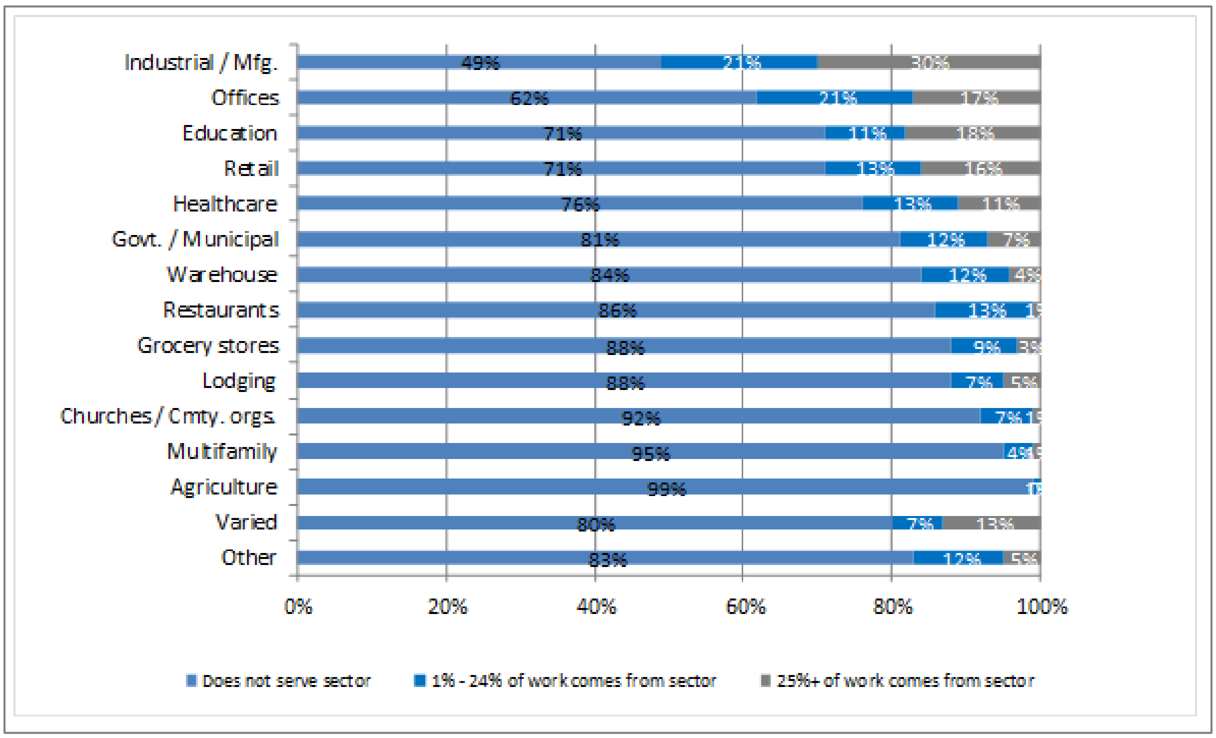


*Figure 5-8 Service Provider Customer Sector/Building Types (n=77, Multiple Responses Allowed)**

Service providers varied in the degree to which their work was focused on a limited number of customer types (e.g., industrial, office, and retail) or distributed across many. Only 11 respondents (14%) said they do all their work for a single customer type, but half of the 77 respondents said one customer type accounts for half or more of their work. At the other extreme, nearly one-third of respondents said their work encompasses a wide range of customer types. [19]

New construction and standard/custom program service providers were likely to report that their work was distributed across multiple customer types, while RSPs tended to focus on one sector (one RSP each mentioned industrial/ manufacturing, research institutions/government, or office buildings). Lighting-only service providers were significantly more likely than non-lighting service providers to report working for government or municipal (33% vs. 5%) and retail clients (56% vs. 14%).[20] This likely reflects the large amount of lighting in retail establishments and in the types of buildings and other sites in the government and municipal sector (e.g., offices, parking lots, street lighting).

5.4.4. Membership in and Awareness of Trade Ally Network

Forty-four of the 77 interviewed service providers (57%) were members of the Ameren Missouri BizSavers TAN: 38 of the 68 custom/standard program service providers, two of the five new construction program service providers, and all four of the RSPs. More than half said their previous experience with an Ameren Missouri program, staff member or website had encouraged them to join the TAN (Table 5-15.)

Table 5-15 How Trade Allies Joined the Ameren Missouri Trade Ally Network (n=44; Multiple Responses Allowed)

	Count				
Source	*Standard / Custom*	*New Construction*	*Retro-commis-sioning*	*Total*	*Percent*
Ameren Missouri	25	0	0	25	57%
Previous involvement	13	0	3	16	36%
Ameren Missouri MO contact	11	0	0	11	25%
Ameren Missouri MO website	2	0	0	2	5%
Industry contact	5	0	0	5	11%
Other	3	0	0	3	7%
Do not know	6	2	1	6	14%
Total	38	2	4	44	100%

TAN members were more active in the standard and custom programs than were non-members; on average, sampled TAN members worked on an average of 13 projects

[19] Five reported that they work for seven or more customer types and 17 said their work was too varied to characterize.

[20] Government / Municipal: $p = 0.002$; Chi Square = 9.346; $n = 67$. Retail: $p < 0.001$; Chi Square = 14.808; $n = 67$.

and non-members worked on an average of 3 projects. [21] This finding could indicate either that participation in the TAN helps service providers sell efficiency to customers or that those most likely to market the program actively are also more likely to become TAN members.

Just over half (17 of 30) of TAN non-members said they were aware of the TAN. Of those 17, four reported they did not realize their membership had expired. Most of those who were aware they were not TAN members had applied to become members (3) or were considering doing so (6). Of the remaining four, one worked for a firm that did little business in Missouri, one was unsure of TAN membership benefits, and two did not provide reasons.

Forty-four of the 77 (57%) of respondents said they or someone else at their company had attended at least one Ameren Missouri public event (such as “Lunch and Learns” or launch events) to learn more about Ameren Missouri’s efficiency programs. Not surprisingly, a higher percentage of TAN members than non-members attended such an event (66% vs. 43%).[22] Nearly all of the 31 TAN members who attended such events said the events had not influenced their decision to join the TAN, but that they already had joined or were planning to join before they attended a public event.

5.4.5. Benefits of Trade Ally Network Membership

TAN members enjoyed several benefits as a result of their membership. One benefit was the ability to use the Ameren Missouri logo to co-brand their services. About two-thirds (65%) of the TAN members reported doing so. Of those that co-branded their services, three-fourths said co-branding had helped their firm; most of them (67%) explained that co-branding improved their firm’s credibility in the market. The 14 TAN members that had not co-branded offered a variety of reasons for not doing so; the most common was that they “simply had not gotten around to it” (six of 13 responses, or 43%). Two others said they plan to co-brand in the future, two said they did not know why their firm did not co-brand, and six others offered miscellaneous reasons (43%). Additional statistical analysis revealed that those who co-branded had done significantly more BizSavers projects than TAN members who had not. [23]

Overall, TAN members reported that membership was beneficial to their firm. About half or more of the interviewees rated their membership as “very beneficial” (“7” to “10” on a 0-10 scale, where “0” was “not at all beneficial” and “10” was “extremely beneficial”) regarding the three items in Figure 5-9. Partaking in co-branding enhanced the benefits.

[21] $p < .001$; Mann-Whitney U = 857.500; $n = 68$. This analysis excludes New Construction trade allies and RSPs, as there may be reason to expect those trade allies have completed fewer projects. However, results did not change when we included those two subgroups in the analysis.

[22] $p = .019$; Chi Square = 5.550; $n = 77$.

[23] $p < .001$; Mann-Whitney U = 334.000; $n = 42$.

Those that co-branded rated TAN membership as more beneficial than did those that did not co-brand, in broadening their customer base and increasing sales.[24]

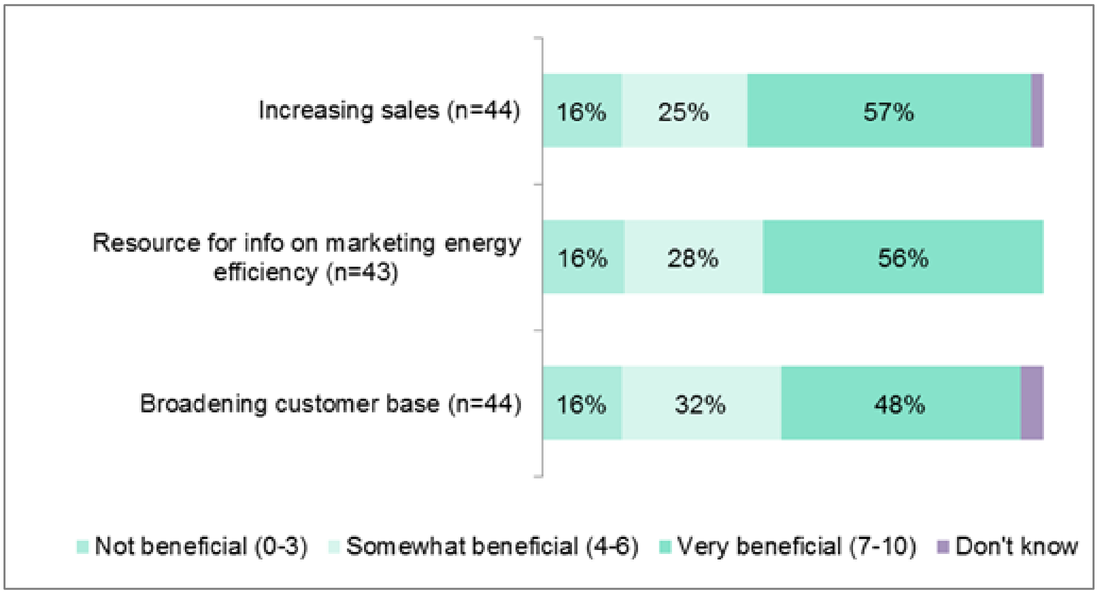


Figure 5-9 Rated Benefits of Membership in Ameren Missouri Trade Ally Network

5.4.6. Training

The interviewer asked service providers whether they had attended any training events other than informal public launch events. One-third of respondents reported having attended a formal training event. [25] Of those, nearly three-quarters (19 of 26) indicated they or a colleague had attended one or two training events, while the rest had attended more events or did not know how many trainings they or their colleagues had attended.

About two-thirds of respondents reported the training they attended covered the standard, custom, and/or new construction programs; about half reported the training covered the retro-commissioning program. Two-thirds reported that the training covered qualifying equipment and general application requirements, and about half said that the training covered calculation of savings and incentives and M&V requirements. Ten of the 26 respondents reported that selling the benefits of energy efficiency was a training topic; of those, seven said the training had helped them convince clients to install higher-efficiency equipment.

[24] Broadening customer base: $p = .031$; Mann-Whitney $U = 205.500$; $n = 35$. Increasing sales: $p = .016$; Mann-Whitney $U = 212.500$; $n = 35$. Ratings on “broadening their customer base” and “increasing sales” also were positively related to a larger number of BizSavers jobs completed, validating the rated benefit. (Broadening customer base: $p < .001$; bivariate linear regression coefficient = .108 (the dependent variable was transformed using log base 10); $n = 42$. Increasing sales: $p = .010$; bivariate linear regression coefficient = .082 (the dependent variable was transformed using log base 10); $n = 43$.)

[25] The distinction between informal and more formal training opportunities appeared not to be meaningful for some respondents, and so these results should be interpreted with caution.

Overall satisfaction with the training was high (Figure 5-10). Lighting-only service providers reported significantly higher satisfaction with coverage of relevant topics than did other respondents. [26]

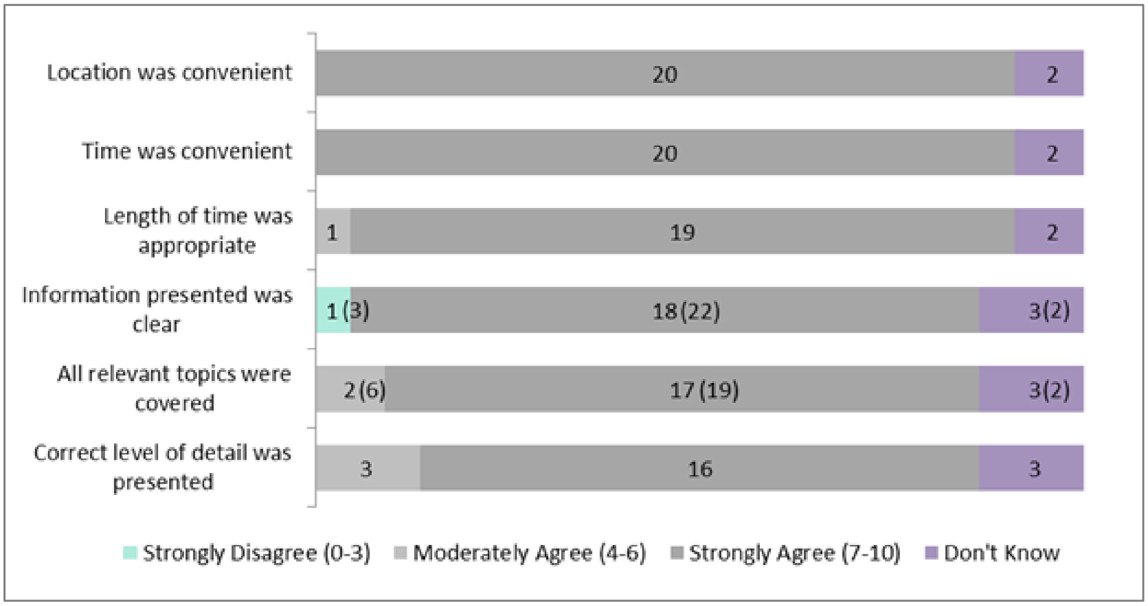


Figure 5-10 Rated Satisfaction with Ameren Missouri Training (n=22),***

* Weighted counts presented in parentheses for statistically significant items.

** Respondents rated agreement with each statement on a 0-10 scale, from "do not agree at all" to "strongly agree." For this legend, we collapsed the scale responses into three categories as defined parenthetically in the figure legend.

Non-lighting service providers were less satisfied with both the clarity of the information and coverage of relevant topics than lighting-only service providers. [27] This may reflect the fact that non-lighting service providers were more likely to do custom projects. [28] In volunteered comments throughout the interviews, service providers reported challenges with custom projects, particularly that the calculations required for custom program project applications were difficult and time-consuming to compute, and program staff were more likely to challenge them than they were the information in the standard program applications.

When asked what suggestions they had for training, 10 respondents provided suggestions. Four suggested additional training on calculating incentives or return on investment (ROI), and on providing increased clarity and detail. One or two each

[26] p = .009; Kruskal-Wallis = 11.502; *n* = 19.

[27] Information presented was clear: p = .048; Mann-Whitney U = 4.500; *n* = 12. All relevant topics were covered: p = .048; Mann-Whitney U = 4.000; *n* = 12.

[28] Custom projects: p = .005; Mann-Whitney U = 8,926.500; *n* = 248 (database analyses).

suggested incorporating case studies, providing information on recent program changes and current procedures, and discussing new technology (particularly LEDs, induction lighting, and outdoor lighting).

5.4.7. Program Marketing and Customer Awareness of Incentives

When asked their opinion of Ameren Missouri's efforts to market BizSavers incentives, more than half (58%) of respondents indicated a favorable opinion, while about one-third (31%) offered no opinion, and the rest (11%) suggested that marketing could be improved. The favorable comments were largely nonspecific (e.g., "doing a good job") but referred to TV, radio, and billboard ads as well as the "Lunch and Learns."

Those who said the marketing efforts could be improved in general said that efforts were not extensive enough, in terms of volume and the number of delivery methods. Suggested improvements included social media marketing, bill inserts, and increased/specialized marketing to small businesses (including a door-to-door sales team that would explain the program to small business owners).

Despite the positive response to the marketing campaign, service providers indicated varying levels of customer awareness of incentives (Figure 5-11).

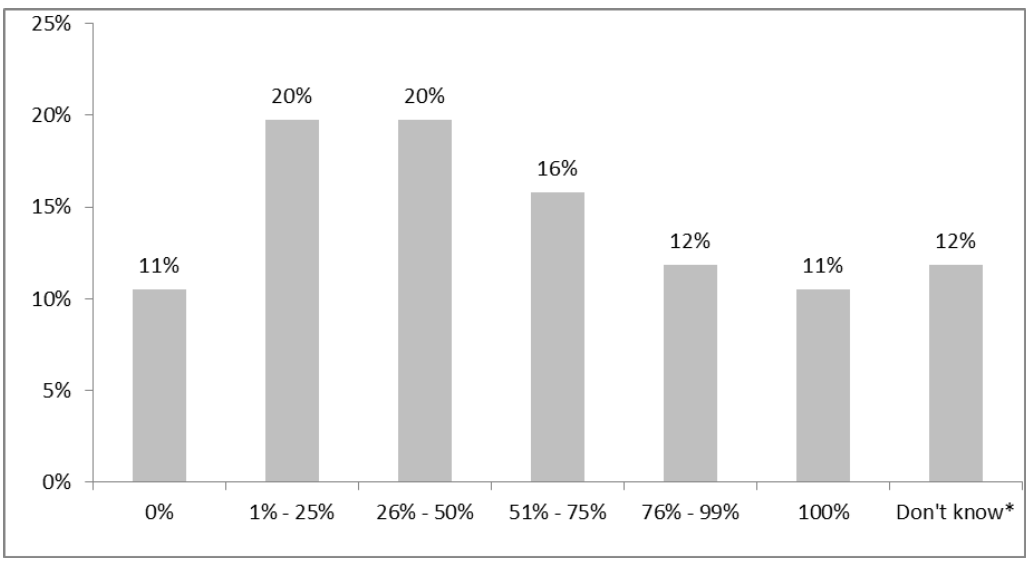


Figure 5-11 Estimated Percent of BizSavers Customers That Already Knew of Program (n=76)

* Includes one respondent who said "a lot are not aware" instead of offering a specific percent.

One goal of the evaluation was to assess to what extent the BizSavers programs are reaching the entire business market sector. To support this goal, we asked interview respondents to indicate the business or building types in which program awareness was highest and lowest. Respondents could report only on the business or building types with which they had work experience, and even so, some respondents had difficulty answering this question. As shown in Figure 5-16, the most reliable evidence – based on largest numbers of reports and greatest levels of agreement – was that awareness was low among small business owners and high among educational customers. Based on the preponderance of evidence (from two to seven respondents), awareness also appears to be relatively strong in healthcare, medium-to-large businesses, and property management companies, and low in office buildings, retail, restaurants and hospitality, and churches.

Table 5-16 Estimated Levels of BizSavers Awareness, by Sector and Building Type (Multiple Responses Allowed)

Sector/Building Type	*Respondents Reporting*	*Low Awareness*	*High Awareness*
Small business	17	16	1
Industrial/Manufacturing	12	6	6
Education	8	0	8
Office Buildings/Space	7	5	2
Retail	7	5	2
Healthcare	7	2	5
Restaurants/Hospitality	5	5	0
Medium/Large Businesses	5	0	5
Government	4	2	2
Property management companies	4	0	4
Churches	2	2	0

5.4.8. Promotion of the BizSavers Brand and Energy Efficiency

To investigate how well service providers promote the BizSavers “brand,” we asked how they refer to the programs when they discussed Ameren Missouri business incentives with clients. Most preferred informal descriptors, such as “Ameren Missouri incentives,” rather than the official ActOnEnergy or BizSavers program names (Figure 5-17). However, three of the four RSPs reported using the ActOnEnergy brand when discussing incentives with clients.

Table 5-17 Names Used When Referring to Ameren Missouri Business Incentives (n=76; Multiple Responses Allowed)

Program Name Used	*Count*	*Percent*
Ameren Missouri incentive or rebate, no brand name	64	84%
ActOnEnergy	12	16%
BizSavers	7	9%
BEE	1	1%
Do not know	2	3%

When asked how they encourage clients to consider higher-efficiency options, respondents most commonly mentioned focusing on the payback or ROI, the availability of the BizSavers incentives, or simply the resulting energy or cost savings (Figure 5-18). Interestingly, lighting-only service providers were more likely than others to mention payback and return on investment, while non-lighting service providers were more likely to mention the incentives specifically. [29] Although these are not separate issues – the incentives reduce the cost, thereby improving return on investment and shortening payback – this finding may suggest that the lighting-only service providers present a more detailed argument for efficiency. Five or fewer respondents each mentioned using case studies or audits, focusing on non-energy features of efficient equipment (e.g., overall quality or lower maintenance costs), or appealing to sustainability or “going green” to encourage higher-efficiency options.

Table 5-18 Selling Points Used by Service Providers to Encourage Clients to Consider Higher-Efficiency Options (n=75; Multiple Responses Allowed)

Selling Point	*Lighting Only (n=45)*		*Non-lighting (n=21)*		*All (n=75)**	
	Count	*Percent*	*Count*	*Percent*	*Count*	*Percent*
Payback analysis / Return on investment (ROI)	37	82%	8	38%	52 (47)	69% (59%)
Ameren Missouri MO incentive availability	13	29%	12	57%	30 (37)	40% (46%)
Energy or cost savings	13	29%	10	48%	26	35%

* Weighted counts and percentages presented in parentheses for statistically significant items.

To further investigate service providers’ efforts to sell efficiency, we asked the 67 standard and custom program respondents the percentage of their jobs in which they proposed equipment that would qualify for BizSavers incentives (Figure 5-12). The

[29] Payback analysis / Return on investment: $p > 0.001$; Chi Square = 12.726; n = 66. Ameren Missouri MO Incentives: $p = 0.009$; Chi Square = 6.699; n = 66.

majority said they did so most of the time, with about one-quarter saying they always propose qualifying equipment. [30]

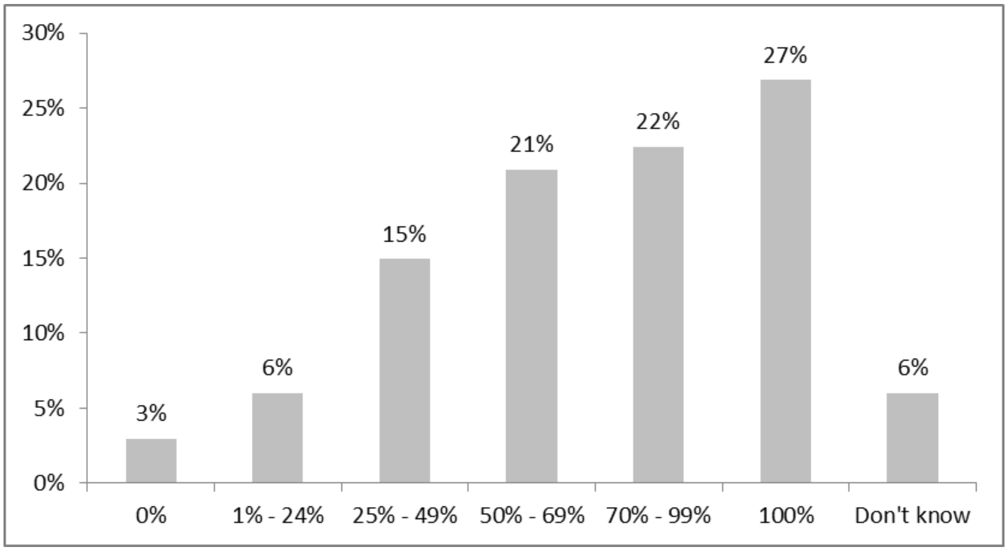


Figure 5-12 Percentage of Jobs in Which Respondents Proposed Qualifying Equipment (Standard and Custom Service Providers Only; n=67)

Respondents said that when they recommended qualifying products, the majority of customers install most of the recommended measures (Figure 5-13), with about one-fifth of respondents saying that customers followed all of their recommendations.

[30] Interestingly, two respondents said they never propose qualifying equipment. It is not clear whether they thought the question referred to equipment sold outside the program or they sold qualifying equipment only when their customers specified it or something else.

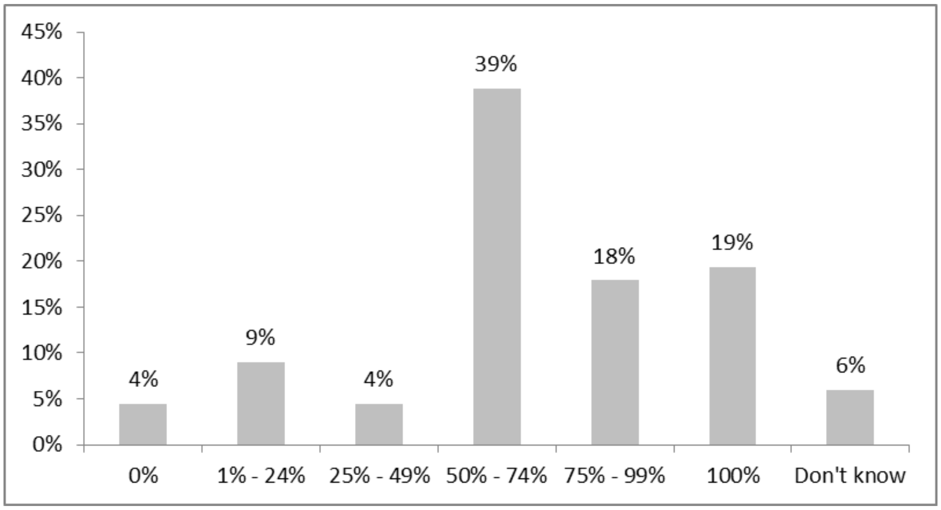


Figure 5-13 Estimated Percent of Jobs Where Client Agreed to Most of the Qualifying Equipment (Standard and Custom Service Providers Only; n=67)

Cost-related issues, such as budget, up-front costs, total project cost, and ROI, were by far the most common reasons given why some clients did not agree to proposed incentive-qualifying equipment.

Most respondents indicated that the reasons for rejecting proposed equipment did not differ by customer type. Seven said that small businesses were more likely to cite issues such as payback, limited capital, and lack of corporate sustainability targets. Five said larger businesses were more likely to be affected by strict corporate ROI policies, bureaucratic "red tape," and unwillingness to deal with application processes for efficient equipment that is only a small part of a larger project.

Interview data indicate that the majority of clients who pursue incentive-qualifying equipment apply for BizSavers incentives, with nearly half saying that all of their customers apply for incentives for such equipment. The most frequently cited reasons for not applying for incentives were overly complicated, burdensome, or time-consuming paperwork or application processes (48%), and financial constraints (16%).

5.4.9. Selection of Measures

The interviewer asked all 75 respondents whether the program rules gave respondents the flexibility to scope jobs that included all of the efficiency recommendations they would like their clients to consider. Three-quarters of respondents reported either no specific concerns (63%) or cited complaints about the process (e.g., complex application, lengthy review) that did not actually appear to limit their recommendations (15%). Of the other 17 respondents:

- Eight referred to equipment types that are not covered (some fluorescent lighting, LEDs, and some kitchen equipment);

- Seven referenced requirements relating to calculation of costs or savings that limited what the
- y could propose (e.g., requirement to establish baselines, incremental cost or ROI requirements, the requirement to use a program-specific lifespan rather than the manufacturer-warranted one); and
- Two referenced limitations specific to the retro-commissioning program – one of which was nonspecific, but the other suggested that they were not allowed to quantify a custom incentive opportunity they identified.

The 17 respondents who reported limitations included all four of the RSPs. All four indicated that the custom incentive structure restricted customers from capitalizing on savings opportunities, either because of payback restrictions or incremental cost issues. One reported the loss of potential business due to changes to incremental cost thresholds.

Although most respondents reported no specific program limitations on their job scoping, just under half of them suggested qualifying measures that Ameren Missouri should add to the BizSavers programs or other changes to the incentive structure. Most suggestions related to lighting (Figure 5-19). Service providers with non-lighting requests suggested a variety of currently unqualified measures, such as appliances, gas measures, automation systems, energy recovery units, and more. “Other” suggestions for changes varied, including how to determine useful life of old equipment, method for calculating hours of use when lighting controls are used, how to factor in set-up costs, and extending similar incentives to residential customers.

Table 5-19 Suggested Changes to Incentive Offerings (n=75; Multiple Responses Allowed)

Suggested Changes	*Count*	*Percent*
No changes needed	36	48%
Suggested additional coverage/changes	33	44%
T-12 replacement incentives	8	11%
Additional non-lighting measures	7	9%
LEDs	6	8%
Other lighting measures	4	5%
Changes in incentive calculations	4	5%
Change some Custom measures to Standard incentives	4	5%
Incentivize audits	2	3%
Other	4	5%
Do not know	6	8%

5.4.10. Clarity of Program Rules and Guidelines

The majority (75%) of respondents – and all new construction program service providers – indicated that program guidelines were clear and useful. Of 12 who reported issues with program guidelines, the most frequent comment, by four respondents, was that custom program application guidelines were not clear. All other comments were general in nature.

5.4.11. Effect of Program Rules on Project Timing

Nearly half (45%) of respondents indicated that complying with program rules affected project timing. Among this group, all described at least one type of effect on project timing. Nearly half (45%) reported minor delays; 24% reported major delays; 15% cancelled projects or proceeded without program incentives; 12% had delays of unspecified length on custom projects; and 12% built extra time into the project schedule.

5.4.12. Effect of New Construction Incentive Pathways on Project Design

The interviewer asked the five new construction program service providers how participation in the new construction program had affected the design of their new construction projects. Two said the process had encouraged inclusion of additional efficiency equipment into their projects. Three cited the flexibility offered by the multiple program pathways, specifically the whole building pathway; this flexibility was especially valuable when a project's scope changed.

5.4.13. Retro-Commissioning Issues

We asked three of the four RSPs about their experience related specifically to the retro-commissioning program.[31] Specifically, we asked about the types of retro-commissioning work they did, their ability to identify opportunities for further savings, any concerns about the audit requirements, and the adequacy of incentives and their own compensation.

All three said they did compressed air optimization and one did building optimization. None did refrigeration optimization.

Two reported that at least half of their retro-commissioning program jobs presented the opportunity for a combination of building, compressed air, or refrigeration optimization, while one said the retro-commissioning program jobs never provided such an opportunity.

[31] At the time of sampling, one RSP's sole Retro-commissioning project had yet to be identified in the database, and so we had identified that respondent as belonging to the Standard/Custom group and did not ask the RSP-specific questions. We subsequently were able to identify that respondent as an RSP.

All indicated having no issues with the engineering audit requirements for the program.

Two of the three RSPs who responded to these questions said the BizSavers program compensation was not adequate, noting they make very little or even lose money on retro-commissioning projects. Further, these RSPs said lack of audit incentives cut into their profits. They indicated that they would prefer to have the audits incentivized up-front, rather than after they identify savings opportunities.

5.4.14. Interactions with Program Staff

The majority (87%) of service providers reported seeking assistance from program staff during the project application and approval processes (Table 5-20). The most common type of assistance sought was help completing an incentive application, followed by inquiries into the status of an application (including the scheduling of site inspections for custom program applications) and general program information (including the availability of funding). Five or fewer respondents said they had sought information about qualifying measures or projects, or about the Trade Ally Network.

Table 5-20 Types of Assistance Service Providers Sought from Program Staff (n=75; Multiple Responses Allowed)

Type of Assistance Sought	*Count*	*Percent*
Any assistance sought	65	87%
Application-related assistance	47	63%
How to complete application (general)	43	57%
Assistance with calculations	6	8%
Incentive-related questions	5	7%
Status of application	20	27%
General program information	15	20%
Questions about qualifying measures or projects	5	7%
Trade Ally Network (TAN) application-related	5	7%
Check status of Trade Ally Network (TAN) application	3	4%
Information about Trade Ally Network (TAN) application process	2	3%
None	10	13%

Most respondents (90%) reported that program staff were able to give them the requested assistance. Those who did not get the desired assistance said they would have liked program staff to be better informed about a project's status and to respond to their questions more promptly.

5.4.15. Program Satisfaction

Overall, respondents reported high levels of satisfaction with program elements (Figure 5-14). They were most satisfied with the quality of the incented measures and products. Non-lighting service providers were less satisfied than lighting-only with the program application process (62% of non-lighting service providers were highly satisfied, compared to 87% of lighting only respondents). [32]

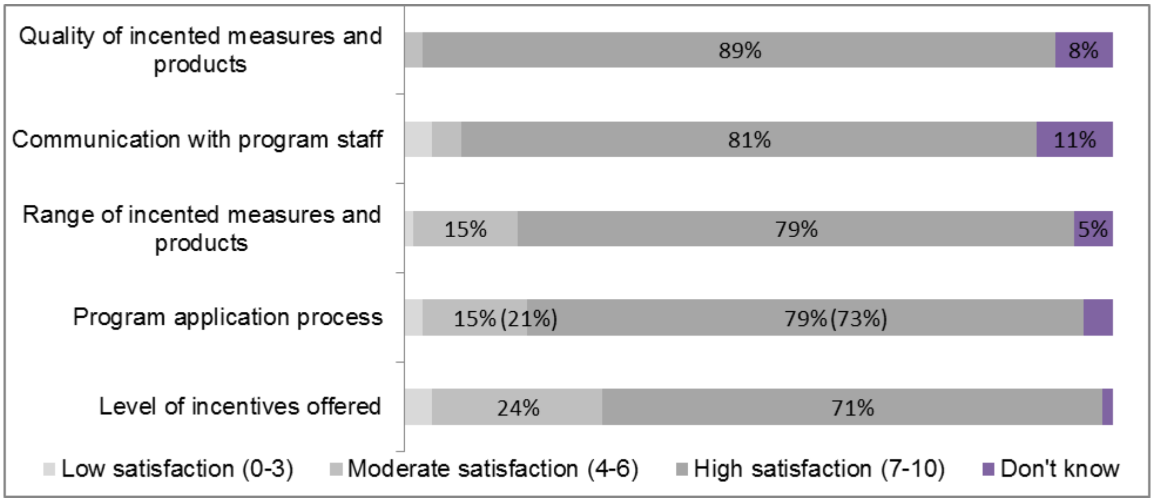


*Figure 5-14 Service Provider Program Satisfaction (n-75)****

* Weighted percentages presented in parentheses for statistically significant items.

** Respondents rated satisfaction on a 0-to-10 scale, from “not at all satisfied” to “extremely satisfied.” For this figure, we collapsed responses into low, moderate, and high satisfaction, as defined parenthetically in the figure legend.

The higher the number of unique issues respondents sought assistance for, the higher the rated satisfaction.[33] Various open-ended comments offered throughout the interviews reinforce this finding, as multiple service providers reported that program staff were very helpful and friendly whenever they interacted with them.

When asked what the best parts of the BizSavers programs were, respondents most often indicated the programs’ role in raising awareness of (and interest in) energy efficiency improvements, and the incentives (Table 5-21).

[32] p = .029; Mann-Whitney U = 295.500; *n* = 63.

[33] p = .046; bivariate linear regression coefficient = 8.096 (The dependent variable was transformed via a quadratic transformation); n = 67.

Table 5-21 The Best Program Elements of BizSavers, According to Standard and Custom Service Providers (n-75; Multiple Responses Allowed)

Program Element	*Count*	*Percent*
Increasing awareness of / interest in energy efficiency	24	32%
Incentives	18	24%
Working with program staff	12	16%
Increases sales	10	13%
Availability of the program	9	12%
Overall program design / ease of program	7	9%
Application process	3	4%
Other	6	8%
Nothing	2	3%
Do not know	2	3%

Thirty-three respondents who provided satisfaction ratings of “6” or lower (on the 0-to-10 scale) on one or more items were asked to elaborate on that rating. About half (17, or 52%) indicated dissatisfaction with the incentive structure. In addition to general requests for increased incentive amounts, seven respondents indicated they would like incentives to be as high as other programs (including Ameren Missouri Illinois). Ten respondents cited dissatisfaction with the application and six said the mix of qualifying measures was insufficient. Six respondents were dissatisfied with the communication per se, not because of specific program issues. No other concern was mentioned by more than three respondents.

When we asked all respondents what improvements to the BizSavers program they would suggest, the most common suggestion was to change the incentive structure, including changing some custom measures (such as variable frequency drives, or VFDs) to standard program, and accepting T-12s and other measures (Table 5-22).

Table 5-22 Standard and Custom Service Providers' Suggested Program Changes (n=75; Multiple Responses Allowed)

Suggested Change	*Count*	*Percent*
Incentive structure	34	45%
Increased incentive amounts	15	20%
More Standard incentives	8	11%
T-12 incentives	6	8%
Other additional measures covered	6	8%
Program process takes too long	9	12%
More training / TA outreach	5	7%
Improved communication	3	4%
Calculation changes/clarification	3	4%
Program extension/stability	3	4%
Program streamlining	2	3%
Other	8	11%
Nothing	11	15%
Do not know	4	5%

5.5. Training Evaluations

Lockheed Martin has held a variety of public "lunch and learns" and "launch events" to introduce service providers and customers to the Ameren Missouri's BizSavers Program and explain program processes and requirements. Lockheed Martin conducted many, if not most, of those as a participant or exhibitor at a trade show, workshop, or other similar event. Lockheed Martin also has held private events for large service providers to provide more in-depth program training. Between the public and private events, Lockheed Martin held 91 events in 2013, with more than 4,500 attendees. [34]

To assess how well these events deliver program information to service providers and customers, the evaluation team distributed a brief paper survey (Appendix D) to attendees at two events held in December of 2013. Eighteen attendees completed the survey. The survey covered attendees' firmographic characteristics, their experience with the event, and their intention to work with the program.

5.5.1. Firmographic Characteristics of Attendees

Of the 18 attendees of the two training events, 14 were service providers and four were business customers of Ameren Missouri. All 14 service providers reported that their organization belonged to the Ameren Missouri Trade Ally Network. Half were electrical contractors, four were distributors, and the others were an energy services company

[34] The evaluation team had only attendee counts, not attendee lists, so we could not determine how many of the attendees were unique individuals or represented unique trade ally firms or customers.

(ESCO), an industrial services contractor, and a respondent who did not indicate business type. The four customers were in the industrial, lodging, wastewater, and biopharmaceutical industries.

Of the 14 trade allies, 12 had completed a project before the current program year. On the other hand, only one of the four customers had previously completed a project. This may suggest that these events are attracting new businesses interested in program incentives.

5.5.2. Experience with the Training Session

Most attendees found the events valuable. More than half (11 of 18) rated the event as "excellent," on a 1-to-5 scale from "poor" to "excellent." Just over three-fourths (14 of 18) rated the event as "somewhat exceeding" or "far exceeding" their expectations.

When asked to evaluate specific aspects of the events, more than half agreed that the information presented was clear, relevant, or helpful, and that time, length, and location of the event were convenient or appropriate (see Figure 5-15).

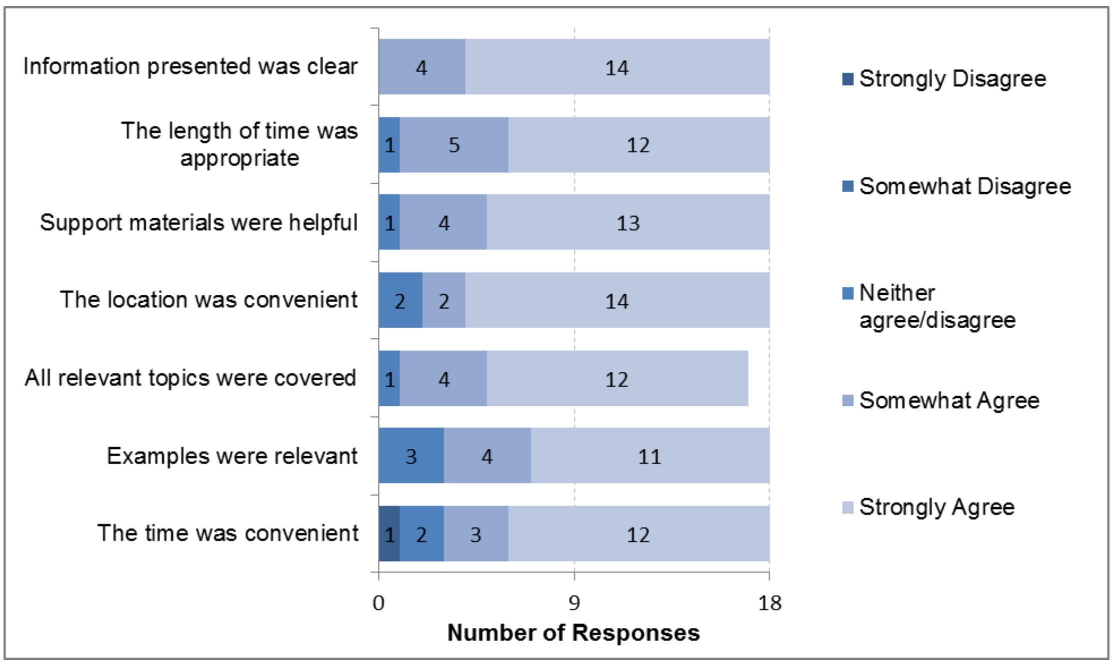


Figure 5-15 Attendees' Rating of Specific Aspects of Events

Three attendees provided additional comments about topics to include in future events. Of those, two suggested solar measures and one mentioned the importance of communicating about the program updates, such as which lamp types are being phased out or benchmarked.

5.5.3. Intention to Work with the program

All but one attendee reported that the training event had increased their interest in working with the BizSavers Program in the future. Only one attendee – a trade ally – identified anything that might prevent them from working with the program in the future, and that was simply “uncertainty about the future.”

5.6. Participant Feedback

The research team conducted an online survey of program participants throughout 2013. The sample included customers whose projects were completed during 2013. The survey collected data on program awareness, customer decision-making and preferences, experience with program processes and installed equipment, satisfaction with various aspects of the program, and any new construction plans. Of the 229 surveyed respondents, one had done a new construction program project and none had done a retro-commissioning project. Appendix E provides the full survey instrument.

5.6.1. Description of Sample

As of January 10th, 2014, 229 program participants (34% of all those invited) had responded to the survey. Of those, 113 (49%) had completed custom-only projects, 90 (39%) had completed standard-only projects, 27 (12%) had completed projects with both custom and standard measures, and one had completed a project with standard and new construction measures. These counts represent response rates of 54% for invitees who completed custom projects and 26% for those who completed standard projects.

The following sections present combined results for all respondents associated with standard and/or custom projects, except for survey questions that were specific to a particular program. In addition, we investigated whether responses differed for standard-only respondents and those with custom-only projects, and we report any such differences.

5.6.2. Respondent Characteristics

Respondents represented a range of job titles or roles; over two-fifths were either a facility manager or energy manager, or had some other facility-specific role (e.g., plant engineer, electrical supervisor) (See Figure 5-16).

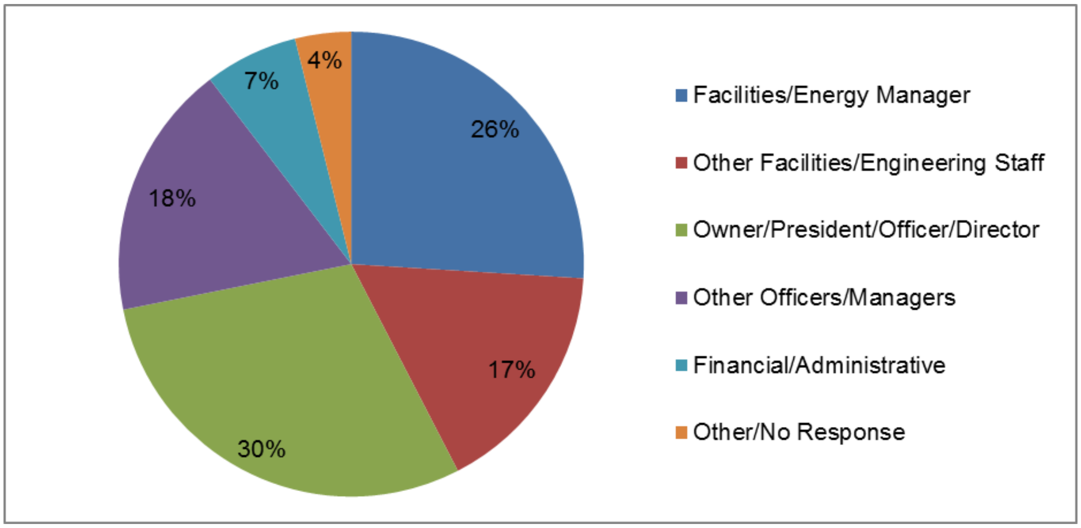


Figure 5-16 Respondent Job Title or Role (n=229)

Respondents represented a variety of building types; offices, industrial, and retail facilities were the most common. Fewer respondents reported school, lodging, warehouse, and healthcare facilities, and a range of miscellaneous facilities types. Figure 5-17 provides a summary of building types reported by respondents, compared to statewide and national data. Thirty-six respondents (16%) reported their firm did industrial work (including food production and distribution). The percentages of office and retail buildings and schools in our sample were slightly lower than those in the statewide data, but both were similar to those in the national data.

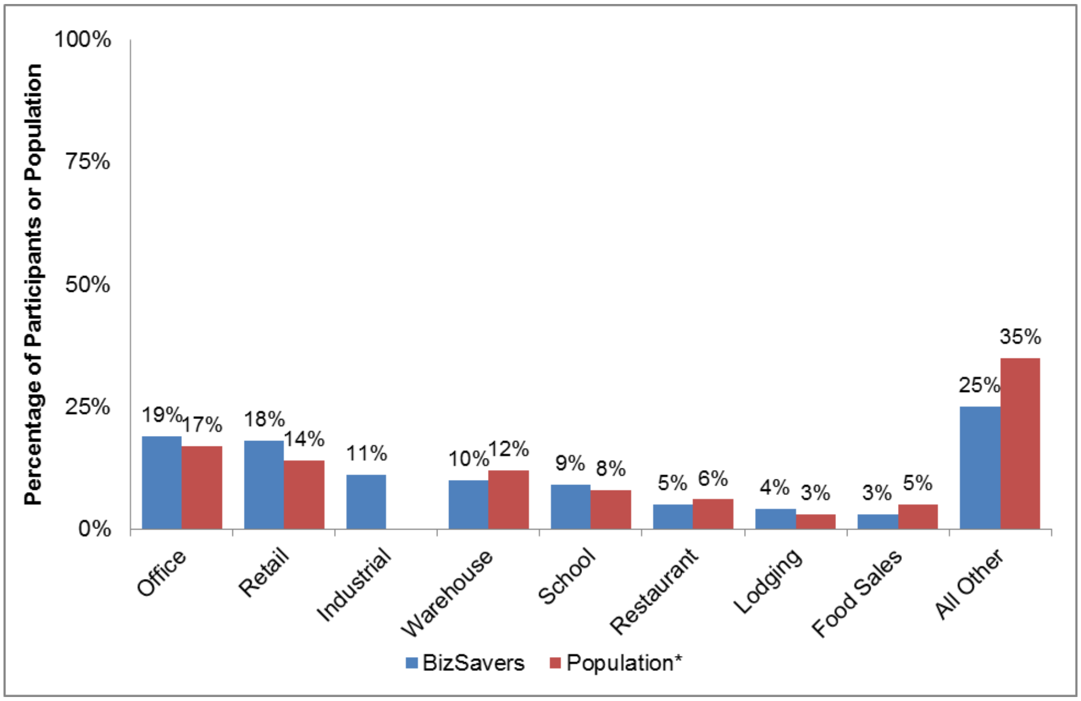


Figure 5-17 Type of Building (n=221)

*The population data are from the Commercial Buildings Energy Consumption Survey (CBECS), a nationwide survey of commercial buildings conducted by the U.S. Energy Information Administration. The "Industrial" end-use type is not shown as that type is not included in CBECS. Appropriate Missouri-specific data were not available.

The size of the facility where the project occurred varied from less than 5,000 square feet (8% of respondents) to more than 1,000,000 square feet (4% of respondents). Three-fifths of respondents reported facilities of 100,000 square feet or less. Size of facility was not significantly related to type of project (standard vs. custom programs).

Over half (55%) of respondents did not report the number of locations within Ameren Missouri territory. Among those who did, the number of locations varied widely, with the distribution skewed toward fewer locations: 42% reported only one location, another 42% reported 2 to 10 locations; 13% reported 11 to 100 locations, and the remaining 4% reported more than 100. Respondents who installed custom measures were slightly more likely to have only one location (50%) compared to those who installed standard measures (38%).

5.6.3. Program Awareness

Respondents learned about the program through a variety of sources (**Error! eference source not found.**). Respondents were more likely to report a source outside of Ameren Missouri – primarily an equipment vendor or building contractor – than an Ameren Missouri source. Those who cited Ameren Missouri sources were about equally likely to mention a program representative, one of the customer service staff, the Ameren Missouri website, or their own prior experience with the program. Most (71%)

respondents reported a single source of awareness, but the remainder reported up to seven sources.

Table 5-23 Sources of Program Awareness (n-229; multiple responses allowed)

Source	*Count*	*Percent*
Any Ameren Missouri Source	111	48%
Past experience with the program	42	18%
Program representative	36	16%
Key Account Representative or Customer Service Advisor	30	13%
Website	33	14%
Brochure/newsletter	13	6%
TV or radio ads	5	2%
Any Outside Source	160	70%
Equipment vendor or building contractor	126	55%
Friend or colleague	25	11%
Architect, engineer, or energy consultant	29	13%
Seminar, conference, or home show	3	1%
Other	1	<1%
Do not know	1	<1%
No response	2	1%

A higher percentage of respondents with custom projects than standard-only projects reported an Ameren Missouri source (53% vs. 41%), while those with standard-only projects were more likely to report equipment vendors or contractors as their first source of information about the program (64% vs. 47%).

The survey asked the 116 respondents with standard-only projects whether they were aware of incentives for custom projects. Forty-four respondents (38%) reported they were aware of custom program incentives. When asked their reasons for not choosing the custom program option, over half (26 respondents) said the standard program application covered all equipment of interest to them. Others referred to budget considerations (6 respondents) and lacking interest in submitting two applications (2 respondents). A minority of respondents indicated that they had in fact completed custom projects or that the custom program application was too complicated (3 and 2 respondents, respectively). Two did not give a reason.

5.6.4. Respondent Motivation to Save Energy

Over half of respondents (52%) reported that their company had one or more policies or practices related to energy management (Figure 5-18). More than two-fifths (41%) reported having an employee or employees responsible for energy monitoring or management. About one-quarter (24%) of respondents reported having defined energy-saving goals or a policy specifying energy efficiency in equipment purchases. Reporting energy-related policies or practices was unrelated to the type of project completed.

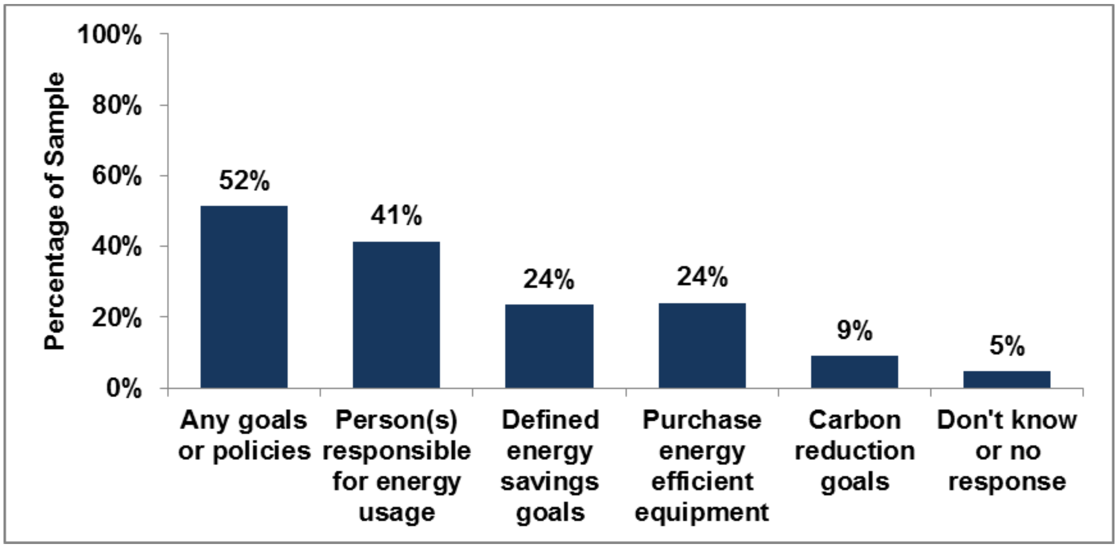


Figure 5-18 Energy Related Policies (n=229)

Nearly two-fifths of respondents reported that the idea to participate in the program either originated within their organization (38%), or that a vendor or contractor presented the idea (38%; **Error! Reference source not found.**). Another 20% said the dea came up in a discussion with their vendor or contractor.

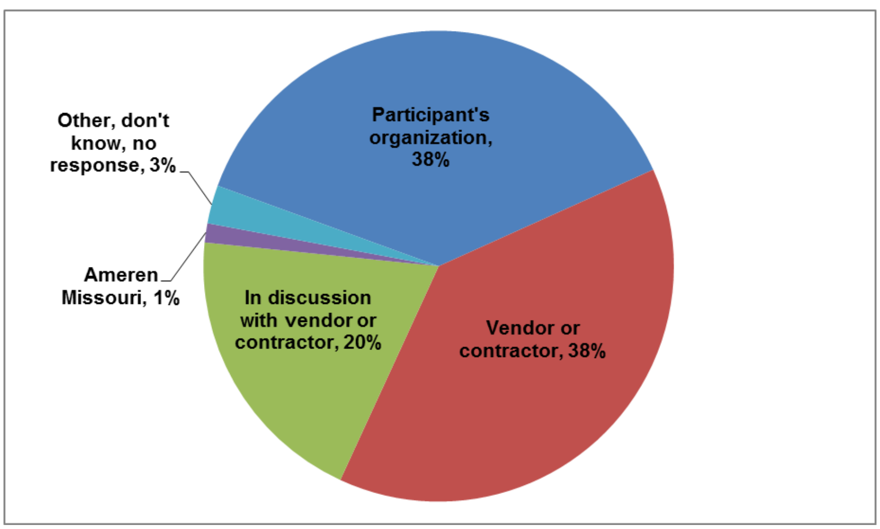


Figure 5-19 Party Initiating Discussion about Program Participation (n=125)

About three-quarters of respondents (70%) either reported having energy-saving policies and practices, or reported that their organization initiated the idea of participating in the incentive program, or reported both.

5.6.5. Factors Affecting Customer Participation

Among all survey respondents, about two-thirds said an equipment vendor had either a moderate to large (36%) or critical (28%) influence on the decision to participate in the program(Figure 5-20.) Respondents reported that contractors and utility staff had much less influence on their decision. Among those who did report influence from contractors, more than two-fifths indicated they had either a moderate to large (25%) or critical (18%) effect. Among those reporting influence from utility staff, most (71%) indicated they had mostly minor ("none to small") influence.

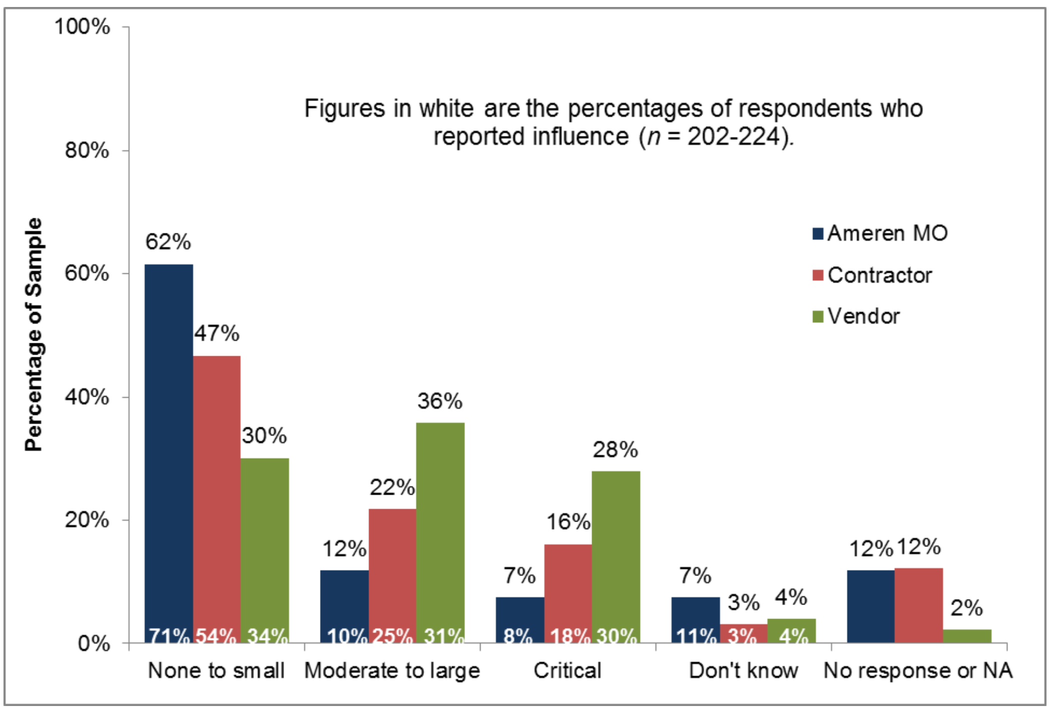


Figure 5-20 Influence of Vendors, Contractors, and Utility Staff on Decision to Install Efficient Equipment (n=229)

About one in seven respondents did not report the level of influence of contractors and about one in five did not report the influence of utility staff. The respondents who reported that a vendor, contractor, or utility representative had at least a "moderate" level of influence were asked what that person (or people) did that influenced them. Of those 175 respondents, about four-fifths did not provide any details. Of the 39 who provided details, about two-fifths said that the person provided cost-related information -- generally information about the incentives or the cost savings that would result from the improvements. About one-quarter said equipment-related information influenced their decision. For example, their contact informed them about products they had not been aware of or helped them compare different equipment types. The remaining respondents cited unspecific information (e.g., “information about the benefits,” “all the pertinent information necessary for the upgrade”) or that the person only provided approval.

5.6.6. Customer Experience with the Application

More than three-quarters of respondents reported that they or a co-worker had a direct role in completing their application for incentives (Table 5-24). However, approximately the same proportion of applicants also reported they had had outside help in completing their applications – most commonly, a vendor. About half of respondents said both they and some outside party had direct roles.

Table 5-24 Direct Experience with the Application (multiple responses allowed)

Role	*Count*	*Percent*
Applicant*	174	76%
Any outside help	162	71%
Contractor	56	24%
Vendor	114	50%
Other	10	4%
Applicant, with outside help	110	48%
Do not know / no response	2	1%
Total	229	100%

*Survey respondent or co-worker.

Of the 174 respondents who reported that they or a co-worker played a direct role in the application, 156 (90%) said they were directly involved. A follow-up survey question asked those 156 respondents about how they completed and submitted the application.

The program provides two versions of the application worksheets that applicants may download and complete: an Excel spreadsheet version and a PDF version. Applicants may submit a completed worksheet as an email attachment or by fax or postal mail for data entry by the implementer. Half of respondents reported they completed the Excel spreadsheet version of the worksheet, most (94%) of whom reported they submitted it as an email attachment.

One-quarter of respondents said they completed the PDF version of the worksheet; over three-quarters (77%) submitted it by email, and the others submitted it by fax (2), mail (2), or vendor (1) or did not know how it was submitted (2). About one in seven respondents did not know which version they completed, most of these (13 of 18) reported they had received outside help to complete their application.

Of the 139 respondents with custom projects, 40 (29%) reported they had to resubmit or provide additional supporting documentation before their application could be approved. Of those 40, about two-fifths reported being asked to provide additional supporting documentation, such as invoices. One in seven said the issue related to how they (or their proxy) had calculated energy savings. Four respondents reported either “delamping issues” (2) or other miscellaneous issues (3) and one said he did not know why he had to resubmit (multiple responses were allowed).

Of the 116 respondents with standard or standard-plus-custom projects, about three-quarters (71%) said that the 180-day timeframe did not limit the types of projects they might propose. The majority of the other standard-plus-custom program respondents said they did not know whether the timeframe limited their projects. A total of nine respondents (8%) said that the timeframe imposed a limit.

5.6.7. Equipment

Two-thirds of respondents reported they had worked directly with a retailer to purchase the incented equipment. Of those 152 respondents, about two-thirds reported that they had received their equipment within two weeks of ordering it from a service provider (Figure 5-21).

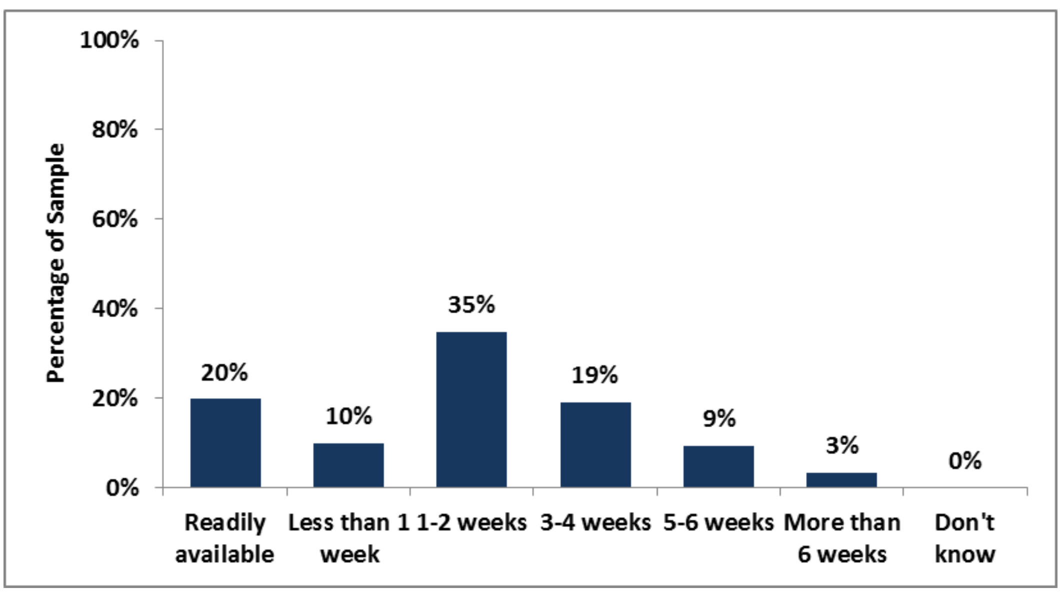


Figure 5-21 Waiting Time to Receive Equipment for Retailer (n=152)

Nearly half of the 229 respondents reported that a member of their staff had installed the equipment. Of the others, about one-third used a contractor they had worked with previously (Figure 5-22).

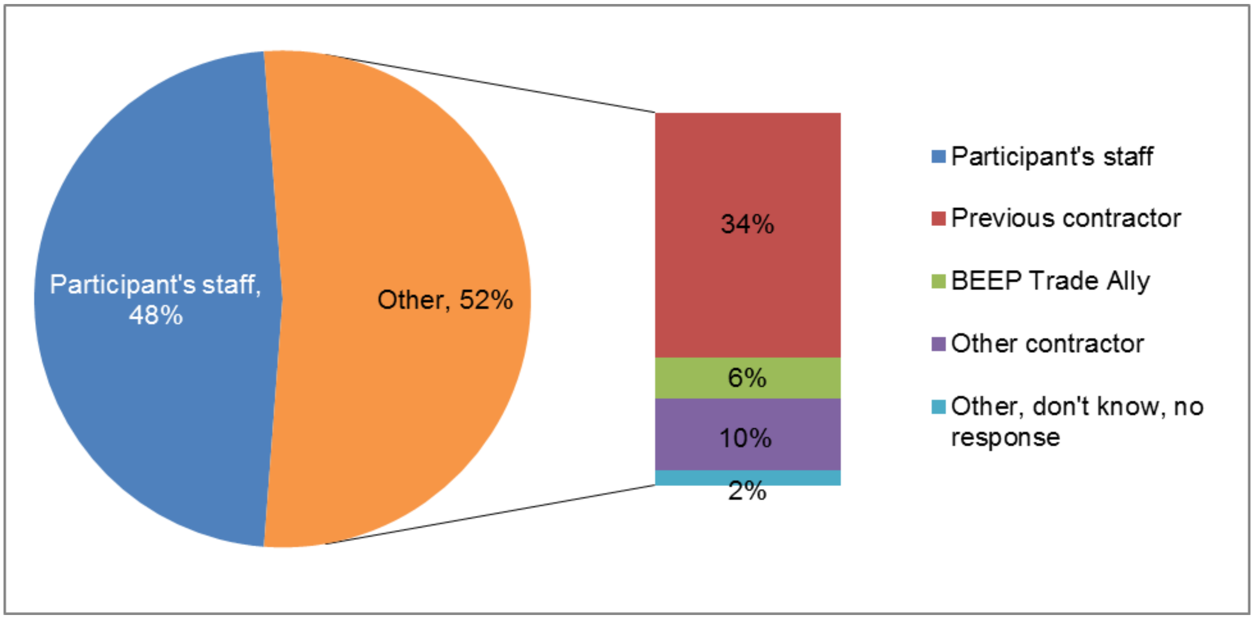


Figure 5-22 Distribution of Who Installed Project (n=229)

5.6.8. Customer Satisfaction with the program

All respondents rated their satisfaction with the steps required to get through the program, the amount of time it took to get their incentive, the range of program-qualified equipment, the equipment that was installed, the quality of the installation, and the program overall. Responses were on a 5-point scale from “1” (“not at all satisfied”) to “5” (“very satisfied”) Satisfaction was high, with 73% to 94% of respondents offering a “4” or “5” rating on all items (Figure 5-23).

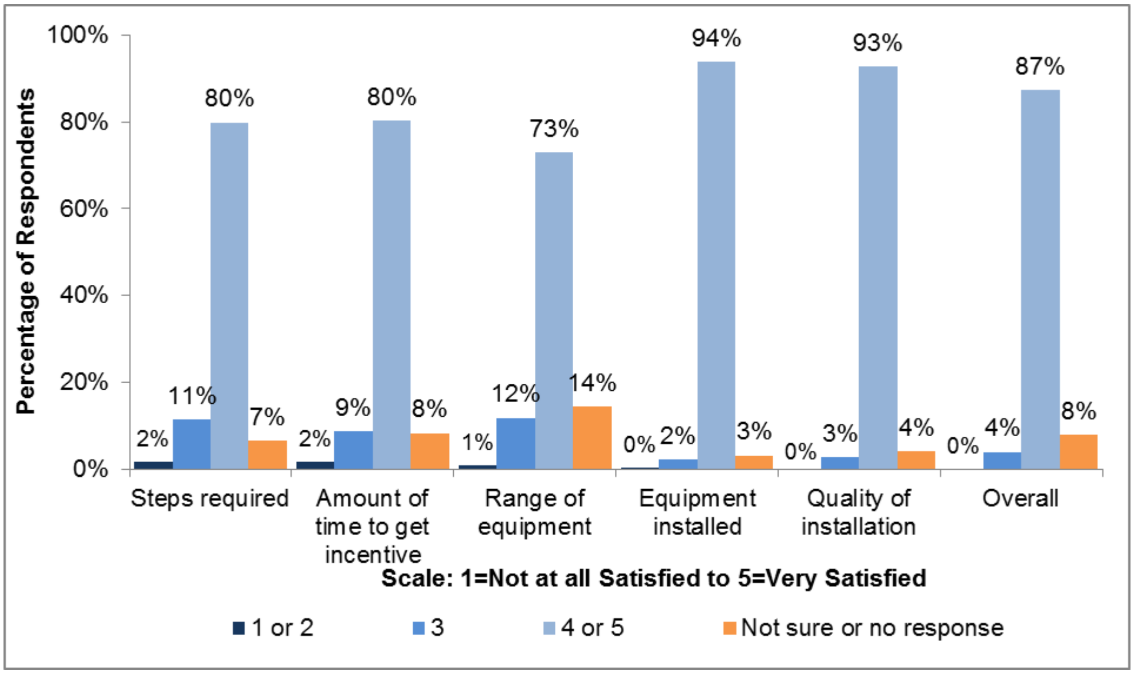


Figure 5-23 Satisfaction with Participation (n=229)

When asked how their incentive amount compared to what they had expected to receive, a large majority (84%) of respondents reported that the incentive was at least as much as they had expected (Figure 5-24).

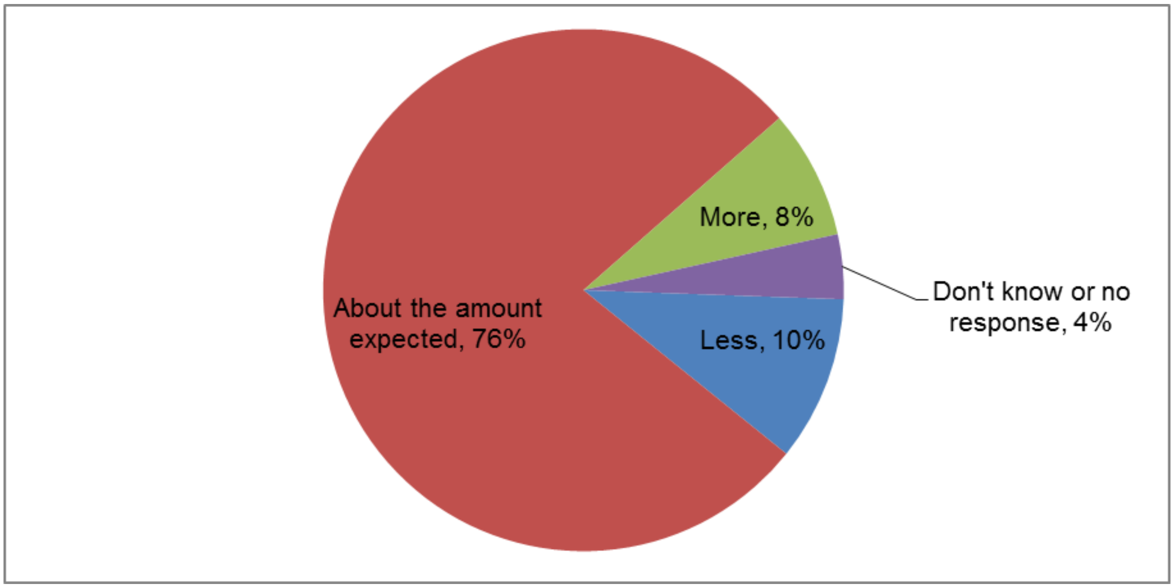


Figure 5-24 How Incentive Compared with Expectations (n=229)

To assess satisfaction with the application process, the 156 respondents who had a role in completing their application were asked to rate several aspects of their experience with the application process, including the clarity of application instructions. As Figure 5-25 shows, on a 5-point scale, from "1" ("not at all clear) to "5" ("completely clear"), respondents gave high ratings on most indices.

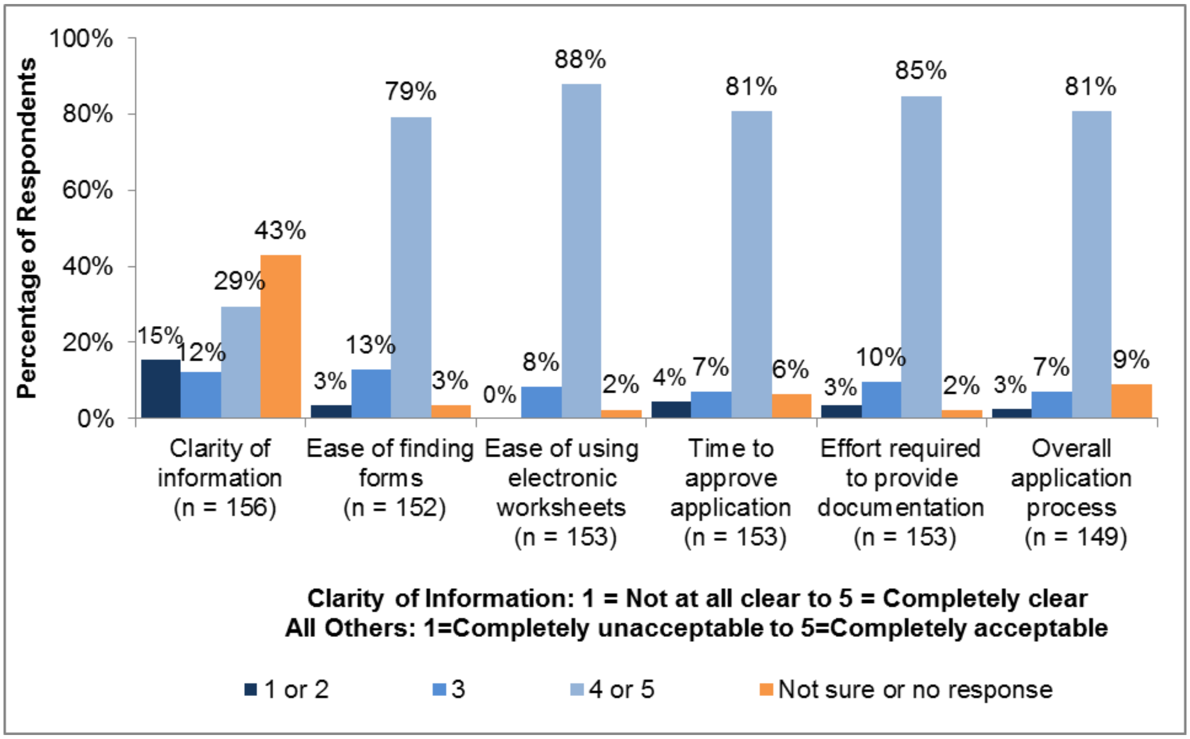


*Figure 5-25 Clarity of Application Instructions and Acceptability of Application Process**

* The percentages shown exclude respondents who indicated the question was "not applicable" (e.g., they did not obtain application forms from the program website, they were not required to provide documentation).

On the other hand, about one in seven respondents reported that the application instructions lacked clarity (a "1" or "2" rating on a five-point scale, from "not at all clear" to "completely clear"). About two-fifths of respondents did not rate the clarity of application instructions. Whether or not respondents rated the clarity of instruction was unrelated to whether they reported outside help.

Four-fifths of respondents said they had a clear sense of whom they could go to for assistance with the application process. This differed slightly between those who did (85%) or did not (72%) find the instructions clear. In addition, the percentage of respondents who reported a clear sense of whom to go to for assistance was higher for those who had done custom projects (86%) than those who had done only standard projects (70%).

When asked whether they had interacted with program staff during the project, 103 of the 229 respondents (45%) reported such interactions; 104, or 45%, reported no interactions; and 22, or 10%, were not sure or did not respond. Of the 103 respondents who interacted with program staff, 99 (96%) rated the program staff as "knowledgeable" or "very knowledgeable" and the majority indicated satisfaction (a rating of "4" or "5" on a 5-point scale) with the amount of time it took program staff to address their questions (88%) or concerns and how thoroughly they addressed them (90%).

Seventy-seven respondents (34%) reported that a program representative had inspected the completed project; 80, or 35%, reported that no inspection occurred; and 72, or 32% did not know or did not respond. Of the 48 who reported an inspection, the majority indicated high agreement (a “4” or “5” on a 5-point scale) that the inspector had been courteous (95%) and efficient (94%; separate statements).

5.6.9. New Construction Plans

Seventy-seven respondents (34% of the total sample) reported considering undertaking a new construction or major building renovation project within the next five years. Of those, more than two-fifths (44%) were already in the design phase, and about one-third (32%) were aware of the new construction program (Table 5-25). Awareness of the new construction program was similar across those already in the design phase (12 of 34, or 35%) and those not yet in the design phase (10 of 38, or 26%); the difference between the groups is not statistically significant.

Table 5-25 Respondents Considering a New Construction or Major Renovation Project (multiple responses allowed)

	Count	*Percent*
In the design phase	34	44%
Aware of the New Construction program	25	32%
Total	77	100%

5.7. Participant Feedback – New Construction and Retro-Commissioning Programs

As of late-October 2013, one new construction and one retro-commissioning projects had been completed during 2013. The evaluation staff interviewed the participants who completed these projects. The interviews explored how the respondents learned about the program; how they decided which energy efficiency measures to pursue; and their experiences with program processes, requirements, and staff. Overall, participants reported that the program worked well, met their needs, and that they were satisfied with their interactions with program staff. The new construction program participant survey is available in Appendix F The retro-commissioning program participant survey is available in Appendix G.

5.7.1. New Construction

The single new construction program project was at a 56,000-square-foot facility used for entertainment purposes as part of a franchise of companies. The facility is the only building owned by the participant in the Ameren Missouri territory and employs 15 people. The project followed the standard program path and involved the removal, replacement, or upgrade of an energy-consuming product or process in an existing building footprint. The respondent was the owner of the participating location and was in charge of all decisions about energy upgrades in the facility.

5.7.1.1. Awareness

The new construction program participant first learned about the potential for energy efficiency incentives from a person who owned a franchise of their business in another location. After learning about the potential for upgrades, the participant contacted Ameren Missouri directly to inquire about incentives for a lighting project they were considering. Ameren Missouri staff informed the participant that incentives were available for the project and the project progressed from that point

5.7.1.2. Program Processes

The new construction program participant already was working with a contractor to design lighting for the facility. Once Ameren Missouri became involved, the participant completed the initial application process – some on paper and some on a computer – before handing the process over to their contractor. The respondent reported that the application was easy to understand, and their contractor was able to complete all of the technical details. The respondent rated the clarity of the application information as a “5” on a 0-5 scale, where “0” was “not at all clear” and “5” was “completely clear.” The participant recalled receiving help on the application from an unspecified program representative, who was very helpful, and reported that the service from program representatives generally was “fantastic.” The participant had no suggestions to improve or simplify the application process.

The participant reported that their contractor handled the project completion and inspections. The participant described the overall process as “easy.”

5.7.1.3. Decision-Making

Initially, the participant had not planned to perform any lighting upgrades at the location. After learning about the potential for incentives, they decided to upgrade the facility’s lighting. They chose the lighting equipment recommended by Ameren Missouri representatives as the most energy-saving; the participant said the equipment also would “give us the most money back.” The respondent said that the contractor performed an audit, but could not recall any details about the process. They described their contractor as vital for completing the project and reported relying in their contractor for the technical parts of the application and for managing the project.

During the process, Ameren Missouri representatives suggested other energy-saving equipment, including a water heater, for which the participant declined to pursue incentives. The participant indicated that the additional measures were not of interest to their company, were not presented at the right time during their construction process, or that the incentives were insufficient to motivate them to change the timeline for construction or make additional effort to apply for the incentive.

5.7.1.4. Barriers

The participant reported experiencing no barriers to project completion related to the Ameren Missouri Program.

5.7.1.5. Satisfaction

We asked the participant to rate their satisfaction with various elements of the program experience on a 0-5 scale, with ”1” meaning “not at all satisfied” and ”5” meaning “completely satisfied.” The participant rated all elements of the program highly (Table 5-26).

Table 5-26 Satisfaction with New Construction Program

Program Element	*Rating*
The steps you had to take to get through the program	5
The range of equipment that qualifies for incentives	5
The number of design meetings with program staff	5
The quality of your interactions with program staff	5
The amount of documentation you were required to provide	5
Any inspections the program carried out at your worksite	5
The program, overall	5
Ameren Missouri	4

In addition to high satisfaction ratings, the participant offered the following comments about their experience:

> *“I worked with the same person all along and she was very enthusiastic. I think she was more excited about the project than I was.”*

The participant also indicated that the amount of their incentive was equal to their expectation.

5.7.1.6. Free-ridership and Spillover

The participant indicated that their company did not buy any non-incentivized energy efficiency equipment due to their experience with the program. The participant also said that their company always makes an effort to buy energy-efficient equipment, although the company does not monitor their energy use or maintain any policies regarding energy use/efficient equipment purchasing. When asked about future upgrades, the participant expressed interest in incentives for standard or custom program lighting incentives and incentives for other upgrade measures, although none were planned at the time.

5.7.2. Retro-Commissioning

The retro-commissioning program participant was the engineering manager at the facility and the decision-maker for energy efficiency upgrades. The participant represented a company that owns the industrial/manufacturing facility where the project was completed. This facility is 125,000 square feet and employs 115 personnel. This is the sole facility operated by the participating firm in the Ameren Missouri territory. The company completed all of the upgrades recommended by Ameren Missouri and the contractors.

5.7.2.1. Awareness

The retro-commissioning program participant learned about the Ameren Missouri program from their contractor. The contractor approached the participant with a potential project and provided a business case for the value of the project. After consulting the president of the company, the project was approved.

5.7.2.2. Program Process

The contractor completed the application on behalf of the participant, who said they were unfamiliar with the application details. The participant described the application process as follows:

> *"I gave [the contractor] a year's worth of [our energy] bills and they compared things on-site with what they were proposing to install. They could tell from the bills what we were paying per kWh. [The contractor] did a great job and was willing to answer questions, but they made it seem like a great deal with the costs required and what Ameren Missouri was offering to pay. It was very easy."*

The participant signed the applications after the contractor completed the paperwork. The participant also received an assurance of the incentive amount from a third party contractor. The retro-commissioning program covered all of the equipment they had hoped to install.

5.7.2.3. Decision-Making

When asked what had motivated the company to complete the project, the participant said that they had completed at least two other projects with funding assistance from Ameren Missouri, and that the compressor equipment was old and nearing replacement. The additional funding from Ameren Missouri allowed the participant to buy “more-efficient units than we would have otherwise.” Because the contractor handled all details of the installation process and answered their questions, the participant could not recall any information about the application, processes, or requirements involved in participating in the program. The participant said they have no strategies to maintain the optimization improvements.

5.7.2.4. Barriers

The participant reported experiencing no barriers to project completion related to the Ameren Missouri retro-commissioning program.

5.7.2.5. Satisfaction

We asked this participant to rate their satisfaction with various elements of the program experience on a 0-5 scale with ”1” meaning “not at all satisfied” and ”5” meaning “completely satisfied.” As shown in Table 5-27 the participant was satisfied with the program.

Table 5-27 Satisfaction with Retro-Commissioning Program

Program Element	*Rating*
The steps you had to take to get through the program	4
The range of equipment that qualifies for incentives	4
The number of design meetings with program staff	4
The quality of your interactions with program staff	4
The amount of documentation you were required to provide	4
Any inspections the program carried out at your worksite	4
The program, overall	4
Ameren Missouri	4

In addition to high satisfaction ratings, the participant offered the following comment:

> *“[I was] very happy with the whole experience. I did interact with one person from Ameren Missouri who came out [to the facility]. It was a good experience.”*

The participant also indicated that the installed equipment had been satisfactory and that the experience was easy. The amount of the incentive was as expected.

5.7.2.6. Free-ridership and Spillover

Although the participant indicated that their company already had planned to replace the equipment that was installed through the retro-commissioning program, they also reported that their company had done other, un-incented energy optimization projects – specifically lighting and air compression equipment – at that facility, because of their experience with the retro-commissioning program. The participant rated their experience with the program as “very important” to their decision to implement additional energy efficiency measures. They also reported that past participation in other Ameren Missouri programs was “very important” in their decision to implement additional energy efficiency measures.

When asked why the company did not apply for incentives for the additional energy efficiency measures, the respondent indicated that the equipment they installed did not qualify for financial incentives. The participant reported that the company would apply for Ameren Missouri incentives again, likely through the Existing Buildings or retro-commissioning program. Beyond tracking their energy bills, the respondent indicated that the facility where the project was completed has no additional practices or policies around the monitoring or reduction of energy use.

5.8. Near-Participant Feedback – All Programs

As of December 31 2013, 114 Ameren Missouri customers had begun a total of 144 applications for BizSavers standard or custom incentives that they later discontinued. The research team sought to conduct in-depth interviews with a sample of those “near participants” to investigate the reasons for discontinuation of the application and possibly prevent future lost savings opportunities. We focused on those with a discontinued application that represented estimated savings of at least 50,000 kWh. Of 29 individuals contacted, we completed interviews with five who passed screening criteria and were able to recall a discontinued application.

5.8.1. Methods

The research team initially identified 153 customers with any discontinued project applications. Of those, the program implementer discontinued the applications for 39 customers because the project type changed or the application was disqualified. The team determined that these 39 customers were not appropriate targets for the near participant interviews as they did not choose to discontinue their applications – the program implementer did.

The remaining 114 customers – representing an estimated nearly 15M kWh – discontinued their projects because of lack of interest, lack of funding, or unidentified other reasons. Of those 114 near-participants, 50 had discontinued applications that represented at least 50,000 kWh. The team initially identified these 50 customers as the sample frame, to focus on those customers whose discontinued projects represented the greatest potential loss of savings. Our initial 14 contacts were with customers that had completed projects as well as discontinued ones. We were able to complete an interview with one of those customers, but none of the remaining 13 customers could recall the discontinued project, and their responses suggested that their discontinued projects mainly reflected their final priorities – that is, they had submitted multiple applications and proceeded with the ones that had the highest priority.

Therefore, the research team redefined the frame to exclude customers that had completed at least one project – except for the one that we had already interviewed. This left 32 customers, with 40 discontinued projects representing a total of about 9M kWh of potential loss of savings. Table 5-28 summarizes the customer and application counts and lost savings totals for customers that discontinued projects, with and without completed applications and by discontinued project size.

Table 5-28 Near Participant Population and Sample Frame

	Customers		Applications		Savings	
Group and Subgroup	Count	%	Count	%	Total	%
Customers that discontinued projects	114	100%	144	100%	14,774,955	100%
With completed applications	38	33%	56	39%	5,047,867	34%
Without completed applications	76	67%	88	61%	9,727,088	66%
≥ One application >= 50,000 kWh*	32	28%	40	28%	9,008,891	61%
No application >= 50,000	44	39%	48	33%	718,197	5%

*This row is the sample frame.

Our goal was to complete 10 to 12 interviews with near-participants. As Table 5-29 shows, we were able to reach 29 individuals with a discontinued application that represented at least 50,000 kWh, including 18 that had not completed any projects. The majority of those either could not recall any discontinued project, reported that the project had been discontinued because of company or site closure (and, therefore, was not related to program processes), or reported they were not an Ameren Missouri customer or were a large customer that had opted out of the utility-sponsored energy efficiency programs. (We could not determine why opt-out customers were listed in the database as having discontinued projects.) We conducted complete or partial interviews with five near-participants, including one that also had completed a project.

Table 5-29 Contact Disposition for Near-Participant Interviews

Disposition	*Discontinued application with at least 50,000 kWh estimated savings*		
	Had no completed projects	*Had completed projects*	*Total*
Contacted	18	11	29
Interviewed	4	1	5
Refusal	1	0	1
Did not pass screen	13	10	23
Could not recall discontinued project	7	10	17
Project discontinued because of company or site closure	3	0	3
Opt-out or not Ameren Missouri customer	3	0	3
Missing or bad contact information	4	3	7
Unable to reach in time to include in report	10	4	14
Total	32	18	50

The project locations of the five interviewees varied in size from 18,000 square feet to 300,000 square feet and had from 30 to 3,200 employees.

The interviews covered how the respondents learned about the program; how they decided which energy efficiency measures to pursue; and their experiences with program processes, requirements, and staff. The research team also asked near-participant respondents why they decided to discontinue their projects.

5.8.2. Program Awareness

Near-participants first learned about the potential for energy efficiency incentives from contractors, Ameren Missouri representatives, or Ameren Missouri presentations. Interviewees also indicated that building industry groups discuss the Ameren Missouri incentives programs during their meetings.

The research team also asked near-participants if they were aware of any other commercial incentives available from Ameren Missouri. Three aware of other incentives and two had received other incentives in the past, specifically for lighting projects.

5.8.3. Feedback on Program Interactions

Interviewees reported working with contractors or equipment manufacturers to evaluate the projects' feasibility and incentive qualification. Three of the interviewees could recall any details about the paperwork. All three described it as "fine" and indicated that they easily obtained required information from people working at the project location or by working with equipment manufacturers.

Interviewees could recall little about their interactions with Ameren Missouri staff or program representatives. Three recalled exchanging emails with Ameren Missouri staff or representatives during the application process but reported no details about the interactions.

Three interviewees reported no issues with the application process, one stated that it "seemed to take a long time to get a response," and one provided no feedback. None had any suggestions for streamlining the application process.

5.8.4. Reasons for Discontinuing Projects

Of the five interviewees, two reported that delays in the processing of program paperwork affected their ability to move forward with their projects, one of whom also reported that preparing the required calculations was a barrier to project completion:

> *"The burden of getting through the calculations and spec'ing out the equipment is the most difficult part. Lots of people get involved: engineers, clerical people. Sometimes manufacturers do it for a piece of equipment but not everyone."*

That interviewee further stated:

> *"I may have to spend $4,000 to get the engineering calculations to the point where I can submit the application to get a $6,000 rebate. That's not worth it."*

Two interviewees indicated that the selection of incented equipment did not suit their needs. One said that the incented lighting equipment would not work in the desired location. Specifically, after seeing the incented lighting at a different location, that respondent did not like its appearance.

One interviewee could not provide any details about why the project was discontinued, saying only that the company's management had decided not to move forward without providing the interviewee any reasons.

5.8.5. Satisfaction

Interviewees rated their satisfaction with various elements of the program experience on a 1-5 scale with "1" meaning "not at all satisfied" and "5" meaning "completely satisfied."

Table 5-30 summarizes the number of respondents who reported being satisfied (a rating of 4 or 5) and not satisfied (a rating of 3 or lower) with each element as well as the number who did not report satisfaction. Satisfaction was most prevalent with interactions with program staff and with Ameren Missouri, in general. Satisfaction was least prevalent regarding the amount of documentation required, where all responding interviewees indicated lack of satisfaction.

Table 5-30 Satisfaction with New Construction Program

Program Element	*Count of Respondents!*		
	Satisfied	*Not Satisfied*	*Unknown*
The quality of interactions with program staff	4	0	1
Ameren Missouri	3	1	1
The steps required to get through the program	2	1	2
The range of equipment that qualifies for incentives	2	1	2
Any worksite inspections	1	0	4
The amount of required documentation	0	3	2
The program, overall	2	2	1

1 Responses of 1 through 3 were collapsed as “not satisfied, and ” 4 and 5 were collapsed as “satisfied.” “Unknown” includes explicit “do not know” responses and non-responses.

We asked the near-participants to explain any ratings lower than three. Their responses were varied. Two referred to the amount of documentation or calculations required, one indicating that the documentation required was “overwhelming.” One indicated that the pre-approval process for equipment purchase “can really hold up a project,” and so wanted the program to provide incentives for recently purchased equipment. One said that the $5,000 incentive for a $60,000 condenser project was inadequate.

6. Cost Effectiveness Evaluation

This chapter summarizes the results of the cost effectiveness evaluation of the Ameren Missouri BizSavers Program.

For each program component, the following cost effectiveness tests were performed: Total Resource Cost (TRC) test, Utility Cost test (UCT), Societal test and Participant test, as defined by the California Standard Practice Manual[35]. This analysis was completed by Morgan Marketing Partners (MMP) utilizing DSMore software, the leading cost benefit analysis model in the country and the same model that was utilized by Ameren Missouri for program development. Developed and licensed by Integral Analytics based in Cincinnati Ohio, the DSMore cost-effectiveness modeling tool takes hourly prices and hourly energy savings from the specific measures/technologies being used in the Ameren Missouri programs, and then correlates both prices and savings to weather. The software references over 30 years of historic weather variability to appropriately model weather variances. In turn, this allows the model to account for low probability, high impact weather events and apply appropriate value to them. Thus, a more accurate view of the value of the efficiency measure can be captured in comparison to other alternative supply options. Additional information on the data sources, test formulas, inputs, and methodology can be found in Appendix I: Cost Effectiveness - Critical Technical Data.

Table 6-1 shows the resulting cost benefit scores for each program and for the overall portfolio. Any score above one signifies cost effectiveness. Table 6-1 also includes the cost of conserved energy (CCE) by program, which describes the costs of acquiring the lifetime benefits of program energy savings. In addition, the present values of the net lifetime benefits (net avoided costs minus program costs) are provided.

Table 6-1 Results of Cost Effectiveness Evaluation

Variable	*Portfolio*	*Custom*	*Standard*	*New Construction*	*RCx*
UCT	5.10	5.67	7.07	0.47	0.34
TRC	2.04	1.93	3.01	0.44	0.34
RIM	0.84	0.89	0.82	0.31	0.24
Participant Test	2.86	2.42	4.50	4.64	10.02
CCE - $/kWh	$0.01	$0.01	$0.01	$0.11	$0.14
Net Lifetime Benefits	$27,553,589	$18,014,180	$10,975,540	$(217,974)	$(212,687)

[35] California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects, October 2001

The overall program passes the UCT and TRC tests, as do the custom and standard programs. The RCx program and the new construction program individually do not pass either the UCT or TRC tests though their impacts are small.

The DSMore analysis was conducted at the individual measure level, which allows for an analysis by measure for all components of the program. Table 6-2 and Table 6-3 provide measures that are underperforming or marginally performing with regards to their TRC values, for the custom and standard programs respectively. Measures that had TRC values of 1.25 or less were included in the following tables as measures to monitor.

Table 6-2 Custom Measures to Monitor

BizSavers Custom Program				
Measure Name	*End Use*	*TRC*	*Efficient*	*Baseline*
104110-CFL-CFL <30 Watt	Lighting BUS	0.16	Compact fluorescent lamp less than 30W	Incandescent lamp
104120-CFL-CFL >30 <100 Watt	Lighting BUS	0.23	Compact fluorescent lamp more than 30W and less than 115W	Incandescent lamp
413010-ECM-ECM replacing Shaded Pole Motor	Motors BUS	0.41	ECM Motor	Shaded Pole Motor
109010-System-Retrocommissioning, Lighting	Lighting BUS	0.67	0	0
103510-LED-LED Case Lighting	Lighting BUS	0.93	LED Case lighting	Fluorescent case lighting
101040-T5-6 Lamp T5 High Bay med BF	Lighting BUS	1.06	T5 High-Bay 6L-F54HO	MH 400 W Normal Start
115020-Daylight Sensor-LED Fixture & Daylight Sensor Control - Interior	Lighting BUS	1.08	LED Fixture with Daylight Sensor Control	Incandescent and/or HID
101030-T5-6 Lamp T5 High Bay high BF	Lighting BUS	1.22	T5 High-Bay 6L-F54HO	Unknown
103710-LED-High Bay LED replacing 1000W HID	Lighting BUS	1.25	High Bay LED Fixture	1000W HID

Table 6-3 Standard Measures to Monitor

BizSavers Standard Program				
Measure Name	*End Use*	*TRC*	*Efficient*	*Baseline*
203120-DX-Between 2.1 and 5.4 ton -AC less than 65,000 1 Ph	Cooling BUS	0.04	14 SEER Minimum	13.0 SEER
551010-ENERGY STAR PC (1)-Commercial Computer Networks	Office BUS	0.05	ENERGY STAR 5.0 Desktop Computer	Desktop computer meeting ENERGY STAR 3.0 with a standard efficiency power supply
521030-Refrigerator-Open Refrigeration Case to Closed Refrigeratioin Case	Refrigeration BUS	0.25	Closed Refrigeration Case	Open Refrigeration Case
203180-HVAC-DX-Packaged or Split System	Cooling BUS	0.36	14 SEER	13 SEER
529020-Refrigeration-Auto Door Closer	Refrigeration BUS	0.72	Install Auto Door Closer	No Auto Door Closer
103510-LED-LED Case Lighting	Lighting BUS	1.03	LED Case lighting	Fluorescent case lighting
ENERGY STAR Commercial Glass Door Freezers 15 to 30 ft3	Refrigeration BUS	1.09	Energy star commercial freezer	Standard efficiency commercial freezer

These measures should be monitored carefully when planning for future years. Some of the severely underperforming measures could be removed from the program, and the funds re-allocated to better performing measures. This should be part of the annual review process when allocating funds and approving measures within each program. Other measures may be close to falling below a TRC of 1, and updates to the baselines or incremental costs could easily drop those measures into the non-cost effective range.

Additionally, during the cost effectiveness analysis significant time was allocated to aggregating both standard and custom measure categories. The final measure level database contained 3343 line items with efficient and baseline measure descriptions. After considerable effort, analysts were able to aggregate that program database down to 123 separate categories of efficiency measure/baseline combinations, 87 standard and 36 custom measures. This process could be considerably less time intensive if the measure listings were more standardized in the program dataset. This will require a more concerted effort during program implementation to keep the number of distinct measure descriptions to a minimum.

7. Conclusions and Recommendations

This chapter summarizes ADM's conclusions and recommendations from the 2013 BizSavers Program evaluation activities. They are organized to present impact and process findings separately. Below is a list of conclusions that were developed to characterize key trends from the impact and cost effectiveness analysis.

- An HCIF of 1.00 was used by program staff to calculated energy savings for lighting projects, regardless of building type. This resulted in an underestimation of energy savings for some lighting projects. ADM analysts use HCIF's that are available in the TRM to calculate the gross savings associated with lighting projects. HCIF will typically increase the realization, by accounting for a decrease in HVAC cooling load due to lighting retrofits.
- Overestimating operating hours was a common issue that the evaluation team encountered when assessing the energy savings from projects with lighting controls. Currently gross ex ante savings are calculated using a deemed value based on control type. The evaluation team uses model that references a room type for every piece of lighting control equipment. Currently customers are not required to provide information or documentation on where the controls are installed or to what fixtures they are connected. Lockheed Martin's approach to estimating ex ante energy savings for project with lighting controls, results in savings that are too high.
- The low gross kWh savings realization rate for cooler door retrofits can be attributed to the gross ex ante savings calculations not taking into account the interactive effects between the refrigerated case work and the HVAC system. In the baseline condition the refrigerated cases have no doors, thus allowing refrigerated air to flow from the cases into the adjacent HVAC zone. This action reduces the overall cooling demand of the HVAC zone thus lowering HVAC energy usage. With the addition of the cooler doors, the infiltration to the zone is greatly reduced thus increasing the overall load on the HVAC system and energy usage as it is not receiving the cooling assistance from the refrigeration system. ADM utilized the DEER Grocery Store prototypical models to calculate the reported savings which were run using appropriate TMY3 weather data. The advantage of this type of analytical simulation is that the interactive effects are taken into consideration along with the effects that weather has on the overall efficiency of the refrigeration system and HVAC system.
- The cost effectiveness analysis provides a list of measures that were either not cost effective, with a TRC < 1, or were close to 1.

Based on the above conclusions, the evaluation team offers the following impact recommendations to improve program effectiveness.

- To more accurately estimate the savings associated with lighting projects, ADM suggests that program staff utilize the HCIF, by building type, that are available in the TRM. Project documentation already requires the customer to indicate the building type; therefore, applying the HCIF should not require the collection of any additional information.
- For lighting controls, the baseline operating hours should be a function of facility type, and a more conservative estimate of the reduction in operating hours, such as 30%, should be used to estimate savings. Additionally, check with the site contact for hours of operation to be sure that the gross ex ante savings estimates are well-grounded in actual operating hours; especially for sites with steady hours of operation, such as restaurants, retail, and production sites.
- When lighting controls are implemented, ADM recommends collecting additional documentation about where the controls are installed and to what fixtures they are connected. When ADM reached out to customers or their contractors to obtain this information it was usually available. If Lockheed Martin would collect this documentation for all projects with lighting controls, they could more accurately estimate savings for these projects.
- When estimating savings for cooler door retrofits, ADM recommends using the normalized savings values found in the ADM ex-post results, which is defined as kWh savings per foot of case for cooler doors
- Ameren Missouri and Lockheed Martin should review the cost effectiveness of eligible measures. If measures are not deemed to be cost effective there is indication that funds could be better spent on measures that provide greater savings. Additionally, program staff should consider standardizing the measure categories. The review process was very time intensive and could improve the efficiency of the evaluation effort and associated evaluation budget.

The results of the process evaluation research are largely positive. Program participant and service provider satisfaction was high across all program facets and the program is on target to meet goals.

Below, conclusions and recommendations are organized according to the five regulatory research questions specified in 4 CSR 240-22.070(8): what are the primary market imperfections; is the target market segment appropriately defined; do program measures reflect the target market's needs and available technologies; are communication and delivery channels and mechanisms appropriate; and are there better ways to address market imperfections to increase adoption of program measures. The conclusions address the first four questions; the fifth question speaks to recommendations.

- **Research Question 1:** What are the primary market imperfections common to target market segment?

  ”Market imperfection” is a term typically used in finance to refer to limitations that reduce an actor’s ability to sign and honor financial contracts. In the context of this process evaluation, we interpret this to mean any structural barriers that prevent Ameren Missouri customers from participating in the BizSavers programs. Overall, results suggest that the primary barrier, common to most energy efficiency programs, is lack of up-front capital. This disproportionately affects small businesses, which also appear to be less aware of BizSavers incentives, on average, than larger businesses. The small business sector is notoriously difficult to reach.[36]

- **Research Question 2:** Is target market segment appropriately defined, or does it need further subdivision or merging with other segments?

  Projects were distributed across a range of business types in rough proportion to the distribution of business types in the general population, suggesting that the program is effectively reaching the main segments of the target market. Projects were disproportionately concentrated in large buildings, and tended to be somewhat disproportionately concentrated in St. Louis and its suburbs. This initially low showing by these targets supports ongoing program plans for follow-up with these targets during 2014.

  Research Question 3: Do program measures reflect diversity of end-use needs and available technologies for target segment?

  The range of equipment meets the needs of respondents. Equipment generally is delivered with little delay, and participants are largely satisfied with the range of program-qualified equipment and the quality both of the equipment they installed and of the installation. Standard program participants that opt not to pursue the custom program option do so primarily because the standard program option covers their equipment needs.

  Program rules and requirements may be too stringent for the retro-commissioning market, as Retro-commissioning Service Providers (RSPs) found that program rules sometimes prevent participation, keep customers from capitalizing on incentives, and do not allow them to capture custom program project opportunities.

- **Research Question 4:** Are communication and delivery channels/mechanisms appropriate for the target market segment?

[36] Fisher, M., Moran, D., and Gogte, S. (2013). Engaging Small Customers: Maximizing the Direct-Install Hook. Presented at the Association of Energy Services Professionals 23rd National Conference, January 2013.

The program is marketed through multiple channels and the implementer reports active outreach to end-use customers and service providers. The latter is important, as service providers are critical to program communication and delivery. However, many service providers who are not members of the trade ally network are not aware of its existence. Moreover, service provider reports suggest that program awareness could be increased in the general business population. Lack of clarity in application instructions may be a barrier to effective program delivery, creating delays in and possibly abandonment of project implementation.

The BizSavers programs were primarily targeting higher energy-use customers during 2013, but program managers also reported outreach aimed at small businesses. The evaluation team compared those reported activities with several recently identified best practices for targeting the small business sector.[37] Based on staff reports, the BizSavers program uses many (but not all) of the identified best practices. Other program administrators and implementers have reported success with free direct install of low-cost measures – both as a source of savings and as a foot in the door for additional savings – and using market research to identify market segment for targeted marketing and outreach.[38,39,40]

- **Research Question 5:** Are there better ways to address market imperfections to increase adoption of each program measure?

Based on the above conclusions, the evaluation team offers the following process recommendations to improve program effectiveness.

- Lockheed Martin should continue working to expand the trade ally network and educate non-member trade allies about program offerings and application processes.
- Lockheed Martin should continue to work to clarify application instructions, particularly for the custom program and ensure that trade allies and end-users know who they can contact to get assistance with applications. To inform efforts to clarify instructions, Lockheed Martin should solicit feedback from customers and trade allies on sources of confusion or difficulty.

[37] Mougne, Ti. (2013). The Playbook for Small Business Direct-Install Programs. Presented at the Association for Energy Services Professionals National Conference, Orlando, FL, 2013.

[38] Mougne, Ti. Op. cit.

[39] Garland, G. (2013). Successful Tactics for Improving Customer Satisfaction in Small and Unassigned Businesses through Energy Efficiency. Presented at the Association for Energy Services Professionals National Conference, Orlando, FL, 2013.

[40] Mazur-Stommen, S. and Herzer, B. (2014). Unmined Gold. Engaging Small Commercial Customers. Presented at the Bonneville Power Administration-Northwest Energy Efficiency Alliance Efficiency Exchange Conference, Kennewick, Washington, 2014.

- Ameren Missouri and Lockheed Martin staff should work together to formalize orientation materials for new trade allies, possibly including a brief online orientation video. Such materials should stress that learning how to fill out the application correctly up front will save them time in the end.
- Lockheed Martin should re-examine the rules and incentives for Custom measures in the Retro-commissioning program and possibly solicit feedback from Retro-commissioning Service Providers on how the current rules limit customers' ability to capitalize on savings opportunities and possibly prevent participation.
- Lockheed Martin staff should continue to work to improve program penetration of the small business sector and should consider additional approaches that may include free direct install of low-cost measures to generate immediate cost-effective savings and generate interest in future projects with this sector and market research to provide information on specific needs and motives of small business segments. Further, Lockheed Martin staff should incorporate feedback from participants in the Distributor Partnership Program trial to determine the extent to which it enables the program to more effectively generate savings from hard-to-reach segments, including smaller businesses and service providers not otherwise engaged with the program.

Appendix A: Project-Level Analyses

This appendix contains project-level analyses for the impact evaluation of the program.

Project Number: C-1

Executive Summary

Under project C-1, the customer replaced a 900 ton chiller with a new 1850 ton chiller. Estimated ex post annual savings are 1,106,616 kWh. The gross kWh savings realization rate of this project is 79%.

Project Description

The customer occupies a 9-story, 774,518 square foot facility built in 1975. The customer replaced a 900 ton Trane Centrifugal chiller, rated 0.821 kW/ton, with a 1,850 ton Trane centrifugal chiller rated at 0.525 kW/ton (Non-Standard Part Load Value, NPLV). The new chiller operates as the lead chiller throughout the year. This project was completed 9/27/13.

Measurement and Verification Effort

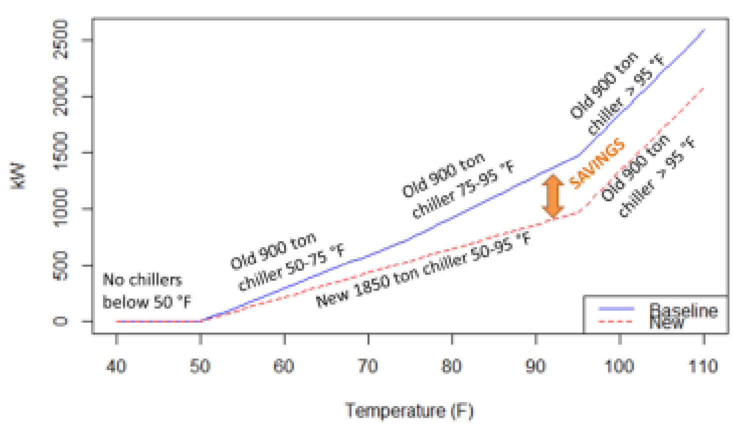
During the M&V visit, ADM staff verified the installation and operation of the new hardware.

For the baseline system, the following schedule was reported during the site visit:

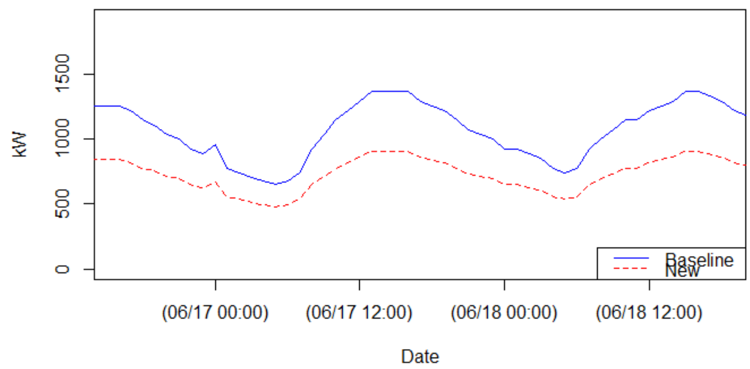
Chiller sequencing:

Less than 50F	-	AHU free cooling, no chiller run
Over 50F	-	1 chiller
Over 75F	-	2 chiller
Over 95F	-	3 chiller

The baseline chillers were 900 ton units, with NPLV rating of 0.821 kW/ton, and the new chiller was a 1,850 ton unit with an NPLV rating of 0.525 kW/ton. NPLV ratings are a weighted average of efficiencies at various representative operating conditions. This rating was used in conjunction with the chiller operating sequence to produce a plot showing kW as a function of temperature.



This power consumption was applied to typical weather for St. Louis (TMY3) to find pre and post typical annual power consumption, and the savings is the difference between the two. An example of the model output is shown below.



Because there are multiple staged chillers with different efficiencies, several assumptions needed to be made. A key assumption in the analysis is that load is linearly related to outside air temperature. This same assumption was made to determine the claimed savings during the implementation phase of this project, so it should not introduce a significant difference in realization. This analysis also assumes that the NPLV efficiency is a representative efficiency over the entire operating range of the chiller. This assumption is inferior to using the actual performance curves of the two chillers, but they were not available.

An eQUEST model of the system helped to validate these results. A typical hospital was equipped with three chillers in the baseline and two chillers in the new model (because the new chiller is double sized) and operating conditions were input. The built-in algorithms for sizing & staging the chillers were run, and the savings were then scaled by the actual capacity. The staging algorithms produced by eQUEST software were dramatically different than the reported staging, and the overall savings from this calculation approach proved to be quite low (project realization of 35%).

Lastly, the technical resource manual for Ameren Missouri suggests using this equation to calculate energy savings

$$\Delta kWh = T\,(OH)\,(\eta_{ex} - \eta_{Ret})$$

Where:

- T is the capacity of the chiller in tons
- OH is the equivalent full load hours
- η_{Ex} is the efficiency of existing chiller at part load condition
- η_{Ret} is the full load capacity of the retrofit chiller

However, this type of calculation is not well suited for multiple staged chillers. It is difficult to estimate equivalent full load hours without modeling the staging of the chillers, which supports the decision to use the bin analysis and eQUEST building simulation to find savings.

Results

The analysis results are summarized in the table below.

Measure Category	Incentive Type	Annual Gross kWh Savings Per Year		
		Ex Ante	Ex Post	Realization Rate
Chiller Retrofit	Custom	1,395,134	1,106,616	79%

The ex post annual energy savings were lower than ex ante annual savings because the chiller sequencing obtained from our M&V site visit was not integrated into the original analysis. Additionally, ADM used TMY3 weather to represent a typical year, whereas the ex ante analysis used Air Force weather data.

Project Number: C-2, S-14

Executive Summary

Under projects C-2 and S-14, the customer received custom and standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 67%.

Project Description

The customer retrofitted the following fixtures:

- Removal of (682) 4' 2L T12 fixtures in Area 1
- Removal of (364) 4' 4L T12 fixtures in Area 1
- Removal of (262) HPS fixtures in Area 2
- Removal of (13) 8' 2L T12 fixtures in the Area 1
- Removal of (25) MH fixtures in Area 2
- Removal of (27) 4’ 2L T12 fixtures in Area 3
- Installation of (239) 4’ 6L T8 fixtures in Area 2
- Installation of (148) 4’ 6L T8 fixtures in Area 1
- Installation of (148) Occupancy Sensors

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed three photo-sensor loggers at the site (from 11/19/13 to 12/11/13) to monitor lighting operation. These data were used to calculate energy savings. The reduction of lighting operating hours associated with occupancy sensors is determined by multiplying the baseline hours by a Power Adjustment Factor of 0.7 (adapted from ASHRAE 90.1-1989).

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as\text{–}built} \times W_{as\text{–}built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as\text{–}built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*
W	= *Wattage controlled by each occupancy sensor*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Gross Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Removal of 4' 2L T12	682	-	62	-	5,596	370,408	258,851	1.09	70%
Removal of 4' 4L T12	364	-	112	-	5,596	357,128	249,570	1.09	70%
Removal of HPS	262	-	469	-	5,569	1,076,411	748,695	1.09	70%
Removal of 8' 2L T12	13	-	110	-	2,431	12,527	3,803	1.09	30%
Removal of MH	25	-	1,080	-	5,569	236,520	164,511	1.09	70%
Removal of 4' 2L T12	27	-	62	-	52	14,664	95	1.09	1%
Installation of High Performance-T8 6L 32W	-	239	-	217	5,538	(416,676)	(314,220)	1.09	75%
Installation of High Performance-T8 6L 32W	-	148	-	170	5,097	(258,025)	(140,290)	1.09	54%
Total						1,392,956	971,015		70%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Gross Annual Savings Calculations

Measure	*Quantity*	*Controlled Wattage*	*Hours*		*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
			Old	*New*				
Controls	148	170.00	5,097	4,375	91,212	19,855	1.09	22%
Total					91,212	19,855	1.09	22%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Custom	1,392,956	971,015	70%	203.70
Lighting Controls	Standard	91,212	19,855	22%	0.00
Total		1,484,168	990,870	67%	203.70

The project-level realization rate is 67%. The realization rate of the lighting retrofit is low mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 52 to 5,596), not accounting for the effect of lighting controls, are less than the lighting operating hours used to perform the ex ante savings estimate (8,760). The lighting controls realization rate is low because ex ante estimation assumed a greater reduction of lighting hours than was measured and verified on site.

Project Number: C-3

Executive Summary

Under project C-3, the customer received incentives from Ameren Missouri for installing a new 1,100 ton chiller with variable frequency drive (VFD). The gross kWh savings realization rate for this project is 93%.

Project Description

The customer installed a 1,100 ton centrifugal chiller with a variable speed drive, replacing a 1991 vintage, 1,000 ton, fixed-speed centrifugal chiller. The identification number for this chiller is Chiller-2. Recently, a different fixed-speed chiller was upgraded, Chiller-1, so there are now two new VFD chillers and one old fixed-speed chiller, Chiller-3, for very hot days. There is also a fourth fixed-speed chiller available, but it is only used as a backup.

Measurement and Verification Effort

During the M&V visit, ADM staff verified installation and operation of the new chiller and interviewed the site representative to gain a better understanding of chiller operation. The three chillers are staged on depending on outside air temperature, as follows:

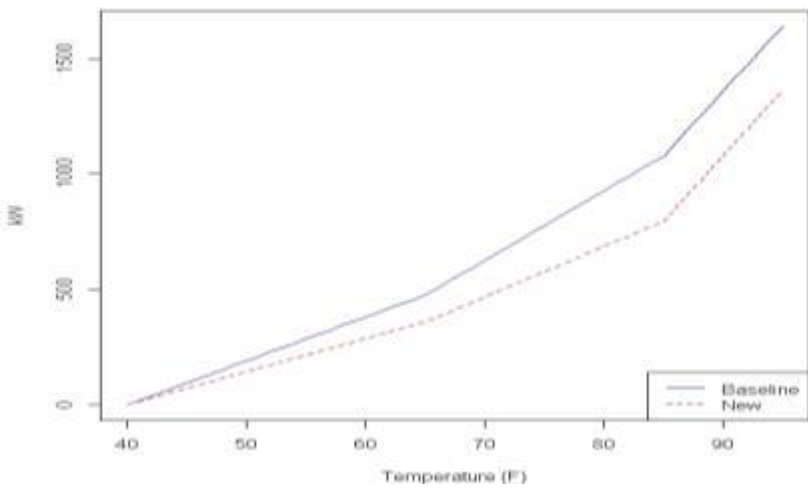
Outside Air Temperature	*Chillers On*
< 40 °F	None
40 - 65 °F	Chiller-1
65 - 85 °F	Chillers-1 & 2
> 85 °F	Chillers-1, 2 & 3

The customer is considering implementing a chiller control package in the future, but currently an operator, on duty 24/7, implements the above sequence.

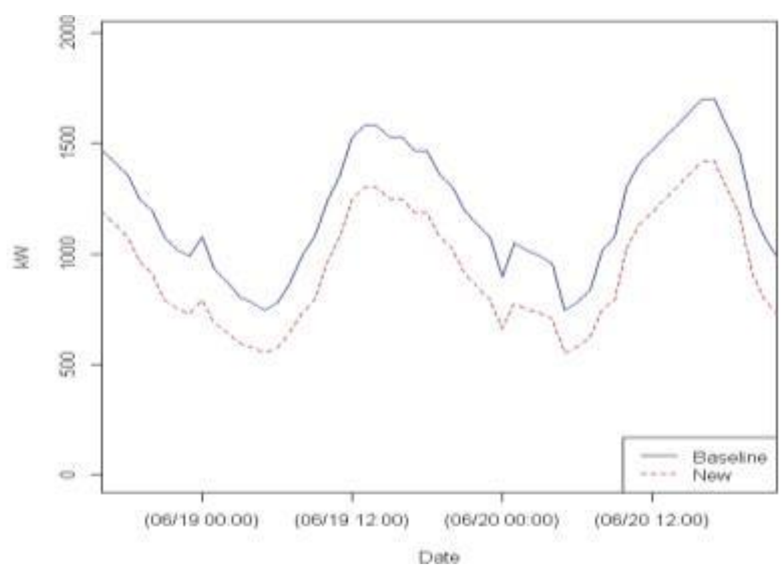
ADM calculated energy savings using RStudio software. Representative System Part Load Values (SPLV) referenced from the project documentation (specifically the Johnson Controls output reports) was assigned to the chillers as follows:

Chiller Description	*SPLV*
Chiller-1, base (VFD)	0.432
Chiller-2, base (fixed speed)	0.603
Chiller-3, base (fixed speed)	0.561
Chiller-1, post (VFD)	0.325
Chiller-2, post (VFD)	0.398
Chiller-3, post (fixed speed)	0.565

SPLV is a project-specific, single number, part-load efficiency indicator that is calculated using the equation form defined in ARI 550/590-1998. Unlike IPLV or NPLV, the factors used to calculate SPLV are project specific and consider multiple-chiller applications, actual operating hours, and project-specific operating conditions. The chiller SPLV values were used in conjunction with the chiller operating sequence to produce a plot showing total chiller input power as a function of outside air temperature.



This power consumption was applied to Typical Meteorological Year 3 (TMY3)weather data for St. Louis to find pre and post-retrofit typical annual hourly power consumption, and the savings are the difference between the two. The 8,760 hourly (one year) model output is shown below.



Results

Measure Category	*Incentive Type*	*Annual kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Chiller Replacement	Custom	977,824	911,720	93%	282.9
Total		977,824	911,720	93%	282.9

The gross kWh savings realization rate for this project is 93%, which can be explained by small differences in chiller load profiles used in the ex ante and post ante models. The ex ante analysis had Chiller-1 coming on at an outside air temperature of 30^{o}F, with a load of 560 tons. The ex post analysis followed the sequence of the operation tabled above, which has Chiller-1 coming on at an outside air temperature of 40^{o}F, starting at a load of zero and ramping up linearly.

Project Number: C-4, S-9

Executive Summary

Under projects C-4 and S-9, the customer received custom and standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for these projects is 87%.

Project Description

The customer retrofitted the following fixtures:

- (31) Incandescent fixtures with (31) LEDs in the Area/Building H and Area/Building D
- (7) Incandescent fixtures with (7) LEDs in the Area/Building A
- (32) Incandescent fixtures with (32) LEDs in the Area/Building B
- (264) Incandescent fixtures with (264) LEDs in the Area/Building H
- (6) Incandescent fixtures with (6) LEDs in the Area/Building H
- (165) Incandescent fixtures with (165) LEDs in the Area/Building H
- (24) 4' 1L T8 fixtures with (24) 4' 1L T8 fixtures in the Area/Building B and Area/Building A
- (20) 4' 1L T8 fixtures with (20) 4' 1L T8 fixtures in the Area/Building C and Area/Building D
- (5) 2' 2L T8 fixtures with (5) 2' 2L T8 fixtures in the Area/Building H building
- (99) 3' 2L T8 fixtures with (99) 3' 2L T8 fixtures in the Area/Building H and Area/Building D
- (361) 4' 2L T8 fixtures with (361) 4' 2L T8 fixtures in the Area/Building B and Area/Building A
- (979) 4' 2L T8 fixtures with (979) 4' 2L T8 fixtures in the Area/Building C, Area/Building H, Area/Building D, Area/Building E
- (149) 4' 3L T8 fixtures with (149) 4' 3L T8 fixtures in the Area/Building B and Area/Building A
- (334) 4' 3L T8 fixtures with (334) 4' 3L T8 fixtures in the Area/Building H, Area/Building D, Area/Building E
- (159) 4' 4L T8 fixtures with (159) 4' 4L T8 fixtures in the Area/Building B and Area/Building A
- (466) 4' 4L T8 fixtures with (466) 4' 4L T8 fixtures in the Area/Building C, Area/Building D, Area/Building E
- (34) 2' 3L T8 fixtures with (34) 2' 3L T8 fixtures in the Area/Building D
- (1) 2' 2L T8 fixture with (1) 2' 2L T8 fixture in the Area/Building A
- (506) U-tube 2L T8 fixtures with (506) 2' 3L T8 fixtures in the Area/Building H, Area/Building D, Area/Building E
- (26) 4' 1L T8 fixtures with (26) 4' 1L T8 fixtures in the Area/Building F and Area/Building G
- (291) 4' 2L T8 fixtures with (291) 4' 2L T8 fixtures in the Area/Building F and Area/Building G
- (12) 4' 3L T8 fixtures with (12) 4' 3L T8 fixtures in the Area/Building F and Area/Building G

- (34) 4' 4L T8 fixtures with (34) 4' 4L T8 fixtures in the Area/Building F and Area/Building G
- (177) u-tube 2L T8 fixtures with (177) 2' 3L T8 fixtures in the Area/Building F and Area/Building G
- (86) 2' 2L T8 fixtures with (86) 2' 2L T8 fixtures in the Area/Building F and Area/Building G
- (25) 3' 2L T8 fixtures with (25) 3' 2L T8 fixtures in the Area/Building F and Area/Building G
- (25) Incandescent fixtures with (25) LEDs in the remaining buildings
- (22) Incandescent fixtures with (22) LEDs in the remaining buildings
- (16) Incandescent fixtures with (16) LEDs in the remaining buildings
- (5) Incandescent fixtures with (5) LEDs in the remaining buildings
- (65) Incandescent fixtures with (65) LEDs in the remaining buildings
- (297) 4' 1L T8 fixtures with (297) 4' 1L T8 fixtures in the remaining buildings
- (37) 2' 2L T8 fixtures with (37) 2' 2L T8 fixtures in the remaining buildings
- (125) 3' 2L T8 fixtures with (125) 3' 2L T8 fixtures in the remaining buildings
- (1237) 4' 2L T8 fixtures with (1237) 4' 2L T8 fixtures in the remaining buildings
- (22) 8' 2L T8 fixtures with (22) 8' 2L T8 fixtures in the remaining buildings
- (456) 4' 3L T8 fixtures with (456) 4' 3L T8 fixtures in the remaining buildings
- (333) 4' 4L T8 fixtures with (333) 4' 4L T8 fixtures in the remaining buildings
- (152) u-tube 2L T8 fixtures with (152) 2' 3L T8 fixtures in the remaining buildings

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed fifteen photo-sensor loggers at the site (from 01/18/14 to 01/28/14) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Gross Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	31	31	100	15	5,075	14,290	14,562	1.09	102%
Incandescent to LED	7	7	40	11	3,846	1,101	850	1.09	77%
Incandescent to LED	32	32	50	8	5,396	7,289	7,898	1.09	108%
Incandescent to LED	264	264	60	11	8,760	70,152	123,405	1.09	176%
Incandescent to LED	6	6	75	14	3,866	1,985	1,541	1.09	78%
Incandescent to LED	165	165	90	20	3,866	63,083	48,977	1.09	78%
4' 1L T8 to 4' 1L T8	24	24	30	21	4,373	1,171	1,029	1.09	88%
4' 1L T8 to 4' 1L T8	20	20	30	23	4,160	976	634	1.09	65%
2' 2L T8 to 2' 2L T8	5	5	33	24	3,866	266	189	1.09	71%
3' 2L T8 to 3' 2L T8	99	99	46	36	4,366	7,892	4,707	1.09	60%
4' 2L T8 to 4' 2L T8	361	361	62	37	7,280	48,943	71,549	1.09	146%
4' 2L T8 to 4' 2L T8	979	979	62	49	4,253	132,728	58,945	1.09	44%
4' 3L T8 to 4' 3L T8	149	149	85	57	4,063	22,625	18,461	1.09	82%
4' 3L T8 to 4' 3L T8	334	334	85	72	5,463	50,716	25,831	1.09	51%
4' 4L T8 to 4' 4L T8	159	159	112	74	5,334	32,766	35,098	1.09	107%
4' 4L T8 to 4' 4L T8	466	466	112	94	4,054	96,030	37,036	1.09	39%
2' 3L T8 to 2' 3L T8	34	34	51	40	8,760	3,227	3,568	1.09	111%
2' 2L T8 to 2' 2L T8	1	1	59	34	8,760	138	243	1.09	176%
U-tube 2L T8 to 2' 3L T8	506	506	59	45	4,090	69,973	31,550	1.09	45%
Incandescent to LED	25	25	40	11	3,827	3,932	3,022	1.09	77%
Incandescent to LED	22	22	50	10	3,827	4,772	3,668	1.09	77%
Incandescent to LED	16	16	60	11	3,827	4,252	3,268	1.09	77%
Incandescent to LED	5	5	75	11	3,827	1,735	1,334	1.09	77%
Incandescent to LED	65	65	90	20	3,827	24,851	19,099	1.09	77%
4' 1L T8 to 4' 1L T8	297	297	30	21	3,827	14,496	11,141	1.09	77%
2' 2L T8 to 2' 2L T8	37	37	33	23	3,827	1,966	1,511	1.09	77%
3' 2L T8 to 3' 2L T8	125	125	46	31	3,827	9,965	7,658	1.09	77%
4' 2L T8 to 4' 2L T8	1,237	1,237	62	37	3,827	167,706	128,890	1.09	77%
8' 2L T8 to 8' 2L T8	22	22	110	100	3,827	1,193	917	1.09	77%
4' 3L T8 to 4' 3L T8	456	456	85	57	3,827	69,241	53,215	1.09	77%
4' 4L T8 to 4' 4L T8	333	333	112	74	3,827	68,623	52,740	1.09	77%
u-tube 2L T8 to 2' 3L T8	152	152	59	34	8,760	21,020	36,976	1.09	176%
4' 1L T8 to 4' 1L T8	26	26	30	21	8,760	1,269	2,232	1.09	176%
4' 2L T8 to 4' 2L T8	291	291	62	37	8,760	39,452	69,401	1.09	176%
4' 3L T8 to 4' 3L T8	12	12	85	57	8,760	1,822	3,205	1.09	176%
4' 4L T8 to 4' 4L T8	34	34	112	74	8,760	7,007	12,325	1.09	176%
u-tube 2L T8 to 2' 3L T8	177	177	59	34	8,760	24,477	43,057	1.09	176%
2' 2L T8 to 2' 2L T8	86	86	33	23	8,760	4,571	8,040	1.09	176%
3' 2L T8 to 3' 2L T8	25	25	46	31	8,760	1,993	3,506	1.09	176%
Total						1,099,693	951,276		87%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	902,251	723.655	80%	144.85
Lighting Retrofit	Standard	197,442	227,622	115%	43.16
Total		1,099,693	951,276	87%	188.01

The gross kWh savings realization rate for these projects is 87%. The custom incentive gross kWh savings realization rate is low mainly because the ex post lighting hours of operation for the classrooms and office areas verified during the M&V site visit (ranging from 2,032 to 4,278) used in the ex post estimation are less than the lighting hours of operation used to perform the ex ante savings estimate (5,423). The standard incentive ex post savings realization rate is high because the largest amount of measures installed had a higher realization of lighting hours of operation verified during the M&V site visit (8,760 hours) than was assumed in the ex ante savings estimate (5,423 hours). In addition, the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated university (1.09), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: C-5

Executive Summary

Under project C-5, the customer received custom project incentives from Ameren Missouri for the installation of a new VFD equipped air compressor and flow controller. The gross kWh savings realization rate for these projects is 93%.

Project Description

The customer installed the following equipment:

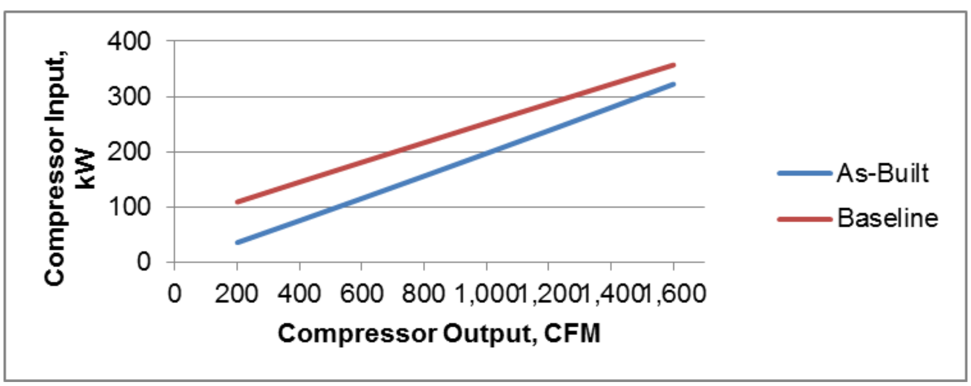
- (1) Ingersoll Rand R60NE 200 hp VFD Air Compressor
- (1) Ingersoll Rand IX03 Flow Controller

The above equipment replaced an aging Ingersoll Rand SSR-EP200 single stage rotary air compressor. The original constant speed air compressor relied on inlet modulation with blow down to control CFM output. This method of control is considered inefficient compared to a VFD equipped air compressor. The flow controller allows for constant downstream pressure control, allowing for the reduction of overall system pressure.

Measurement and Verification Effort

During the M&V visit, ADM staff verified the installation of the new compressor and flow controller. Watt node loggers were installed on the new VFD compressor in which compressor kW was monitored for 3 weeks with a five minute interval. Using this data in conjunction with Compressed Air and Gas Institute (CAGI) compressor curves, ADM calculated the corresponding CFM output for each data point for the new compressor. Using the assumption that the CFM for the pre- and post-retrofit compressors remains the same, CAGI curves for the baseline SSR-EP200 compressor was then used to calculate the required kW input to produce the same CFM. The following graph illustrates the compressed air system efficiency before and after the installation of the new VFD compressor:

Baseline vs. As-Built System Efficiency



From the monitoring data and derived kW & CFM values for the as-built and baseline systems, typical daily operating profiles were determined. Annual energy savings was determined by extrapolating these daily profiles to an entire year. The kWh savings is then calculated as the difference between the baseline and as-built consumption.

ADM calculated the savings of the flow controller in a similar manner as for the compressor retrofit. The installation of the flow controller effectively allowed for the reduction of the plant pressure, thus reducing compressor CFM. The plant pressure was reduced from approximately 116 PSI to a more appropriate 88 PSI. Since monitoring was performed post install, the CFM demand without the flow controller was calculated for each data point using the following equation:

$$CFM_{w/o} = \frac{PSI_B + 14.5}{PSI_p + 14.5} \times CFM_w$$

Where:

$CFM_{w/o}$ = *Required CFM without flow controller*

PSI_b = *Maintained system PSI before flow controller*

PSI_p = *Maintained system PSI after flow controller*

CFM_w = *CFM with flow controller*

The baseline CAGI compressor curves were then used once again to determine the required kW input to produce the adjusted CFM value. From the adjusted CFM and derived kW values, typical daily operating profiles were determined. Annual energy savings for the flow controller was determined by extrapolating these daily profiles to an entire year. The kWh savings is then calculated as the difference between the non-flow controller system and the consumption of the system with the flow controller.

Results

Verified Annual Gross Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
VFD Air Compressor	Custom	-	510,902	-	69.36
Flow Controller	Custom	-	187,226	-	31.42
Total		751,986	698,128	93%	100.78

The project-level gross kWh savings realization rate is 93%. The low realization rate can be attributed to the differences in the approaches utilized in the ex ante and ex post calculations. ADM calculated an individual operating profile for each day of the week, as compressed air demand can be reduced on weekends. The ex ante analysis utilized a typical day operating profile which was then extrapolated to an entire year without making a reduction for weekends.

Project Number: C-6

Executive Summary

Under project C-6, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 90%.

Project Description

The customer retrofitted the following fixtures (400) MH fixtures with (400) 4' 4L T5 fixtures.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed one photo-sensor logger at the site (from 11/20/13 to 12/11/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH to 4' 4L T5	400	400	461	234	6,718	678,918	681,342	1.01	100%
Total						678,918	681,342	1.01	100%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	678,918	681,342	100%	142.76
Total		678,918	681,342	100%	142.76

The project-level gross kWh savings realization rate is 100%. The ex ante annual kWh savings were very similar to the ex post annual kWh savings.

Project Number: C-7

Executive Summary

Under project C-7, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the exterior of its facility. The gross kWh savings realization rate for this project is 100%.

Project Description

The customer retrofitted the following fixtures:

- (121) HPS 150W fixtures with (78) LEDs in Area 1
- (75) HPS 150W fixtures with (43) LEDs in Area 2
- (20) HPS 150W fixtures with (14) LEDs in Area 3
- (147) HPS 150W fixtures with (85) LEDs in Area 4
- (90) HPS 150W fixtures with (54) LEDs in Area 5
- (7) MH 400W fixtures with (7) LEDs in Area 6
- (2) MH 1000W fixtures with (2) LEDs in Area 6
- (22) MH 400W fixtures with (22) LEDs in Area 7
- (2) MH 400W fixtures with (2) LEDs in Area 7
- (2) MH 400W fixtures with (2) LEDs in Area 8
- (16) MH 400W fixtures with (16) LEDs in Area 8

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
HPS 150W to LED	121	78	173	45	8,760	152,830	152,830	1.00	100%
HPS 150W to LED	75	43	173	51	8,760	94,450	94,450	1.00	100%
HPS 150W to LED	20	14	173	51	8,760	24,055	24,055	1.00	100%
HPS 150W to LED	147	85	173	45	8,760	189,492	189,492	1.00	100%
HPS 150W to LED	90	54	173	51	8,760	112,268	112,268	1.00	100%
MH 400W to LED	7	7	461	178	4,308	8,677	8,534	1.00	98%
MH 1,000W to LED	2	2	1,080	255	4,308	7,227	7,108	1.00	98%
MH 400W to LED	22	22	461	77	4,308	37,002	36,394	1.00	98%
MH 400W to LED	2	2	461	131	4,308	2,891	2,843	1.00	98%
MH 400W to LED	2	2	461	146	4,308	2,759	2,714	1.00	98%
MH 400W to LED	16	16	461	146	4,308	22,075	21,713	1.00	98%
Total						653,727	652,403		100%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	653,727	652,403	100%	65.42
Total		653,727	652,403	100%	65.42

The project-level gross kWh savings realization rate is 100%. The ex ante annual kWh savings were very similar to the gross ex post kWh savings.

Project Number: C-8

Executive Summary

Under project C-8, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility. The gross kWh savings realization rate for this project is 72%.

Project Description

The customer retrofitted the following fixtures:

- (14) MH 400W fixtures with (14) Induction Wall-pack fixtures in Area 1
- (14) MH 400W fixtures with (14) Custom Single Pole fixtures in Area 1
- (60) MH 400W fixtures with (60) 6 LAMP - F54HO T5 fixtures in Area 2
- (20) MH 400W fixtures with (20) 6 LAMP - F54HO T5 fixtures in Area 3
- (36) MH 400W fixtures with (36) 6 LAMP - F54HO T5 fixtures in Area 4
- (20) MH 400W fixtures with (20) 4 LAMP - F54HO T5 fixtures in Area 5
- (36) MH 250W fixtures with (36) High Performance-T8 2L 32W fixtures in Area 6
- (36) MH 250W fixtures with (36) High Performance-T8 4L 28W fixtures in Area 7
- (4) MH 400W fixtures with (4) 4 LAMP - F54HO T5 fixtures in Area 8

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed four photo-sensor loggers at the site (from 9/21/13 to 10/16/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
MH 400W to Induction Wall-pack	14	14	461	162	4,308	16,744	18,032	1.00	108%
MH 400W to Custom Single Pole	14	14	461	162	4,308	16,744	18,032	1.00	108%
MH 400W to 6 LAMP - F54HO - T5	60	60	815	358	3,998	168,715	119,917	1.09	71%
MH 400W to 6 LAMP - F54HO - T5	20	20	815	358	3,998	56,238	39,972	1.09	71%
MH 400W to 6 LAMP - F54HO - T5	36	36	815	358	4,004	101,229	72,074	1.09	71%
MH 400W to 4 LAMP - F54HO - T5	20	20	461	234	3,998	27,935	19,855	1.09	71%
MH 250W to High Performance-T8 2L 32W	36	36	295	64	3,773	51,168	31,377	1.00	61%
MH 250W to High Performance-T8 4L 28W	36	36	295	94	3,773	44,523	27,301	1.00	61%
MH 400W to 4 LAMP - F54HO - T5	4	4	461	234	3,998	5,587	3,971	1.09	71%
Total						488,884	350,531		72%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	488,884	350,531	72%	101.14
Total		488,884	350,531	72%	101.14

The project-level gross kWh savings realization rate is 72%. The savings realization rate is low mainly because seven measures had ex post lighting hours of operation verified during the M&V site visit (ranging from 3,773 to 4,308) were less than the hours of operation used to perform the ex ante savings estimate (6,153).

Project Number: C-9, S-26

Executive Summary

Under projects C-9 and S-26, the customer received custom and standard incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility. The gross kWh savings realization rate for these projects is 136%.

Project Description

The customer retrofitted the following fixtures:

- (77) MH fixtures with (77) 4' 6L T5 fixtures in Area 1
- (18) MH fixtures with (18) 4' 6L T5 fixtures in Area 2
- (2) MH fixtures with (2) 2' 6L T5 fixtures in Area 3
- (3) MH fixtures with (3) LEDs in Area 4
- (3) MH fixtures with (3) 4' 4L T5 fixtures in Area 5
- (2) MH fixtures with (2) LEDs in Area 6
- (194) 8' 2L T12 fixtures with (194) 4' 4L T8 fixtures in Area 7
- (71) 8' 2L T12 fixtures with (71) 4' 2L T8 fixtures in Area 8
- (29) 4' 4L T12 fixtures with (29) 4' 3L T8 fixtures in Area 9
- (21) MH fixtures with (21) 4' 4L T8 fixtures in Area 10
- (9) MH fixtures with (9) 4' 6L T8 fixtures in Area 11
- (75) Incandescent fixtures with (75) LEDs in Area 12
- (4) MH fixtures with (4) 4' 8L T8 fixtures in Area 11
- (5) Incandescent fixtures with (5) LEDs in Area 12
- (39) 8' 2L T12 fixtures with (39) 4' 2L T8 fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed five photo-sensor loggers at the site (from 11/19/13 to 12/10/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
MH to 4' 6L T5	77	77	1,080	340	4,490	227,920	255,865	1.00	112%
MH to 4' 6L T5	18	18	1,080	340	4,490	23,976	59,813	1.00	249%
MH to 2' 6L T5	2	2	461	226	4,490	1,880	2,111	1.00	112%
MH to LED	3	3	461	34	4,490	5,124	5,752	1.00	112%
MH to 4' 4L T5	3	3	1,080	226	4,490	10,248	11,504	1.00	112%
MH to LED	2	2	461	34	4,490	3,416	3,835	1.00	112%
8' 2L T12 to 4' 4L T8	194	194	185	99	4,642	61,764	85,806	1.11	139%
8' 2L T12 to 4' 2L T8	71	71	185	49	4,522	35,747	43,660	1.00	122%
4' 4L T12 to 4' 3L T8	29	29	112	72	4,452	4,294	5,722	1.11	133%
MH to 4' 4L T8	21	21	461	145	8,358	24,566	55,465	1.00	226%
MH to 4' 6L T8	9	9	461	215	8,399	8,196	18,596	1.00	227%
Incandescent to LED	75	75	100	18	4,642	22,767	31,629	1.11	139%
MH to 4' 8L T8	4	4	461	290	8,399	2,532	5,745	1.00	227%
Incandescent to LED	5	5	100	17	4,642	1,536	2,134	1.11	139%
8' 2L T12 to 4' 2L T8	39	39	110	74	8,399	5,198	11,793	1.00	227%
Total						439,165	599,429		136%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	414,861	565,666	136%	40.14
Lighting Retrofit	Standard	24,304	33,764	139%	7.85
Total		439,165	599,429	136%	47.99

The project-level gross kWh savings realization rate is 136%. The realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 4,452 to 8,389) are greater than the hours of operation used to perform the ex ante savings estimate (ranging from 1,800 to 4,000).

Project Number: C-10, S-27

Executive Summary

Under projects C-10 and S-27, the customer received incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility and installing occupancy sensors. The gross kWh savings realization rate for this project is 122%.

Project Description

The customer retrofitted the following fixtures:

- (16) MH fixtures with (16) 4' 4L T5 fixtures in Area 1
- (24) MH fixtures with (24) 4' 6L T5 fixtures in Area 2
- (7) MH fixtures with (7) 4' 4L T5 fixtures in Area 3
- (29) MH fixtures with (5) LEDs in Area 4
- (12) MH fixtures with (12) 4' 6L T5 fixtures in Area 5
- (36) MH fixtures with (24) 4' 4L T8 fixtures in Area 6
- (4) MH fixtures with (4) 2' 4L T5 fixtures in Area 7
- (26) MH fixtures with (26) U-tube 2L T8 fixtures in Area 8
- (10) MH fixtures with (10) 4' 3L T8 fixtures in Area 8
- (65) 4' 4L T12 fixtures with (65) 4' 3L T8 fixtures in Area 9
- (1) 4' 2L T12 fixture with (1) 4' 2L T8 fixture in Area 10
- (13) MH fixtures with (13) 4' 4L T8 fixtures in Area 11
- (21) MH fixtures with (21) 4' 6L T8 fixtures in Area 12
- (18) 8' 2L T12 fixtures with (18) 4' 2L T8 fixtures in Area 13
- (32) MH fixtures with (32) 4' 6L T5 fixtures in Area 14
- Installation of (30) Occupancy Sensors in Area 15

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and utilized data from five photo-sensor loggers placed at another, similar site in the area. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of occupancy sensors*

W = *Wattage controlled by each occupancy sensor*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH to 4' 4L T5	16	16	1,080	240	4,490	53,760	60,351	1.00	112%
MH to 4' 6L T5	24	24	1,080	340	4,490	71,040	79,750	1.00	112%
MH to 4' 4L T5	7	7	1,080	240	4,490	23,520	26,404	1.00	112%
MH to LED	29	5	461	33	4,490	52,816	59,292	1.00	112%
MH to 4' 6L T5	12	12	1,080	340	4,490	35,520	39,875	1.00	112%
MH to 4' 4L T8	36	24	465	145	4,490	53,040	59,543	1.00	112%
MH to 2' 4L T5	4	4	295	105	4,490	3,040	3,413	1.00	112%
MH to U-tube 2L T8	26	26	465	74	4,642	36,577	52,284	1.11	143%
MH to 4' 3L T8	10	10	295	110	4,642	6,656	9,515	1.11	143%
4' 4L T12 to 4' 3L T8	65	65	112	84	4,795	6,548	9,669	1.11	148%
4' 2L T12 to 4' 2L T8	1	1	62	49	4,642	47	67	1.11	143%
MH to 4' 4L T8	13	13	461	145	8,399	14,781	34,504	1.00	233%
MH to 4' 6L T8	21	21	461	215	8,399	18,587	43,391	1.00	233%
8' 2L T12 to 4' 2L T8	18	18	110	74	4,522	2,332	2,930	1.00	126%
MH to 4' 6L T5	32	32	461	340	2,237	6,970	8,663	1.00	124%
Total						385,234	489,649		127%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	*Quantity*	*Controlled Wattage*	*Hours*		*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
			Old	*New*				
Controls	30	5,460	4,795	4,452	18,489	2,072	1.11	11%
Total					18,489	2,072		11%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	385,234	489,649	127%	25.03
Lighting Controls	Standard	18,489	2,072	11%	0.00
Total		403,723	491,721	122%	25.04

The project-level gross kWh savings realization rate is 122%. The lighting realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 2,237 to 8,399), not accounting for the effect of lighting controls, are greater than the hours of operation used to perform the ex ante savings estimate (ranging from 1,800 to 4,000). The lighting controls savings realization rate was low because the ex ante savings estimation of the lighting controls assumed a greater reduction of lighting hours than was verified.

Project Number: C-11, S-16

Executive Summary

Under projects C-11 and S-16, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 98%.

Project Description

The customer retrofitted the following fixtures:

- (94) MH fixtures with (85) 4' 4L T8 fixtures in Area 1
- (56) MH fixtures with (56) 4' 4L T8 fixtures in Area 2
- (44) MH fixtures with (44) 4' 4L T8 fixtures in Area 1
- (142) 4' 2L T8 fixtures with (142) 4' 1L T8 fixtures in Area 3
- (103) 4' 4L T8 fixtures with (103) 4' 2L T8 fixtures in Area 4
- (5) 4' 2L T8 fixtures with (5) 4' 1L T8 fixtures in Area 4
- (59) 4' 4L T8 fixtures with (59) 4' 2L T8 fixtures in Area 5
- (11) 4' 4L T8 fixtures with (11) 4' 2L T8 fixtures in Area 6
- (3) U-Tube 2L T8 fixtures with (1) U-Tube 2L T8 fixture in Area 6
- (9) Halogen fixtures with (9) LEDs in Area 7
- (9) Halogen fixtures with (9) LEDs in Area 8
- (128) 4' 4L T8 fixtures with (146) 4' 2L T8 fixtures in Area 9

In addition, the customer installed (140) occupancy sensor controls.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed five photo-sensor loggers at the site (from 6/05/13 to 6/18/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

$HCIF$ = *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of occupancy sensors*

W = *Wattage controlled by each occupancy sensor*

t = *Lighting operating hours*

$HCIF$ = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH to 4' 4L T8	94	85	461	145	3,834	119,323	130,069	1.09	109%
MH to 4' 4L T8	56	56	461	145	2,661	68,094	51,521	1.09	76%
MH to 4' 4L T8	44	44	461	145	3,834	53,503	58,321	1.09	109%
4' 2L T8 to 4' 1L T8	142	142	62	25	4,199	20,217	24,137	1.09	119%
4' 4L T8 to 4' 2L T8	103	103	112	49	5,169	26,319	37,095	1.11	141%
4' 2L T8 to 4' 1L T8	5	5	62	25	5,169	750	1,058	1.11	141%
4' 4L T8 to 4' 2L T8	59	59	112	49	4,847	15,076	19,927	1.11	132%
4' 4L T8 to 4' 2L T8	11	11	112	49	4,847	2,811	3,715	1.11	132%
U-Tube 2L T8 to U-Tube 2L T8	3	1	59	49	4,847	519	686	1.11	132%
Halogen to LED	9	9	50	15	4,847	1,278	1,689	1.11	132%
Halogen to LED	9	9	50	15	4,847	1,278	1,689	1.11	132%
4' 4L T8 to 4' 2L T8	128	146	112	49	2,901	29,130	23,042	1.11	79%
Total						338,298	352,949		104%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	*Quantity*	*Controlled Wattage*	*Hours*		*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
			Old	*New*				
Controls	40	654.55	5,109	4,784	15,492	9,452	1.11	61%
Controls	100	461	3,338	2,448	61,630	44,897	1.09	73%
Total					77,122	54,332		70%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	335,743	349,571	104%	112.08
Lighting Retrofit	Standard	2,555	3,377	132%	0.86
Lighting Controls	Standard	77,122	57,709	70%	10.75
Total		415,420	407,280	98%	123.69

The project-level gross kWh savings realization rate is 98%. The lighting retrofit realization rate is high mainly because the ex post lighting hours of operation verified byt the M&V site visit (ranging from 2,661 to 5,168), not accounting for the effect of lighting controls, are greater than the hours of operation used to perform the ex ante savings estimate (ranging from 3,848 to 4,056). The lighting controls savings realization rate is low because the ex ante savings estimate assumed a greater reduction on lighting hours than was verified on site.

Project Number: C-12

Executive Summary

Under project C-12, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the exterior of its facility. The gross kWh savings realization rate for this project is 96%.

Project Description

The customer retrofitted the following fixtures in the garage area:

- (350) MH fixtures with (350) 4' 2L T5HO fixtures
- (80) MH fixtures with (80) 4' 2L T5HO fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH to 4' 2L T5HO	350	350	210	117	8,760	316,096	285,138	1.00	90%
MH to 4' 2L T5HO	80	80	210	117	4,311	15,624	32,071	1.00	205%
Total						331,720	317,209		96%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	331,720	317,209	96%	32.55
Total		331,720	317,209	96%	32.55

The project-level gross kWh savings realization rate is 96%. The realization rate is slightly low because the ex post number of fixtures that were operating 24/7(350) and fixtures that were operating dusk to dawn (80) varied from the ex ante pre-retrofit numbers (388 and 42). In addition, the lighting hours of operation verified during the M&V site visit (ranging from 4,310 to 8,760) differ from those used to calculate the ex ante energy savings estimate (ranging from 4,000 to 8,760). The dusk to dawn calculation was performed by the non-daylighting calculator for the current year in conjunction with the US Naval Observatory Sunrise/Sunset table.

Project Number: C-13

Executive Summary

Under project C-13, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 68%.

Project Description

The customer retrofitted (3,500) 4'T8 lamps with (3,500) LED tubes throughout the facility.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as\text{–}built} \times W_{as\text{–}built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
4' 4L T8 to LED	3,500	3,500	33	13.6	2,860	291,270	197,316	1.02	68%
Total						291,270	197,316		68%

Results

Verified Gross Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	291,270	197,316	68%	93.84
Total		291,270	197,316	68%	93.84

The project-level gross kWh savings realization rate is 68%. The lighting realization rate is low mainly because the ex post lighting hours of operation verified during the M&V site visit (2,860) are less than the lighting hours of operation used to perform the ex ante savings estimate (4,380).

Project Number: C-14, S-29

Executive Summary

Under projects C-14 and S-29, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for these projects is 122%.

Project Description

The customer retrofitted the following fixtures:

- (100) MH fixtures with (214) 4' 2L T8(2) fixtures
- (15) MH fixtures with (40) 4' 2L T8 fixtures
- Installation of (20) occupancy sensors

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed six photo-sensor loggers at the site (from 5/25/13 to 6/20/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*
W	= *Wattage controlled by each occupancy sensor*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
MH to 4' 2L T8	100	214	461	89	7,543	157,995	202,626	1.02	128%
MH to 4' 2L T8	15	40	461	44	7,411	30,105	38,852	1.02	129%
Total						188,101	241,478		128%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	Quantity	Controlled Wattage	Hours		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
			Old	New				
Controls	2	50	6,279	4,949	775	135	1.02	17%
Controls	9	170.67	7,791	7,527	6,934	412	1.02	6%
Controls	9	85.33	6,279	4,949	3,486	1,038	1.02	30%
Total					11,193.90	1,585		14%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	188,101	241,478	128%	39.56
Lighting Controls	Standard	10,419	1,585	14%	0.17
Total		198,519	243,063	122%	39.73

The project-level gross kWh savings realization rate is 122% The lighting retrofit realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 7,410 to 7,543) are greater than the ex ante hours of operation savings estimate (5,840). The lighting controls realization rate was low because the ex ante savings estimate assumed a greater reduction on lighting hours than was verified on-site.

Project Number: C-15

Executive Summary

Under project C-15, the customer received Custom incentives from Ameren Missouri for installing a variable frequency drive (VFD) on a 300 horsepower fan used in the metal/trash separator. The gross kWh savings realization rate for this project is 70%.

Project Description

The customer installed a VFD on a 300 horsepower fan used in the metal/trash separator. Baseline control was a throttle plate in the air duct, which reduced the airflow to the trash separator, with the diverted air being wasted. The motor ran at full speed, 60 hertz. The VFD is adjusted manually by the operator for proper trash separation, and is set at 43 hertz, which was observed during both of ADM's field visits, one taking place on October 1st, 2013 and the other on October 29th, 2013. Energy savings are achieved via the reduction in fan speed, following the fan affinity laws.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, took one-time power measurements (OTPM), equipment photos, and interviewed the site representative regarding equipment operating characteristics. The fan runs only in the morning, Monday through Friday, 7:00 AM to 11:30 AM with 15 holidays per year. This equates to 1,193 annual operating hours. Energy savings were calculated by multiplying annual operating hours by the demand reduction, based on ADM's OTPM at 43 hz and using the fan affinity law.

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Process VFD	Custom	181,818	127,546	70%	0
Total		181,818	127,546	70%	0

The project-level gross kWh savings realization rate is 70%. The realization rate is low because the claimed operating hours (1,800) were greater than actual (1,193). The ex ante annual energy savings calculations assumed the fan came on during the weekends, six hours on Saturday and five hours on Sunday. However, a site representative confirmed that this is not the case.

Project Number: C-16, S-32

Executive Summary

Under projects C-16 and S-32, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 84%.

Project Description

The customer retrofitted (123) MH 400W fixtures with (131) 4' 6L T8 fixtures in the retail area. In addition, the customer installed (11) lighting controls.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed five photo-sensor loggers at the site (from 09/17/13 to 10/14/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*
W	= *Wattage controlled by each occupancy sensor*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
MH 400W to 4' 6L T8	123	131	461	186	4,316	176,899	154,069	1.10	87%
Total						176,899	154,069		87%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	Quantity	Controlled Wattage	Hours		Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
			Old	New		
Controls	2	144	4,357	4,316	13	1.10
Controls	9	266.67	4,357	4,316	109	1.10
Total					122	

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	176,899	154,069	87%	41.59
Lighting Controls	Standard	7,709	122	2%	0.00
Total		184,608	154,192	84%	41.59

The project-level gross kWh savings realization rate is 84%. The lighting retrofit realization rate is low mainly because the ex post lighting hours of operation verified during the M&V site visit (4,315), are less than the hours of operation used to predict ex ante savings estimate (5,840). The lighting controls realization rate is low because the ex ante savings estimate assumed a greater reduction of lighting hours than was verified on-site.

Project Number: C-17

Executive Summary

Under project C-17, the customer received incentives from Ameren Missouri for installing a new air compressor with VFD. The gross kWh savings realization rate for this project is 77%.

Project Description

The customer installed a 100HP Quincy QGV-100 w/ VFD controls in place of their previous 100HP Sullair LS-16-100H w/ blow off controls.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment and installed a watt node on the new compressor, which monitored kW from 11/21/2013-12/11/2013. ADM used the CAGI data sheet for the new compressor to generate the CFM load profile. ADM assumed equal CFM load requirements pre and post replacement of their air compressor. The baseline systems inlet modulation with blow-down control %HP to %CFM profile is defined in the CEATI Compressed Air Energy Efficiency Reference Guide Figure 8. ADM used data points from the ex ante report monitoring to set bounds for the baseline system profile. The savings are the kW difference at each monitored 5 minute data interval for the 11 full workdays recorded. Production data for the monitored period and for the year was requested to normalize the monitored period. Confirmation was received that the monitored period is a typical representation of the CFM load requirements. The 11 days are extrapolated to a 251 workday year.

Results

Measure Category	*Incentive Category*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Compressed Air	Custom	136,800	105,708	77%	36.03
Total		136,800	105,708	77%	36.03

There are several reasons for the low gross kWh savings realization rate for this project. The ex ante calculation is as follows.

	Existing Arrangement Normal Production Load			
Compressor	**Shaft BHP**	**Input kW**	**SCFM**	**% Cap**
Sullair LS-16-100H	9	8	11	2.7%
Sullair LS-16-100H	85	69	233	57.3%
Dryers	5	4		
Total	**99**	**81**	**244**	

EQ	Proposed Arrangement Normal Production Load			
Compressor	Shaft BHP	Input kW	SCFM	% Cap
Sullair LS-16-100H	0	0	0	0.0%
Sullair LS-16-100H	0	0	0	0.0%
QGV-100	60	47	244	51.6%
Dryers	5	4		
Total	**65**	**51**	**244**	

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EQ

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Analysis

Compressed Air System Analysis

The Science of Compressed Air

Existing Flow & Power

Supply Side Opportunities

Compressor Control Mode
Centrifugal Compressors
System Storage
Compressor Sequencing
Equipment Maintenance
Ambient Conditions
Air Treatment
System Pressure Drop

Compressor controls are a major part of the supply side opportunity – compressors operating at less than full flow are very inefficient.

The range of the system's operating characteristics is displayed in the System Summary table which presents the data from the graph in a more useful format. The average system flow for this system is **239 scfm.** The average plant header pressure is **95 psi.** The kW includes the energy consumption of the compressors as well as the dryers in the system. Note that as the demand for air increases (scfm), the pressure drop across the air treatment systems increases (psid) which makes it difficult to get the air to the header at acceptable pressures. Notice also that the header pressure (P3) drops during this condition as well. The Clean-Up DP is the measured total pressure drop before and after the dryers and filters in the system.

EQ	System Summary						
Production	P2	P3	System Flow	Power	kW	SCFM/kW	Clean-up ΔP
NORM	102	95	239	99	81	3.0	7.0
PEAK	47	33	814	187	155	5.3	14.1

EQ	Energy Summary				
Existing Arrangement	**BHP**	**kW**	**Hours**	**kWH**	**Costs**
[normal]	99	81	4,560	369,360	$40,260
Annual Energy Costs			**4,560**	**369,360**	**$40,260**
Proposed Arrangement	**BHP**	**kW**	**Hours**	**kWH**	**Costs**
[normal]	65	51	4,560	232,560	$25,349
Annual Energy Costs			**4,560**	**232,560**	**$25,349**
The annual energy costs are based upon avg. electrical rate [kWH] of $0.109					

The ex ante includes 8kW used from the backup compressor running in standby. The new compressor with VFD is equally sized to each of the old ones. A compressor in standby is not used and not required to meet the load requirements in the pre or post case so these savings are removed.

There were no incentives performed on the dryer. The ex ante calculation includes 4kW into the average equally for the pre and post case. The extra 4kW to both the pre and post case is not included because the same dryer is used in both scenarios.

With these corrections the ex ante table is as follows:

Measure	Previous ex ante average kW	corrected ex ante average KW taking out stand by compressor and dryers
baseline 100HP w/ inlet modulation & blow-down Sullair LS-16 100H	81	69
post 100HP w/ VFD Quincy QGV-100	51	47
difference	30	22

The ex post analysis takes the difference between the baseline system and the post system at each 5-minute interval monitoring point. This captures the best representation of the system performance because savings vary based on the different operating levels. The ex post analysis used 19 days of monitoring, which include 6 days off for the weekends and 2 days off for Thanksgiving. This results in 11 full workdays and two partial workdays to analyze. The 11 full workdays are extrapolated to a typical 251 workday year. This yields 105,708 kWh savings, a gross kWh savings realization rate of 77%. The ex post calculates peak savings by averaging Monday-Friday savings between 3PM and 5PM. This yields 36.03 kW peak savings.

Project Number: C-18

Executive Summary

Under project C-18, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility. The gross kWh savings realization rate for this project is 78%.

Project Description

The customer retrofitted the following fixtures:

- (4) MH 400W fixtures with (4) Custom Dual Pole fixtures in Area 1
- (6) MH 400W fixtures with (6) Custom Single Pole fixtures in Area 1
- (72) 8' 2L T12 fixtures with (72) 8' 2L T8 fixtures in Area 2
- (8) 8' 2L T12 fixtures with (6) 8' 2L T8 fixtures in Area 2
- (14) 2' 2L T12 fixtures with (14) 2' 2L T8 fixtures in Area 3
- (3) 4' 4L T12 fixtures with (3) 4' 4L T8 fixtures in Area 3
- (128) 4' 4L T12 fixtures with (128) 4' 4L T8 fixtures in Area 4
- (6) MH 400W fixtures with (6) 4 LAMP - F54HO T5 fixtures in Area 5
- (21) MH 400W fixtures with (21) 4 LAMP - F54HO T5 fixtures in Area 6

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 9/21/13 to 10/16/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
MH 400W to Custom Dual Pole	4	4	461	162	4,308	4,784	5,152	1.00	108%
MH 400W to Custom Single Pole	6	6	461	162	4,308	7,176	7,728	1.00	108%
8' 2L T12 to 8' 2L T8	72	72	110	54	4,994	24,809	22,026	1.09	89%
8' 2L T12 to 8' 2L T8	8	6	110	54	8,760	3,421	5,328	1.09	156%
2' 2L T12 to 2' 2L T8	14	14	59	30	4,994	2,498	2,218	1.09	89%
4' 4L T12 to 4' 4L T8	3	3	112	54	4,994	1,071	951	1.09	89%
4' 4L T12 to 4' 4L T8	128	128	112	54	2,762	45,680	22,675	1.11	50%
MH 400W to 4 LAMP - F54HO - T5	6	6	461	234	4,994	8,380	7,440	1.09	89%
MH 400W to 4 LAMP - F54HO - T5	21	21	461	234	4,994	29,331	26,042	1.09	89%
Total						127,150	99,561		78%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	127,150	99,561	78%	26.67
Total		127,150	99,561	78%	26.67

The project-level gross kWh savings realization rate is 78%. The realization rate is low mainly because six of the measures had ex post lighting hours of operation verified during the M&V site visit (ranging from 2,761 to 4,994), that were less than the hours of operation used to perform the ex ante savings estimate (6,153).

Project Number: C-19

Executive Summary

Under project C-19, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility. The gross kWh savings realization rate for this project is 80%.

Project Description

The customer retrofitted the following fixtures:

- (77) 4' 2L T12 fixtures with (77) LED tube fixtures in Area 1
- (18) MH fixtures with (18) LED panel fixtures in Area 2
- (48) 4' 2L T12 fixtures with (48) LED tube fixtures in Area 3
- (40) HPS fixtures with (40) LED high Bay fixtures in Area 4

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 5/30/13 to 6/27/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*
$HCIF$	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
4' 2L T12 to LED - Tube	77	77	62	15	8,760	31,702	37,504	1.18	118%
MH to LED - Panel	18	18	461	59	4,309	29,060	31,177	1.00	107%
4' 2L T12 to LED - Tube	48	48	62	15	2,414	8,686	5,447	1.00	63%
HPS to LED – High Bay	40	40	469	100	1,802	56,826	26,604	1.00	47%
Total						126,274	100,731		80%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Custom	126,274	100,731	80%	14.44
Total		126,274	100,731	80%	14.44

The project-level gross kWh savings realization rate is 80%. The realization rate is low mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 1,802 to 8,760) were less than the hours of operation used to perform the ex ante savings estimate (ranging from 3,850 to 8,760).

Project Number: C-20, S-21

Executive Summary

Under projects C-20 and S-21, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 85%.

Project Description

The customer retrofitted the following fixtures:

- (39) 8' 2LHO fixtures with (39) 4' 4LT5HO fixtures
- (93) 8' 2LHO fixtures with (69) 4' 4LT5HO fixtures

In addition, the customer installed (69) lighting controls.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed six photo-sensor loggers at the site (from) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
W	*= Wattage of each fixture*
t	*= Lighting operating hours*
HCIF	*= HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of occupancy sensors*
W	*= Wattage controlled by each occupancy sensor*
t	*= Lighting operating hours*
HCIF	*= HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
8' 2LHO to 4' 4LT5HO	39	39	370	234	4,976	27,581	28,871	1.09	105%
8' 2LHO to 4' 4LT5HO	93	69	370	234	4,714	94,973	94,189	1.09	99%
Total						122,554	123,060		100%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	Quantity	Controlled Wattage	Hours		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
			Old	New				
Controls	69	234	4,714	3,748	42,504.00	17,068	1.09	40%
Total					42,504.00	17,068		40%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	122,554	123,060	100%	34.42
Lighting Controls	Standard	42,504	17,068	40%	2.75
Total		165,058	140,128	85%	37.17

The project-level gross kWh savings realization rate is 85%. The lighting retrofit realization rate is high mainly because the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated light manufacturing (1.09), while the ex ante savings estimate did not account for heating and cooling interactive effects. The lighting controls savings realization rate is low because ex ante savings estimate of lighting controls assumed a greater reduction of annual lighting hours than was verified on-site.

Project Number: C-21

Executive Summary

Under project C-21, the customer received custom incentives from Ameren Missouri for the installation of three new five door Hussmann freezer cases. The gross kWh savings realization rate for this project is 70%.

Project Description

The customer installed (3) Hussmann RL five door cases with LED lighting fixtures.

The cases replaced (5) four door RI-4-DFR-KT cases which were originally served by two separate condenser systems. In order to increase the overall efficiency of the refrigeration system, the new cases were tied into a previously installed Protocol system that had excess capacity.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, and installed current monitoring equipment on case lighting and the defrost circuits of the new cases.

Monitoring data indicated that the case lights are operational approximately 4,409 hours per year, while the defrosters cycle on for 48 minutes per day. Manufacturer specifications of both the baseline and as-built cases were used to determine the energy savings at the case. The savings for the cases can be seen in the following table:

Refrigerated Case Level Gross Annual Savings

As-Built Cases (Hussman RL)							
Case End Use	*#*	*Watts*	*Total Watts*	*# Days*	*Hours/Day*	*Hours*	*Annual kWh*
Fans	3	90	270	365	23	8,395	2,267
Door ASH	3	455	1,365	365	23	8,395	11,459
Frame ASH	3	236	708	365	24	8,760	6,202
Lights	3	108	324	365	12	4,409	1,428
Defrost	3	3,500	10,500	365	0.80	291	3,059
Total							24,416
Baseline Cases (RI-4-DFR-KT)							
Fans	5	102	510	365	23	8,395	4,281
Frame ASH	5	1,106	5,530	365	24	8,760	48,443
Lights	5	450	2,250	-	-	4,409	9,920
Defrost	5	2,750	13,750	365	0.75	274	3,764
Total							66,408
Savings							41,993

Compressor level savings for the reduction in load due to the new cases and the switching of condenser systems was calculated using the following equation:

$$kWh_{Annual} = \frac{\# \times Btu_{Case} \times 8{,}760}{COP \times 3{,}412}$$

Where:

kWh_{Annual} = *Annual kWh of compressor system*

\# = *Number of cases connected to compressor system*

Btu_{case} = *Manufacturer's rated case Btu/hr*

COP = *Coefficient of Performance for the compressor system*

Compressor level savings for the reduction in load due to the new cases and the switching of condenser systems can be seen in the following table:

Compressor Level Annual Savings

Condition	Case	# Cases	Case BTU/H	Ref System	COP	Annual BTU	Annual kWh
Base	RI-4-DFR-KT	5	6,265	2-Condenser	1.19	274,407,000	67,583
As-Built	Hussman RL	3	6,125	Protocol	1.75	160,965,000	26,958
Savings							40,625

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
New Hussmann Cases	Custom	62,751	41,993	67%	5.62
Compressor	Custom	54,611	40,625	74%	4.64
Total		117,362	82,618	70%	10.26

The project-level gross kWh savings realization rate is 70%. The low realization rate is attributed to the ex ante annual kWh savings calculations that assumed higher connected loads for the baseline cases. For example, the ex ante calculations assumed that the baseline cases have a connected load of 7,404 Btu/hr compared to the ex post 6,265 Btu/hr, which was verified by the manufacturer specification sheets. This overestimation of connected loads was also made for the fans, lights, and anti-sweat heaters.

Project Number: C-22, S-30

Executive Summary

Under projects C-22 and S-30, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility. The gross kWh savings realization rate for these projects is 71%.

Project Description

The customer retrofitted the following fixtures:

- (16) MH 400W fixtures with (15) LED - Custom fixtures in Area 1
- (9) MH 250W fixtures with (9) LED - Custom fixtures in Area 2
- (10) MH 1,000W fixtures with (10) LED - Custom fixtures in Area 1
- (8) Incandescent fixtures with (8) Screw-in LEDs in Area 3
- (22) MH 400W fixtures with (22) LED - Custom fixtures in Area 3
- (6) 2 Lamp-F96HO - 8ft – (6) LED –Custom fixtures in Area 4
- (18) 4 Lamp - F40ES fixtures with (18) LED - Custom fixtures in Area 3
- (10) 8' 1L T12 Case fixtures - (10) 8’ 1L LED Case fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed four photo-sensor loggers at the site (from 9/21/13 to 10/15/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH 400W to LED	16	15	461	141	4,308	22,426	22,664	1.00	101%
MH 250W to LED	9	9	295	70	4,308	8,870	8,723	1.00	98%
MH 1000W to LED	10	10	1,080	426	4,308	28,645	28,174	1.00	98%
Incand. to Screw-in LED	8	8	100	18	4,308	5,747	2,826	1.00	49%
MH 400W to LED	22	22	461	105	1,166	34,304	9,189	1.01	27%
8' 2L HO to LED	6	6	110	48	8,760	3,259	3,298	1.01	101%
4L ES to LED	18	18	112	63	2,457	5,282	2,175	1.01	41%
8' 1L T12 Case Lighting to 8' 1L LED Case Lighting	10	10	85	54	8,760	3,862	2,716	1.00	70%
Total						112,394	79,765		71%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Custom	102,785	74,223	72%	7.23
Lighting Retrofit	Standard	9,609	5,542	58%	0.42
Total		112,394	79,765	71%	7.65

The project-level gross kWh savings realization rate is 71%. The standard incentive realization rate is 58%. This realization rate is low mainly because one measure's ex post lighting hours of operation verified during the M&V site visit (4,308) were less than the lighting hours of operation used to perform the the ex ante savings estimate (8,760). The custom incentive realization rate is 74%. This realization rate is low because two measures' ex post annual hours of operation also verified during the M&V site visit (1,166-2,457) were less than the hours of operation used to perform the ex ante savings estimate (4,380).

Project Number: C-23, S-12

Executive Summary

Under projects C-23 and S-12, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for these projects is 108%.

Project Description

The customer retrofitted the following fixtures:

- (381) Incandescent fixtures with (381) LEDs
- (300) Incandescent fixtures with (300) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*
	Old	*New*	*Old*	*New*			
Incandescent to LED	381	381	25	3	6,935	66,151	1.14
Incandescent to LED	300	300	60	13	6,935	112,461	1.14
Incandescent to LED	381	381	19	2	1,825	13,056	1.14
Incandescent to LED	300	300	45	10	1,825	21,963	1.14
Total						213,631	

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	73,426	79,207	108%	11.13
Lighting Retrofit	Standard	124,830	134,424	108%	18.92
Total		198,256	213,631	108%	30.06

The project-level gross kWh savings realization rate is 108%. The realization rate is high mainly because the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated assembly (1.14), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: C-24, S-28

Executive Summary

Under projects C-24 and S-28, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 53%.

Project Description

The customer retrofitted the following fixtures:

- (18) MH 400W fixtures with (18) LED - Custom fixtures in Area 1
- (2) MH 400W fixtures with (2) LED - Custom fixtures in Area 2
- (4) MH 400W fixtures with (4) LED - Custom fixtures in Area 3

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed four photo-sensor loggers at the site (from 10/9/13 to 10/28/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of occupancy sensors*

W = *Wattage controlled by each occupancy sensor*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH 400W to LED	18	18	461	192	2,663	42,416	12,973	1.01	31%
MH 400W to LED	2	2	461	98	8,760	6,360	6,398	1.01	101%
MH 400W to LED	4	4	461	68	8,760	13,771	13,853	1.01	101%
Total						62,546	33,224		53%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	*Quantity*	*Controlled Wattage*	*Hours*		*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*
			Old	*New*		
Controls	18	192	2,663	482	7,583	1.01
Controls	2	98	8,760	8,760	-	1.01
Total					7,583	

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	62,546	33,224	53%	6.85
Lighting Controls	Standard	14,642	7,583	52%	2.00
Total		77,188	40,807	53%	8.85

The project-level gross kWh savings realization rate is 53%. The lighting retrofit realization rate is low mainly because the majority of the ex post lighting hours of operation verified during the M&V site visit (2,663) are less than the annual hours of operation used to predict the ex ante savings estimate (8,760). The lighting controls ex ante savings estimate assumed a greater reduction of lighting hours than was measured and also verified during the M&V site visit for the ex post analysis. In particular, two of the sensors' logger data revealed that no reduction in lighting hours of operation was achieved.

Project Number: C-25, S-39

Executive Summary

Under projects C-25 and S-39, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings gross kWh savings realization rate for these projects is 49%.

Project Description

The customer retrofitted the following light fixtures:

- (4) 4' T8 & 2' T8 fixtures with (4) 6' LEDs
- (6) 4' T8 & 2' T8 fixtures with (6) 6' LEDs
- (4) T8 Case Lighting fixtures with (4) LED case Lighting fixtures
- (4) T8 Case Lighting fixtures with (4) LED case Lighting fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as\text{-}built} \times W_{as\text{-}built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
	Old	New	Old	New			
4' T8 & 2' T8 to 6' LED	4	4	45	14	8,760	1,401	1.29
4' T8 & 2' T8 to 6' LED	6	6	45	28	8,760	1,153	1.29
T8 Case lighting to LED	4	4	45	14	8,760	1,249	1.15
T8 Case lighting to LED	4	4	45	28	8,760	685	1.15
Total						4,488	

ADM staff verified installation of dairy cooler doors accounting for 20 feet of cooler space. ADM utilized DEER eQUEST models to determine savings of 320.31 kWh/ft of cooler door added to calculate gross ex post savings of 6,406 kWh.

ADM staff verified installation of (15) ECM motors in walk-in coolers. The motor retrofit savings were calculated as:

$$kWh_{savings} = kWh_{base} - kWh_{as\text{-}built}$$

Where:

$kWh_{savings}$ = *Annual energy savings*

kWh_{base} = *Energy use of existing motors, from ex ante calculations*

$kWh_{as\text{-}built}$ = *Energy use of retrofitted motors, n*kW*h*

n = *number of motors*

kW = *motor demand*

h = *motor operating hours*

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	2,470	2,554	103%	0.29
Lighting Retrofit	Standard	2,574	1,934	75%	0.29
Cooler Doors	Custom	39,785	3,224	8%	3.57
ECM Motors	Custom	12,015	20,175	168%	1.81
Total		56,844	27,887	49%	5.96

The project-level realization rate is 49%. The custom lighting retrofit gross kWh savings realization rate is high mainly because the ex post HCIF is higher than the ex ante HCIF. The standard lighting incentive gross kWh savings realization rate is low mainly because the ex ante annual kWh savings estimation is based on stipulated per unit values, while the ex post annual kWh savings estimation is based on a savings calculation that considers site-specific details.

The cooler door gross kWh savings realization rate is low because the pre-retrofit calculations did not account for the interactive effects between the refrigerated case work and the HVAC system. In the baseline condition, the refrigerated cases have no doors, thus allowing refrigerated air to flow from the cases into the adjacent HVAC zone. This action reduces the overall cooling demand of the HVAC zone thus lowering HVAC energy usage. With the addition of the cooler doors, the infiltration to the HVAC zone is greatly reduced, therefore, increasing the overall load on the HVAC system and energy usage because it is not receiving the cooling assistance from the refrigeration system. ADM utilized the DEER Grocery Store prototypical models to calculate the reported savings that were run using appropriate TMY3 weather data. This type of analytical simulation's advantage is that the interactive effects were taken into consideration along with the effects that weather has on the overall efficiency of the refrigeration system and HVAC system.

The motor gross kWh savings realization rate is high because the ex ante annual kWh savings calculations account for neither motor efficiency nor the interaction of heat produced by the motors with the refrigeration unit as a whole.

Project Number: C-26, S-38

Executive Summary

Under projects C-26 and S-38, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. In addition, the store received custom incentives for retrofitting open dairy coolers with doors and for retrofitting walk-in cooler evaporator fan. The gross kWh savings realization rate for these projects is 52%.

Project Description

The customer retrofitted the following light fixtures:

- (4) 4' T8 + 2' T8 fixtures with (4) 6' LED - Custom fixtures
- (6) 4' T8 + 2' T8 fixtures with (6) 6' LED - Custom fixtures
- (4) T8 Case Lighting fixtures with (4) LED - Case Lighting fixtures
- (4) T8 Case Lighting fixtures with (4) LED - Case Lighting fixtures

The customer installed (8) doors on its open-air dairy coolers.

The customer replaced (15) shaded pole motors with (15) Arktic 59, 1/20 horsepower ECM Motors for the evaporator fans in its walk-in coolers.

Measurement and Verification Effort

During the M&V visit, ADM staff verified lighting equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 09/24/13 to 10/14/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area}\left[HCIF \times \left(t_{base} \times N_{base} \times W_{base} - t_{as-built} N_{as-built} \times W_{as-built}\right)/1000\right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
	Old	New	Old	New	Old	New		
4' T8 + 2' T8 to 6' LED - Custom	4	4	45	14	8,760	5,256	1,654	1.29
4' T8 + 2' T8 to 6' LED - Custom	6	6	45	28	8,760	5,256	1,912	1.29
T8 Case Lighting to LED - Case Lighting	4	4	45	14	8,760	5,256	1,475	1.15
T8 Case Lighting to LED - Case Lighting	4	4	45	28	8,760	5,256	1,136	1.15
Total							6,178	

ADM staff verified installation of dairy cooler doors accounting for 20 feet of cooler space. ADM utilized DEER eQUEST models to determine savings of 320.31 kWh/ft of cooler door added to calculate gross ex post savings of 6,406 kWh.

ADM staff verified installation of (15) ECM motors in walk-in coolers. The motor retrofit savings were calculated as:

$$kWh_{savings} = kWh_{base} - kWh_{as\text{-}built}$$

Where:

$kWh_{savings}$ = *Annual energy savings*

kWh_{base} = *Energy use of existing motors, from ex ante calculations*

$kWh_{as\text{-}built}$ = *Energy use of retrofitted motors, n*kW*h*

n = *number of motors*

kW = *motor demand*

h = *motor operating hours*

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	2,470	3,566	144%	0.29
Lighting Retrofit	Standard	2,574	2,611	101%	0.29
Cooler Doors	Custom	39,785	3,224	8%	3.57
ECM Motors	Custom	12,015	20,175	97%	1.81
Total		56,844	29,576	52%	5.96

The project-level gross kWh savings realization rate is 52%. The lighting incentive gross kWh savings realization rates are high mainly because the ex post HCIF is higher than the ex ante HCIF and the ex post annual hours of operation in the ex post estimation are less than the annual hours of operation used to predict ex ante gross ex ante kWh savings.

The cooler door gross kWh savings realization rate is low because the pre-retrofit calculations did not account for the interactive effects between the refrigerated case work and the HVAC system. In the baseline condition, the refrigerated cases have no doors, thus allowing refrigerated air to flow from the cases into the adjacent HVAC zone. This action reduces the overall cooling demand of the HVAC zone thus lowering HVAC energy usage. With the addition of the cooler doors, the infiltration to the HVAC zone is greatly reduced, therefore increasing the overall load on the HVAC system and energy usage because it is not receiving the cooling assistance from the refrigeration system. ADM utilized the DEER Grocery Store prototypical models to calculate the reported savings that were run using appropriate TMY3 weather data. This type of analytical simulation’s advantage is that the interactive effects are taken into consideration along with the effects that weather has on the overall efficiency of the refrigeration system and HVAC system.

The motor gross kWh savings realization rate is high because the ex ante annual kWh savings calculations account for neither motor efficiency nor the interaction of heat produced by the motors with the refrigeration unit as a whole.

Project Number: C-27, S-36

Executive Summary

Under projects C-27 and S-36, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. In addition, the store received custom incentives for retrofitting open dairy coolers with doors and for retrofitting walk-in cooler evaporator fan. The gross kWh savings realization rate for these projects is 50%.

Project Description

The customer retrofitted the following light fixtures:

- (4) 4' T8 & 2' T8 fixtures with (4) 6' LEDs
- (6) 4' T8 & 2' T8 fixtures with (6) 6' LEDs
- (4) T8 Case Lighting fixtures with (4) LEDs
- (4) T8 Case Lighting fixtures with (4) LEDs

The customer installed (8) doors on its open-air dairy coolers.

The customer replaced (15) shaded pole motors with (15) Arktic 59, 1/20 horsepower ECM Motors for the evaporator fans in its walk-in coolers.

Measurement and Verification Effort

During the M&V visit, ADM staff verified lighting equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 09/24/13 to 10/14/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area}\left[HCIF \times \left(t_{base} \times N_{base} \times W_{base} - t_{as-built} N_{as-built} \times W_{as-built}\right)/1000\right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
	Old	New	Old	New	Old	New		
4' T8 + 2' T8 to 6' LED	4	4	45	14	8,760	5,201	1,658	1.29
4' T8 + 2' T8 to 6' LED	6	6	45	28	8,760	5,201	1,924	1.29
T8 Case Lighting to LED	4	4	45	14	8,760	5,201	1,478	1.15
T8 Case Lighting to LED	4	4	45	28	8,760	5,201	1,143	1.15
Total							6,204	

ADM staff verified installation of dairy cooler doors accounting for 20 feet of cooler space. ADM utilized DEER eQUEST models to determine savings of 320.31 kWh/ft of cooler door added to calculate gross ex post savings of 6,406 kWh.

ADM staff verified installation of (15) ECM motors in walk-in coolers. The motor retrofit savings were calculated as:

$$kWh_{savings} = kWh_{base} - kWh_{as\text{-}built}$$

Where:

$kWh_{savings}$ = *Annual energy savings*

kWh_{base} = *Energy use of existing motors, from ex ante calculations*

$kWh_{as\text{-}built}$ = *Energy use of retrofitted motors, n*kW*h*

n = *number of motors*

kW = *motor demand*

h = *motor operating hours*

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	2,470	3,582	145%	0.29
Lighting Retrofit	Standard	2,574	2,622	102%	0.29
Cooler Doors	Custom	39,785	3,224	8%	3.57
ECM Motors	Custom	12,015	20,175	168%	1.81
Total		56,844	28,595	50%	5.96

The project-level gross kWh savings realization rate is 50%. The lighting incentive gross kWh savings realization rates are high mainly because the ex-post HCIF is higher than the pre-retrofit HCIF and the ex post annual hours of operation in the ex post estimation are less than the annual hours of operation estimate used to estimate the ex ante ex ante annual kWh savings.

The cooler door gross kWh savings realization rate is low because the pre-retrofit calculations did not account for the interactive effects between the refrigerated case work and the HVAC system. In the baseline condition, the refrigerated cases have no doors, thus allowing refrigerated air to flow from the cases into the adjacent HVAC zone. This action reduces the overall cooling demand of the HVAC zone thus lowering HVAC energy usage. With the addition of the cooler doors, the infiltration to the HVAC zone is greatly reduced, therefore increasing the overall load on the HVAC system and energy usage because it is not receiving the cooling assistance from the refrigeration system. ADM utilized the DEER Grocery Store prototypical models to calculate the reported savings that were run using appropriate TMY3 weather data. This type of analytical simulation's advantage is that the interactive effects are taken into consideration along with the effects that weather has on the overall efficiency of the refrigeration system and HVAC system.

The motor gross kWh savings realization rate is high because the ex ante annual kWh savings calculations account for neither motor efficiency nor the interaction of heat produced by the motors with the refrigeration unit as a whole.

Project Number: C-28, S-37

Executive Summary

Under projects C-28 and S-37, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. In addition, the store received custom incentives for retrofitting open dairy coolers with doors and for retrofitting walk-in cooler evaporator fan. The gross kWh savings realization rate for these projects is 51%.

Project Description

The customer retrofitted the following light fixtures:

- (4) 4' T8 & 2' T8 fixtures with (4) 6' LEDs
- (6) 4' T8 & 2' T8 fixtures with (6) 6' LEDs
- (4) T8 Case Lighting fixtures with (4) LEDs
- (4) T8 Case Lighting fixtures with (4) LEDs

The customer installed (8) doors on its open-air dairy coolers.

The customer replaced (15) shaded pole motors with (15) Arktic 59, 1/20 horsepower ECM Motors for the evaporator fans in its walk-in coolers.

Measurement and Verification Effort

During the M&V visit, ADM staff verified lighting equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 09/24/13 to 10/14/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times \left(t_{base} \times N_{base} \times W_{base} - t_{as-built} N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
	Old	New	Old	New	Old	New		
4' T8 + 2' T8 to 6' LED	4	4	45	14	8,760	5,986	1,602	1.29
4' T8 + 2' T8 to 6' LED	6	6	45	28	8,760	5,986	1,754	1.29
T8 Case Lighting to LED	4	4	45	14	8,760	5,986	1,428	1.15
T8 Case Lighting to LED	4	4	45	28	8,760	5,986	1,042	1.15
Total							5,826	

ADM staff verified installation of dairy cooler doors accounting for 20 feet of cooler space. ADM utilized DEER eQUEST models to determine savings of 320.31 kWh/ft of cooler door added to calculate gross ex post savings of 6,406 kWh.

ADM staff verified installation of (15) ECM motors in walk-in coolers. The motor retrofit savings were calculated as:

$$kWh_{savings} = kWh_{base} - kWh_{as\text{-}built}$$

Where:

$kWh_{savings}$ = *Annual energy savings*

kWh_{base} = *Energy use of existing motors, from ex ante calculations*

$kWh_{as\text{-}built}$ = *Energy use of retrofitted motors, n*kW*h*

n = *number of motors*

kW = *motor demand*

h = *motor operating hours*

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	2,470	3,355	136%	0.29
Lighting Retrofit	Standard	2,574	2,470	96%	0.29
Cooler Doors	Custom	39,785	3,224	8%	3.57
ECM Motors	Custom	12,015	20,175	168%	1.81
Total		56,844	29,224	51%	5.96

The project-level gross kWh savings realization rate is 51%. The custom lighting incentive gross kWh savings realization rate is high mainly because the ex post HCIF is higher than the ex ante HCIF and the ex post annual hours of operation in the ex post kWh savings estimation are less than the annual hours of operation used in the ex ante kWh savings estimation. The standard lighting incentive gross kWh savings realization rate is low mainly because the ex ante annual kWh savings estimation is based on stipulated per unit values, while the gross ex post kWh savings estimation is based on a savings calculation that considers site-specific details.

The cooler door retrofit gross kWh savings realization rate is low because the pre-retrofit calculations did not account for the interactive effects between the refrigerated case work and the HVAC system. In the baseline condition, the refrigerated cases have no doors, thus allowing refrigerated air to flow from the cases into the adjacent HVAC zone. This action reduces the overall cooling demand of the HVAC zone thus lowering HVAC energy usage. With the addition of the cooler doors, the infiltration to the HVAC zone is greatly reduced, therefore, increasing the overall load on the HVAC system and energy usage because it is not receiving the cooling assistance from the refrigeration system. ADM utilized the DEER Grocery Store prototypical models to calculate the reported savings that were run using appropriate TMY3 weather data. This type of analytical simulation's advantage is that the interactive effects were taken into consideration along with the effects that weather has on the overall efficiency of the refrigeration system and HVAC system.

The motor gross kWh savings realization rate is high because the ex ante annual kWh savings calculations account for neither motor efficiency nor the interaction of heat produced by the motors with the refrigeration unit as a whole.

Project Number: C-29, S-17

Executive Summary

Under projects C-29 and S-17, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings gross kWh savings realization rate for these projects is 79%.

Project Description

The customer retrofitted the following fixtures:

- (43) MH 400W fixtures with (43) 4 LAMP -F54HO - T5 fixtures in Area 1
- (45) MH 400W fixtures with (45) 6 LAMP - F54HO - T5 fixtures in Area 1
- Installation on (97) occupancy sensors

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed eight photo-sensor loggers at the site (from 10/5/13 to 10/28/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*
W	= *Wattage controlled by each occupancy sensor*
t	= *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
MH 400W to 4 LAMP -F54HO - T5	43	43	461	234	2,998	29,263	32,014	1.09	109%
MH 400W to 6 LAMP - F54HO - T5	45	45	461	358	2,998	13,896	15,202	1.09	109%
Total						43,159	47,216		109%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	Quantity	Controlled Wattage	Hours		Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
			Old	New		
Controls	43	234	2,998	2,383	6,767	1.09
Controls	45	358	2,998	1,813	20,887	1.09
Controls	9	278.44	2,998	937	5,649	1.09
Total					33,303	

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	43,159	47,216	109%	20.79
Lighting Controls	Standard	58,549	33,303	57%	5.22
Total		101,708	80,519	79%	26.01

The project-level gross kWh savings realization rate is 79%. The lighting retrofit realization rate is high because the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated light manufacturing (1.09), while the ex ante savings estimate did not account for heating and cooling interactive effects. The lighting controls realization rate is low because the ex ante savings estimate assumed a greater reduction on annual lighting hours than was measured and verified on-site.

Project Number: C-30

Executive Summary

Under project C-30, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 131%.

Project Description

The customer retrofitted (182) 4' 4L T12 fixtures with (182) 4' 2L T8 fixtures in Area 1

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 6/06/13 to 6/23/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
4' 4L T12 to 4' 2L T8	182	182	112	55	4,816	42,191	55,261	1.11	131%
Total						42,191	55,261		131%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	42,191	55,261	131%	13.45
Total		42,191	55,261	131%	13.45

The project-level gross kWh savings realization rate is 131%. The realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (4,816) are greater than the hours of operation used to perform the ex ante savings estimate (4,067).

Project Number: C-31, S-18

Executive Summary

Under projects C-31 and S-18, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 115%.

Project Description

The customer retrofitted the following fixtures:

- (71) MH 400W fixtures with (56) 5' 4L T5 HO fixtures and (56) occupancy sensors in Area 1
- (38) occupancy sensors in Area 2

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed seven photo-sensor loggers at the site (from 09/26/13 to 10/15/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*
W	= *Wattage controlled by each occupancy sensor*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
MH 400W to 5' 4L T5 HO	71	56	461	358	4,901	39,685	62,165	1.00	157%
Total						39,685	62,165		157%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	Quantity	Controlled Wattage	Hours		Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
			Old	New		
Controls	56	358	4,901	3,488	28,338	1.00
Controls	38	358	4,670	3,103	21,322	1.00
Total					49,659	

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	39,685	62,165	157%	12.68
Lighting Controls	Standard	57,904	49,659	86%	2.53
Total		97,589	111,824	115%	15.21

The project-level gross kWh savings realization rate is 115%. The lighting retrofit realization rate is 157%. The realization rate is high because the ex post lighting hours of operation verified during the M&V site visit (4,901), are greater than the hours of operation used to predict the ex ante savings estimate (3,129). The lighting controls realization rate is 91%. The ex ante savings estimate for lighting controls savings estimation assumes a greater impact on lighting hours than was measured and verified on-site.

Project Number: C-32

Executive Summary

Under project C-32, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 130%.

Project Description

The customer retrofitted the following fixtures (30) MH 400W fixtures with (30) 4' 6L T8 fixtures in Area 1.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 11/21/13 to 12/10/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH 400W to 4' 6L T8	30	30	461	217	6,181	38,166	49,496	1.09	130%
Total						38,166	49,496		130%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	38,166	49,496	130%	10.72
Total		38,166	49,496	130%	10.72

The project-level gross kWh savings realization rate is 130%. The realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (6,180) are greater than the hours of operation used to perform the ex ante savings estimate (5,214).

Project Number: C-33, S-33

Executive Summary

Under projects C-33 and S-33, the customer received custom and standard incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 78%.

Project Description

The customer retrofitted the following fixtures:

- (76) 8' 2L T12 fixtures with (76) 4' 4L T8 fixtures in Area 1
- (8) 4' 4L T12 fixtures with (8) 4' 4L T8 fixtures in Area 2
- (16) Halogen fixtures with (8) LEDs in Area 3
- (8) Halogen fixtures with (8) LEDs in Area 4
- (5) Incandescent fixtures with (5) LEDs in Area 5
- Installation of (2) occupancy sensors in Area 2

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed five photo-sensor loggers at the site (from 12/9/13 to 1/13/14) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*

W = *Wattage controlled by each occupancy sensor*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
8' 2L T12 to 4' 4L T8	76	76	185	108	4,134	29,599	26,566	1.10	90%
4' 4L T12 to 4' 4L T8	8	8	112	92	4,719	809	826	1.09	102%
Halogen to LED	16	8	90	38	1,369	4,976	1,556	1.00	31%
Halogen to LED	8	8	90	10	950	2,821	612	1.00	22%
Incandescent to LED	5	5	75	12	4,231	1,593	1,463	1.10	92%
Total						39,798	31,023		78%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	Quantity	Controlled Wattage	Hours		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
			Old	New				
Controls	2	368	4,719	3,276	1,232	1,162	1.09	94%
Total					1,232	1,162		94%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	35,384	28,948	82%	7.53
Lighting Retrofit	Standard	4,414	2,075	47%	0.39
Lighting Controls	Standard	1,232	1,162	94%	0.25
Total		41,030	32,185	78%	8.17

The project-level gross kWh savings realization rate is 78%. The lighting realization rate is low mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 949 to 4,719), not accounting for the effect of lighting controls, are less than the hours of operation used to perform the ex ante savings estimate (ranging from 4,380 to 5,058). The ex ante lighting controls savings estimation was nearly consistent with the ex post lighting controls savings estimation.

Project Number: C-34

Executive Summary

Under project C-34, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings gross kWh savings realization rate for this project is 101 %.

Project Description

The customer retrofitted the following fixtures:

- (111) 8' 2L T12 fixtures with (73) 4' 4L T8 fixtures in Area 1
- (9) MH fixtures with (9) 4' 6L T8 fixtures in Area 2
- (13) 4' 4L T12 fixtures with (13) 4' 2L T8 fixtures in Area 3

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed five photo-sensor loggers at the site (from 11/20/13 to 12/11/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

$HCIF$ = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
8' 2L T12 to 4' 4L T8	111	73	110	94	2,971	15,894	16,109	1.01	101%
MH to 4' 6L T8	9	9	461	217	2,911	6,527	6,399	1.00	98%
4' 4L T12 to 4' 2L T8	13	13	112	49	3,117	2,434	2,594	1.02	107%
Total						24,855	25,101		101%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	24,855	25,101	101%	11.76
Total		24,855	25,101	101%	11.76

The project-level gross kWh savings realization rate is 101%. The realization rate indicates a highly accurate ex ante savings estimate.

Project Number: C-35, S-5

Executive Summary

Under projects C-35 and S-5, the customer received custom and standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and installing occupancy sensors. The gross kWh savings realization rate for these projects is 111%.

Project Description

The customer retrofitted the following fixtures:

- (14) Incandescent fixtures with (14) LEDs in Area 1
- (110) 4' 4L T12 fixtures with (110) LEDs in Area 1
- (46) Incandescent fixtures with (46) CFL fixtures in Area 1
- (50) Incandescent fixtures with (50) CFL fixtures in Area 1
- (180) Incandescent fixtures with (180) CFL fixtures in Area 1
- Installation of (30) Wall Occupancy Sensors were installed in Area 2
- Installation of (13) Ceiling Occupancy Sensors were installed in Area 3

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed four photo-sensor loggers at the site (from 12/11/13 to 1/22/14) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*

W = *Wattage controlled by each occupancy sensor*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	14	14	100	26	8,760	9,075	9,928	1.09	109%
4' 4L T12 to LED	110	110	112	43	6,499	23,681	51,223	1.04	216%
Incandescent to CFL	46	46	300	85	8,760	86,636	94,506	1.00	109%
Incandescent to CFL	50	50	100	23	8,760	33,726	33,726	1.00	100%
Incandescent to CFL	180	180	150	42	8,760	170,294	170,294	1.00	100%
Total						323,413	359,678		111%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	*Quantity*	*Controlled Wattage*	*Hours*		*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
			Old	*New*				
Controls	30	169.80	6,754	3,112	18,480	19,669	1.06	106%
Controls	13	104.62	8,760	2,974	8,007	7,869	1.00	98%
Total					26,487	27,538		104%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Custom	23,681	51,223	216%	9.42
Lighting Retrofit	Standard	299,732	308,454	103%	34.60
Lighting Controls	Standard	26,487	27,533	103%	1.94
Total		349,900	386,931	111%	45.97

The project-level gross kWh savings realization rate is 111%. The realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 6,498 to 8,760), not accounting for the effect of lighting controls, are greater than the hours of operation used to calculate the ex ante savings estimate (ranging from 3,120 to 8,760). The lighting control realization rate is high because the ex ante annual savings estimation predicted a smaller decrease on lighting hours than was measured and verified on-site in the ex post analysis.

Project Number: C-36

Executive Summary

Under project C-36, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the exterior of its facility. The gross kWh savings realization rate for this project is 84%.

Project Description

The customer retrofitted the following fixtures:

- (26) MH fixtures with (26) LEDs
- (5) MH fixtures with (5) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
MH to LED	26	26	205	30	3,648	19,929	16,598	1.00	83%
MH to LED	5	5	95	18	4,308	1,686	1,659	1.00	98%
Total						21,615	18,257		84%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	21,615	18,257	84%	0.00
Total		21,615	18,257	84%	0.00

The project-level gross kWh savings realization rate is 84%. The realization rate is low mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 3,647 to 4,307) were less than the lighting hours of operation used to calculate the ex ante energy savings estimate (4,380).

Project Number: C-37, S-15

Executive Summary

Under projects C-37 and S-15, the customer received standard and custom incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for these projects is 139%.

Project Description

The customer retrofitted the following fixtures:

- (1) HPS 1000W fixture with (1) LED in Area 1
- (4) HPS 400W fixtures with (4) LEDs in Area 2
- (1) HPS 70W fixture with (1) LED in Area 2
- (2) MH 400W fixtures with (2) LEDs in Area 1
- (3) MH 400W fixtures with (3) LEDs in Area 2
- (2) MH 250W fixtures with (2) LEDs in Area 2
- (360) 40W Incandescent lamps with (360) LEDs in the showroom lamps
- (360) 60W Incandescent lamps with (360)) LEDs in the showroom lamps

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor
	Old	New	Old	New			
HPS 1000W to LED	1	1	1,090	412	4,310	2,922	1.00
HPS 400W to LED	4	4	469	20	4,310	7,741	1.00
HPS 70W to LED	1	1	93	20	4,310	315	1.00
MH 400W to LED	2	2	461	81	4,310	3,276	1.00
MH 400W to LED	3	3	461	30	4,310	5,573	1.00
MH 250W to LED	2	2	295	94	4,310	1,733	1.00
Incandescent to LED	360	360	40	8	2,639	33,684	1.11
Incandescent to LED	360	360	60	8	2,639	54,736	1.11
Incandescent to LED	180	180	20	4	6,121	13,729	1.11
Incandescent to LED	180	180	30	4	6,121	22,310	1.11
Total						146,018	

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Custom	20,008	21,559	108%	0.00
Lighting Retrofit	Standard	84,914	124,460	147%	37.98
Total		104,922	146,018	139%	37.98

The project-level gross kWh savings realization rate is 139%. The standard incentive realization rate is 147%. This realization is high mainly because the verified baseline wattage (40 watts to 60 watts) is greater than the baseline wattage used in the ex ante estimation of annual kWh savings (35watts). In addition, the site visit revealed that half of the showroom lights are dimmed and the ex ante estimation of savings did not consider this. The custom incentive realization rate is 108%. This realization is high mainly because the ex post lighting hours of operation verified during the M&V site visit (4,310) are greater than the hours of operation used to perform the ex ante savings estimate (4,000).

Project Number: C-38

Executive Summary

Under project C-38, the customer received custom incentives from Ameren Missouri for retrofitting lighting in the interior and exterior of its facility. The gross kWh savings realization rate for this project is 50%.

Project Description

The customer retrofitted the following fixtures:

- (2) 4' 2L T12 fixtures with (2) 4' 2L T8 fixtures in Area 1
- (3) U-Tube 2L T12 fixtures with (3) U-Tube 2L T8 fixtures in Area 1
- (44) 4' 2L T12 fixtures with (44) 4' 2L T8 fixtures in Area 2
- (78) 4' 2L T12 fixtures with (78) 4' 2L T8 fixtures in Area 3
- (6) 4' 4L T12 fixtures with (6) 4' 4L T8 fixtures in Area 3
- (6) 4' 2L T12 fixtures with (6) 4' 2L T8 fixtures in Area 4
- (60) 4' 2L T12 fixtures with (60) 4' 2L T8 fixtures in Area 5
- (3) MH fixtures with (3) 4' 4L T5HO fixtures in Area 6

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed six photo-sensor loggers at the site (from 5/30/13 to 6/23/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
4' 2L T12 to 4' 2L T8	2	2	62	49	3,546	92	102	1.11	111%
U-Tube 2L T12 to U-Tube 2L T8	3	3	59	49	3,546	106	118	1.11	111%
4' 2L T12 to 4' 2L T8	44	44	62	49	1,110	2,028	696	1.10	34%
4' 2L T12 to 4' 2L T8	78	78	62	49	1,317	3,596	1,464	1.10	41%
4' 4L T12 to 4' 4L T8	6	6	112	89	1,317	489	199	1.10	41%
4' 2L T12 to 4' 2L T8	6	6	62	49	365	277	31	1.10	11%
4' 2L T12 to 4' 2L T8	60	60	62	49	437	2,766	374	1.10	14%
MH to 4' 4L T5HO	3	3	461	234	4,308	2,415	2,934	1.00	121%
Total						11,769	5,918		50%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Custom	11,769	5,918	50%	1.34
Total		11,769	5,918	50%	1.34

The project-level gross kWh savings realization rate is 50%. The gross kWh savings realization rate is low mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 365 to 4,308) are less than the hours of operation used to perform the ex ante ex ante energy savings estimate (3,546).

Project Number: C-39, S-25

Executive Summary

Under projects C-39 and S-25, the customer received custom and standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for these projects is 79%.

Project Description

The customer retrofitted the following fixtures:

- (40) Incandescent fixtures with (40) LEDs in Area 1
- (48) Incandescent fixtures with (48) LEDs in Area 2
- (2) 8' 2L T12 fixtures with (2) 4' 2L T8 fixtures in Area 3
- (4) 8' 2L T12 fixtures with (4) 4' 4L T8 fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed three photo-sensor loggers at the site (from 11/20/13 to 12/10/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*	*Wattage*	*Hours*	*Gross Ex Ante kWh*	*Gross Ex Post kWh*	*Heating Cooling*	*Gross kWh Savings*

	Old	New	Old	New		Savings	Savings	Interaction Factor	Realization Rate
Incandescent to LED	40	40	60	3	3,295	12,634	8,398	1.12	68%
Incandescent to LED	48	48	65	9	4,649	14,577	13,972	1.12	96%
8' 2L T12 to 4' 2L T8	2	2	110	54	4,013	1,822	502	1.12	28%
8' 2L T12 to 4' 4L T8	4	4	110	112	4,876	-	(44)	1.13	-
Total						28,764	22,829		79%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting	Standard	26,941	22,370	83%	5.96
Lighting	Custom	1,822	459	25%	0.14
Total		28,763	22,829	79%	6.10

The project-level gross kWh savings realization rate is 79%. The realization rate is low mainly because the ex post lighting hours of operation verified suring the M&V site visit (ranging from 3,294 to 4,876) are less than the lighting hours of operation used to perform the ex ante energy savings estimate (5,423). Additionally, a few verified fixtures in the kitchen area differed from the provided documentation and had a higher load than the fixture types used to estimate ex ante annual energy savings.

Project Number: N-1

Executive Summary

Under project N-1, the customer received new construction incentives from Ameren Missouri for retrofitting lighting in the interior of its facility and for installing occupancy sensors. The gross kWh savings realization rate for this project is 133%.

Project Description

The customer retrofitted the following fixtures:

- (1) Baseline of 4' 6L T5 HO fixture with (65) 4' 6L T5 HO fixtures
- (1) Baseline of LED with (7) LEDs
- (1) Baseline of 4' 3L T8 fixture with (2) 4' 3L T8 fixtures
- (1) Baseline of 4' 2L T8 fixture with (8) 4' 2L T8 fixtures
- Installation of (2) Fixture Mounted OC fixtures
- Installation of (2) Infrared/Ultrasonic Sensor fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed four photo-sensor loggers at the site (from 11/19/13 to 12/10/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

Lighting occupancy sensor energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times W \times N \times \left(t_{base} - t_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of occupancy sensors*
W	= *Wattage controlled by each occupancy sensor*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
Baseline of 4' 6L T5 HO to 4' 6L T5 HO	1	65	57,068	346	5,237	140,627	199,919	1.10	142%
Baseline of LED to LED	1	7	188	11	5,237	465	661	1.10	142%
Baseline of 4' 3L T8 to 4' 3L T8	1	2	406	80	4,996	1,000	1,357	1.10	136%
Baseline of 4' 2L T8 to 4' 2L T8	1	8	1,259	62	5,142	3,101	4,329	1.10	140%
Total						153,596	206,266		134%

The table shown below presents ex ante and ex post gross annual energy savings for the lighting controls installed under the project.

Lighting Controls Annual Savings Calculations

Measure	Quantity	Controlled Wattage	Hours		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
			Old	New				
Controls	2	124	5,142	3,452	794	463	1.10	58%
Controls	2	124	5,142	3,452	1,233	463	1.10	38%
Total					2,027.00	925		46%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	New Construction	153,596	206,266	134%	45.76
Lighting Controls	New Construction	2,027	925	46%	0.21
Total		155,623	207,192	133%	45.97

The project-level gross kWh savings realization rate is 133%. The lighting retrofit realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 4,996 to 5,237), not accounting for the effect of lighting controls, were greater than the lighting hours of operation used to perform ex ante energy savings estimate (4,067). The lighting controls realization rate is low because the ex ante savings estimation assumed a greater reduction of lighting hours than was measured and verified on-site.

Project Number: N-2

Executive Summary

Under project N-2, the customer received new construction incentives from Ameren Missouri for installing lighting in the interior of its facility. The gross kWh savings realization rate for this project is 100%.

Project Description

The customer installed the following fixtures:

- (20) 4' 4L T5 fixtures
- (2) CFL fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as\text{–}built} \times W_{as\text{–}built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Baseline of 4' 4L T5 to 4' 4L T5	1	20	11,531	234	1,512	10,359	10,360	1.00	100%
Baseline of CFL to CFL	1	2	69	14	1,512	62	62	1.00	100%
Total						10,421	10,422		100%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	New Construction	10,421	10,422	100%	0.00
Total		10,421	10,422	100%	0.00

The project-level gross kWh savings realization rate is 100%. This site contact would not allow monitoring of the facility. The lighting hours of operation used to perform gross ex ante savings, 29 hours per week, are reasonable and were assumed when performing gross ex post savings. Billing data was also reviewed which supported using these ex ante lighting operating hours

Project Number: S-1, S-7

Executive Summary

Under projects S-1 and S-7, the customer upgraded its computers to high-efficiency models. The old model was a large desktop system, and the new model is the high-efficiency ThinkCentre M72e Tiny. The savings realization rate for these projects is 91%.

Project Description

Project S-1 installed 1,925 new high-efficiency computers. Project S-7 installed 675 new high-efficiency computers.

Measurement and Verification Effort

During the M&V visit, ADM staff verified the installation and operation of the new hardware. A power meter was used to measure the power consumption of both the baseline system and of the new high-efficiency computers. This data was used to calculate the energy savings using the following equation:

$$kWh\ savings = (kW_{old} - kW_{new}) * HCIF * number\ of\ computers\ * 8760hr/yr$$

ADM developed lighting waste heat factors for Ameren Missouri. This project uses the waste heat factor for a hospital. It is assumed that the computers' wasted heat will affect the HVAC system the same as lighting does.

There were also kWh savings penalties for new servers that were added as a result of installing the new computers.

Annual Savings Penalties for New Servers

Project #	ratio	kW penalty	kWh penalty
S-7	19%	1.07	9,400
S-1	81%	4.73	41,408

Results

The results are summarized in the table below.

Project ID	Incentive Type	# computers	kWh/yr baseline	kWh/yr as-built	Gross Ex Post Savings kWh/yr	Gross Ex Post Peak kW Savings	Gross Ex Ante Savings kWh/yr	Realization Rate
S-7	Standard	437	264,140	63,376.62	215,821	22.84	236,417	91%
S-1	Standard	1925	1,163,547	279,176.17	950,699	100.60	1,041,125	91%
Total		2362	1,427,687	342,553	1,166,520	123.44	1,277,542	91%

The ex post annual energy savings were slightly lower than ex ante annual energy savings because original estimations of the new computers' power consumption varied from actual on site power measurements and because the ex post analysis included savings penalties for adding new servers related to installing the new computers.

Project Number: S-2

Executive Summary

Under project S-2, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 81%.

Project Description

The customer retrofitted the following fixtures:

- (1,179) Incandescent fixtures with (1,179) LEDs in Area 1
- (2,673) Incandescent fixtures with (2,673) LEDs in the Area 2
- (472) Incandescent fixtures with (472) LEDs in the Area 2

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed eight photo-sensor loggers at the site (from 01/17/14 to 01/30/14) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	1,179	1,179	60	12	2,787	165,249	148,559	0.94	90%
Incandescent to LED	2,673	2,673	60	8	2,300	405,868	301,143	0.94	74%
Incandescent to LED	472	472	60	8	3,064	71,669	70,852	0.94	99%
Total						642,786	520,554		81%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	642,786	520,554	81%	100.53
Total		642,786	520,554	81%	100.53

The project-level gross kWh savings realization rate is 81%. The realization rate is low mainly because the ex post hours of operation verified during the M&V site visit for two measures (2,300 - 2,790) were less than the lighting hours of operation used to perform the ex ante savings estimate (2920). In addition, the ex post savings analysis included a heating and cooling interactive factor for electric-heated multi family in St. Louis (0.94), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: S-3

Executive Summary

Under project S-3, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 111%.

Project Description

The customer retrofitted the following lamps:

- (5,500) Incandescent lamps with (5,500) CFLs
- (700) Incandescent lamps with (700) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation and baseline and post-retrofit connected load. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Lamps)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to CFL	5,500	5,500	52	23	1,810	465,740	515,108	1.11	111%
Incandescent to LED	700	700	60	11	1,810	100,156	110,773	1.11	111%
Total						565,896	625,881		111%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	565,896	625,881	111%	55.39
Total		565,896	625,881	111%	55.39

The project level gross kWh savings realization rate is 111%. The realization rate is high because the ex post savings analysis included a heating and cooling interactive factor for electiric-heated hotel in St. Louis (1.11), while the ex ante savings estimate did not account for heating and cooling interactive effects. For this project, the site contact would not allow monitoring in the hotel's guest rooms. The lighting hours of operation used to perform gross ex ante savings, 8 hours per day, were assumed when performing gross ex post savings.

Project Number: S-4

Executive Summary

Under project S-4, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 110%.

Project Description

The customer retrofitted the following fixtures:

- (636) Incandescent fixtures with (636) LEDs in Area 1
- (64) Incandescent fixtures with (64) LEDs in Area 2

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as\text{–}built} \times W_{as\text{–}built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

$HCIF$ = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Heating Cooling Interaction Factor	Gross kWh Savings Realization Rate
	Old	New	Old	New					
Incandescent to LED	636	636	100	19	8,760	496,692	498,213	1.10	100%
Incandescent to LED	64	64	100	19	8,734	-	49,985	1.10	
Incandescent to LED	64	64	19	10	26	-	167	1.10	
Total						496,692	548,365		110%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	496,692	548,365	110%	72.92
Total		496,692	548,365	110%	72.92

The project-level gross kWh savings realization rate is 110%. The realization rate is high because the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated large retail (1.10), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: S-6

Executive Summary

Under project S-6, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 95%.

Project Description

The customer retrofitted (653) Incandescent lamps with (653) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	653	653	60	8	7,636	297,455	283,913	1.10	95%
Total						297,455	283,913		95%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Standard	297,455	283,913	95%	47.71

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Total		297,455	283,913	95%	47.71

The project-level gross kWh savings realization rate is 95%. The realization rate is slightly low because the ex post lighting hours of operation verified during the M&V site visit (7,636) were less than the lighting hours of operation used to perform the ex ante energy savings estimate (8,760).

Project Number: S-8

Executive Summary

Under project S-8, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 110%.

Project Description

The customer retrofitted the following fixtures:

- (100) Incandescent fixtures with (100) LEDs
- (250) Incandescent fixtures with (250) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	100	100	90	17	8,760	63,948	70,599	1.10	110%
Incandescent to LED	250	250	75	14	8,760	133,590	147,483	1.10	110%
Total						197,538	218,082		110%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	197,538	218,082	110%	29.00
Total		197,538	218,082	110%	29.00

The project-level gross kWh savings realization rate is 110%. The realization rate is high because the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated large retail (1.06), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: S-10

Executive Summary

Under project S-10, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 114%.

Project Description

The customer retrofitted (422) Incandescent fixtures with (422) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	422	422	60	8	8,760	192,229	218,757	1.14	114%
Total						192,229	218,757		114%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Standard	192,229	218,757	114%	29.14
Total		192,229	218,757	114%	29.14

The project-level gross kWh savings realization rate is 114%. The realization rate is high because the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated assembly (1.14), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: S-11

Executive Summary

Under project S-11, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 46%.

Project Description

The customer retrofitted the following fixtures:

- (195) Incandescent fixtures with (195) LEDs
- (6) Incandescent fixtures with (6) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed three photo-sensor loggers at the site (from 6/01/13 to 6/24/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	195	195	100	12	3,645	150,322	68,191	1.09	45%
Incandescent to LED	6	6	35	2	8,760	1,756	1,882	1.07	107%
Total						152,077	70,073		46%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	152,077	70,073	46%	14.74
Total		152,077	70,073	46%	14.74

The project-level gross kWh savings realization rate is 46%. The realization rate is low mainly because the ex post lighting operating hours verified during the M&V site visit (ranging from 3,645 to 8,760) are less than the lighting operating hours used to perform the ex ante energy savings estimate (8,760).

Project Number: S-13

Executive Summary

Under project S-13, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 107%.

Project Description

The customer retrofitted the following fixtures:

- (144) Halogen fixtures with (144) LEDs
- (48) Halogen fixtures with (48) LEDs
- (180) Halogen fixtures with (180) LEDs

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed three photo-sensor loggers at the site (from 6/07/13 to 6/20/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as\text{–}built} \times W_{as\text{–}built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

$HCIF$ = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Halogen to LED	144	144	75	17	4,243	37,016	39,120	1.10	106%
Halogen to LED	48	48	50	9	4,236	8,722	9,204	1.10	106%
Halogen to LED	180	180	75	17	4,366	46,270	50,316	1.10	109%
Total						92,008	98,640		107%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	92,008	98,640	107%	26.70
Total		92,008	98,640	107%	26.70

The project-level gross kWh savings realization rate is 107%. The realization rate is high mainly because the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated large retail (1.10), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: S-19

Executive Summary

Under project S-19, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 251%.

Project Description

The customer retrofitted the following fixtures:

- (96) Incandescent fixtures with (96) LEDs in Area 1
- (258) Incandescent fixtures with (258) LEDs in Area 2

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed one photo-sensor logger at the site (from 09/26/13 to 10/30/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	96	96	60	11	8,760	13,736	46,894	1.14	341%
Incandescent to LED	258	258	60	11	5,561	36,915	80,010	1.14	217%
Total						50,650	126,904		251%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Lighting Retrofit	Standard	50,650	126,904	251%	21.36
Total		50,650	126,904	251%	21.36

The project-level gross kWh savings realization rate is 251%. The realization rate is high mainly because the ex post lighting operating hours verified during the M&V site visit (ranging from 5,561 to 8,760) are greater than the lighting operating hours used to perform the ex ante ex ante energy savings estimate (2,920).

Project Number: S-20

Executive Summary

Under project S-20, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 267%.

Project Description

The customer retrofitted the following fixtures:

- (96) Incandescent fixtures with (96) LEDs in Area 1
- (254) Incandescent fixtures with (254) LEDs in Area 2

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed one photo-sensor logger at the site (from 09/26/13 to 10/30/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	96	96	60	11	8,760	13,736	46,894	1.14	341%
Incandescent to LED	254	254	60	11	6,126	36,342	86,766	1.14	239%
Total						50,078	133,659		267%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	50,078	133,659	267%	22.78
Total		50,078	133,659	267%	22.78

The project-level gross kWh savings realization rate is 267%. The realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 6,125 to 8,760) are greater than the lighting hours of operation used to perform the ex ante energy savings estimate (2,920).

Project Number: S-22

Executive Summary

Under project S-22, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 311%.

Project Description

The customer retrofitted the following fixtures:

- (168) Incandescent fixtures with (168) LEDs in Area 1
- (60) Incandescent fixtures with (60) LEDs in Area 2

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed two photo-sensor loggers at the site (from 09/26/13 to 10/30/13) to monitor lighting operation. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	168	168	60	11	8,760	24,037	82,064	1.14	341%
Incandescent to LED	60	60	60	11	5,844	8,585	19,551	1.14	228%
Total						32,622	101,615		311%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	32,622	101,615	311%	14.64
Total		32,622	101,615	311%	14.64

The project-level gross kWh savings realization rate is 311%. The realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (ranging from 5,843 to 8,760) are greater than the lighting hours of operation used to perform the ex ante energy savings estimate (2,920).

Project Number: S-23

Executive Summary

Under project S-23, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the exterior of its facility. The gross kWh savings realization rate for this project is 98%.

Project Description

The customer retrofitted (290) Incandescent fixtures with (290) LEDs.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

$HCIF$ = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	290	290	25	3	4,308	28,198	27,736	1.00	98%
Total						28,198	27,736		98%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	28,198	27,736	98%	0.00
Total		28,198	27,736	98%	0.00

The project-level gross kWh savings realization rate is 98%. The realization rate is slightly low because the ex post lighting hours of operation verified during the M&V site visit (4,308) are less than the lighting hours of operation used to perform the ex ante energy savings estimate (4,380).

Project Number: S-24

Executive Summary

Under project S-24, the customer received standard incentives from Ameren Missouri for installing two steam cookers and one solid door freezer. The gross kWh savings realization rate for this project is 25%.

Project Description

The customer installed the following equipment:

- (2) five-pan pressure less steam cooker, re-thermalizer and holding cabinets
- (1) reach-in solid door freezer, 23 cubic feet of space.

There was no baseline equipment.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, installed current (amperage) monitoring equipment on one of the steamers and the freezer, took one-time power measurements, and equipment nameplate photos. The monitoring period was approximately two and a half weeks.

Monitoring data indicated the steamer was used between 7 and 11:30 AM during full operating days, equating to 792 hours per year. These hours were multiplied by the deemed connected load reduction of 3.16 kW, as provided in the Missouri Technical Reference Manual, to determined annual energy savings.

Monitoring data for the freezer indicated that the compressor and fan were on approximately 42% of the time and off approximately 57% of the time. This operating profile was used to calculate annual energy consumption of the new freezer. The baseline consumption was found using commercial kitchen energy star calculator. The gross ex post savings were the difference in the new freezer usage and a congenial freezer.

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Steamers	Standard	26,278	5,005	19.0%	6.32
Freezer	Standard	869	1,657	191%	0.10
Total		27,147	6,663	25%	6.42

The project-level gross kWh savings realization rate is 25%. The realization rate is low because the ex ante savings estimate assumed 4,380 hours of operation for the steamers compared to the ex post hours of operation based on monitoring data of .

One-day plots showed the steamer was only used between 7:00 and 11:30 AM during operating days, whereas the claimed savings assumed operations of 12 hours per day, 365 days per year operation.

Project Number: S-31

Executive Summary

Under project S-31, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 107%.

Project Description

The customer retrofitted (32) Incandescent lamps with (32) LEDs.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$ = *Annual energy savings*

N = *Number of fixtures*

W = *Wattage of each fixture*

t = *Lighting operating hours*

HCIF = *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	32	32	40	11	8,760	8,247	8,865	1.07	107%
Total						8,247	8,865		107%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	8,247	8,865	107%	1.10
Total		8,247	8,865	107%	1.10

The project-level gross kWh savings realization rate is 107%. The realization rate is high because the ex post lighting operating hours verified during the M&V site visit (8,760) are greater than the lighting hours used to perform the ex ante energy savings estimate (8,736). In addition, the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated hospital (1.07), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: S-34

Executive Summary

Under project S-34, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 231%.

Project Description

The customer retrofitted (21) incandescent lamps with (21) LEDs.

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
HCIF	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
Incandescent to LED	21	21	75	13	8,760	5,466	12,637	1.11	231%
Total						5,466	12,637		231%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	5,466	12,637	231%	1.66
Total		5,466	12,637	231%	1.66

The project-level gross kWh savings realization rate is 231%. The realization rate is high mainly because the ex post lighting hours of operation verified during the M&V site visit (8,760) are greater than the lighting hours of operation used to perform the ex ante energy savings estimate (4,198). In addition, the ex post savings analysis included a heating and cooling interactive factor for natural gas-heated small retail (1.11), while the ex ante savings estimate did not account for heating and cooling interactive effects.

Project Number: S-35

Executive Summary

Under project S-35, the customer received standard incentives from Ameren Missouri for retrofitting lighting in the interior of its facility. The gross kWh savings realization rate for this project is 72%.

Project Description

The customer retrofitted the following fixtures:

- Installed (5) LED Case Lighting fixtures
- Installed (7) LED Case Lighting fixtures

Measurement and Verification Effort

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and determined the lighting operating schedule. These data were used to calculate energy savings.

Lighting retrofit energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
W	= *Wattage of each fixture*
t	= *Lighting operating hours*
$HCIF$	= *HVAC interactive factor*

The table shown below presents ex ante and ex post gross annual energy savings for the lighting retrofit installed under the project.

Lighting Retrofit Annual Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Gross Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Heating Cooling Interaction Factor*	*Gross kWh Savings Realization Rate*
	Old	*New*	*Old*	*New*					
LED Case Lighting	5	5	36	19	8,760	1,609	877	1.18	55%
LED Case Lighting	7	7	36	10	8,760	2,252	1,897	1.19	84%
Total						3,861	2,774		72%

Results

Verified Gross Annual Savings/Realization Rates By Measure

Measure Category	Incentive Type	kWh Savings			Gross Ex Post Peak kW Savings
		Ex Ante	Ex Post	Realization Rate	
Lighting Retrofit	Standard	3,861	2,774	72%	0.32
Total		3,861	2,774	72%	0.32

The project-level gross kWh savings realization rate is 72%. The realization rate is low because the incentive covers a range of LED wattages used by the company where center lamps are 19 watts and end lamps are 10 watts. The analysis to estimate ex ante annual energy savings assumed lower energy consumption for the fixtures actually used.

Project Number: R-1

Executive Summary

Under project R-1, the customer received incentives from Ameren Missouri for fixing compressed air system leaks. The gross kWh savings realization rate for this project is 106%.

Project Description

The customer fixed 54 leaks in the compressed air system reducing air load demand by 156 CFM.

Measurement and Verification Effort

During the M&V visit, ADM staff verified leak repair and installed power monitoring equipment on each of the three compressors, which monitored kW from 1/15/2014-1/24/2014. ADM generated the post air load profile using the %kW to %CFM profile defined in the CEATI Compressed Air Energy Efficiency Reference Guide Figure 8 for systems with inlet modulation and blow-down control. The pre air demand profile was generated by adding 156 CFM to the monitored load. The savings are the kW difference at each 5 minute monitored data interval for the 9 days recorded. The 9 monitored days were extrapolated to a typical year.

Results

Measure Category	*Incentive Type*	*kWh Savings*			*Gross Ex Post Peak kW Savings*
		Ex Ante	*Ex Post*	*Realization Rate*	
Compressed Air	RCx	316,031	335,638	106%	72.58
Total		316,031	335,638	106%	72.58

The project-level gross kWh savings realization rate is 106%. The peak savings are lower than ex ante because the weekday kW savings between 3:00 PM and 5:00 PM are lower than the overall average savings. The company's maximum kW savings occur on the weekends, which increase the company's average kW savings. However, weekends are outside the utility's peak period, therefore, the company's peak kW savings are less than the average kW reduction

Appendix B: Program Staff Interview Guide

Roles and Responsibilities

1. Let's start with a bit about you. What is your job title?
2. How long have you been at Ameren Missouri?
3. Briefly, what are your responsibilities at Ameren Missouri overall, including with the Business Energy Efficiency Programs?
    a. How long have you had those responsibilities?
    b. Background or training?
4. IF NOT ANSWERED ABOVE: What are your responsibilities with regards to Ameren Missouri's Business Energy Efficiency Programs? Which specific programs are you involved in? (Standard, Custom, Retro-Commissioning, New Construction)
    a. How long have you had those responsibilities?
    b. About what percent of your time do you spend on the Business Energy Efficiency Programs?
    c. In what areas, if any, could you use additional support?
5. Were you involved in the first program cycle, in addition to this current one?
    a. IF YES: What, if anything, was different about your role during the first cycle?

BizSavers Program Management

6. [IF NOT ALREADY RECEIVED] Do you have a current organizational chart for Ameren Missouri staff working on the program that you can share with me?
    a. Who do you report to for the program?
    b. And who reports to you? What are their roles?
7. AS NEEDED: Who else at Ameren Missouri do you interact with relating to the BEE programs, and what are their roles?
8. RE: CSAs & KARs – What roles do CSAs (Customer Service Advisors) and KARs (Key Account reps) play in the program, if any?
    a. What kinds of program training do they receive, if any?
    b. What kinds of incentives do they receive, if any?

   c. AS NEEDED: Can you tell me who manages these groups (CSAs/KARs) so I can contact them for an interview?

9. What support does the program need from other Ameren Missouri departments or divisions to make it successful?
   a. Does it get the support it needs?
   b. What additional support, if any, does the program need?

Program Goals

Now I'd like to hear about program goals, and the types of businesses targeted.

10. What are the goals of the various programs, both overall and by individual initiative? (Numeric as well as intention).
11. How well do you think the programs are designed to meet their goals? Why do you say that?
    a. [If indicates any issues:] What particular issues or concerns do you have about the design of the programs?
    b. [If not obvious] What needs to change to address those concerns?
    c. What might prevent those changes?
    d. How and when might changes to address those concerns occur?
12. How do program goals and processes differ from the last program cycle?
    a. Probe: Any other differences?
    b. [IF CHANGES NOTED:] What is the reason for those changes?
    c. Probe about incentive levels, efforts to get more non-lighting projects
13. What barriers, if any, do you see to expand market penetration? [Probe to relate barriers to specific market sectors.]
    a. [If any] What could Ameren Missouri do to overcome those barriers? [If any] Why hasn't that action been implemented so far?
    b. What could Lockheed Martin do to overcome those barriers? [If any] Why hasn't that action been implemented so far?
14. How, if at all, did the program hiatus between Cycle 1 and Cycle 2 affect the program?
15. Are there any other opportunities that this program might address? [e.g., additional measures, other customers or trade allies, additional services, other market segments?]

a. (If any) What changes are needed to address those opportunities? [e.g., program evolution, bigger budget, more staff, measure-cost reduction, or implementation or program delivery changes?]

16. So far, have Lockheed Martin's efforts met your expectations? If not, in what way do they fall short of expectations?

    a. [Probe about differences between the four programs and about each of the following:]

    - Marketing and outreach
    - Application processing
    - M&V (measurement and verification)
    - QA/QC (quality assurance and quality control)
    - Reporting

17. Is there anything else that Lockheed Martin needs to be doing?

    a. [PROBE for differences between individual programs: Standard, Custom, Retro-commissioning, and New Construction.]

Internal Communications

Next I'd like to hear about how communication processes, starting with internal communication.

18. What, if any, regularly scheduled program communication do you have with other Ameren Missouri staff regarding the BEE program? Anything else?

    For each item:

    a. who
    b. method
    c. frequency
    d. purpose/objectives
    e. meet objectives - why or why not
    f. What's working well
    g. Any problems or suggested improvements

19. Overall, how would you characterize internal communications regarding the BEE program?

    [If issues – what are they, any suggested solutions]

Communication with Implementers

20. What, if any, regularly scheduled program communication do you have with Lockheed Martin regarding the program? Anything else?

    For each item:

    a. Who
    b. Method
    c. Frequency
    d. Purpose/objectives
    e. Meet objectives
    f. Why or why not
    g. What's working well
    h. Any problems or suggested improvements

21. Do you have informal communications with any Lockheed Martin staff regarding the BEE program?

    a. Who, how, why, how often
    b. what's working well
    c. any problems or suggested improvements

22. Overall, how would you characterize your communications with Lockheed Martin?

    [If issues – what are they, any suggested solutions]

Trade Allies & Other Program Partners

23. I'd also like to hear about how the program works with trade allies and any other program partners. Is there someone else at Ameren Missouri I should ask about that? (If yes, get contact info and skip to next section.)

24. What interaction, if any, do Ameren Missouri staff have with trade allies and other program partners, including retro-commissioning agents or others? Does this vary by individual program (Standard, Custom, RCx, and New Construction)? (PROBE for which individual Ameren Missouri staff members interact with each type of trade ally/partner.)

25. How did the bridge year affect trade allies and any other program partners? What communication did you have, if any, with partners who went inactive due to the bridge year?

26. From your perspective, how well is Lockheed Martin managing trade allies or other program partners?

27. [IF CONCERNS NOTED] What is being done about those concerns? What else should be done? [Probe about the various aspects of managing TAs – recruiting, training, keeping them informed, maintaining a TA list on the website.]
28. Do you have any suggestions for ways to improve the program with regard to trade allies and program partners?
29. Have you heard any feedback from trade allies or program partners so far, and if so, what have you heard?

Marketing

INTERVIEWER NOTE: PROBE AS NEEDED ABOUT DIFFERENCES BY: program, participant type, and trade ally type.

Now, I'd like to hear about marketing activities for the program.

30. What responsibilities for marketing does …
    a. Ameren Missouri have?
    b. Lockheed Martin have?
31. What marketing channels does Ameren Missouri use to reach potential customers? [mass marketing, organizations –types, how often, other?] How does this differ for the various programs?
32. How are websites and Internet activities used for marketing?
33. What feedback have you gotten so far on how marketing and outreach activities are working? [Probe about different programs and different sub-segments]
34. How are changes in the program communicated to the target market?
35. What success or challenges are partners and implementers having with communicating changes?
36. We've received electronic versions of the tear sheets and brochure; can we anticipate receiving other collateral items as well (such as case studies, PowerPoint presentations, email marketing, and so on)? We'd also like to have access to website properties, as well as related website metrics and analytics/reports – will those be made available?
37. How are things going with encouraging trade allies to use co-branded marketing materials?

a. Tell me a little about who is using them, how widespread use is, and why they use them. Also, what kinds of trade allies are using them—and why not?

b. What feedback have you heard from trade allies about co-marketing efforts so far?

38. What is the reason for introducing the BIZSAVERS branding, and how does that relate to the ActOnEnergy branding?

    a. How is the BIZSAVERS branding rollout going so far? Are there plans to introduce a BIZSAVERS website?

    b. Is the plan to phase out ActOnEnergy? Why or why not?

Tracking & Reporting

Next, I'd also like to hear about tracking and reporting.

39. How well is the current tracking and reporting process working to meet your needs?

    a. What reports or other information provided by Lockheed Martin do you find to be most useful? Least useful (if anything)? Why?

    b. What would you like to see improved or streamlined, if anything? [PROBE FOR SPECIFIC REPORT REFERENCE(S)]

    c. Are reports provided in a timely manner?

    d. Is all needed information available, or are some data points missing or not readily available? If so, what?

40. Can you provide me with the person on your staff who handles tracking and reporting for this program? (If yes: Get contact info and skip to next section.)

41. How well have the recent tracking changes for the current cycle worked out from your perspective?

42. Regarding using SharePoint to share reports and other documents between Ameren Missouri and Lockheed Martin– what is working well, and what needs improvement?

Quality Control

Now let's talk about Quality Control…

43. Is there a person on the Ameren Missouri staff who monitors quality control for this program? (If yes: Get contact info and skip to next section.)

44. How does Ameren Missouri define Quality Control? What types of Quality Control activities are done by Ameren Missouri staff? By Lockheed Martin?

45. From your perspective, how adequate are Lockheed Martin’s procedures for ensuring quality control?
46. What are typical types of QC issues that come up now? How is different from in the past?
47. How are the issues addressed?
48. Are there problems that are more common with a specific type of partners, participants, contractors, or sector? How do you address these issues?
49. Have you had any feedback about the program? If so, from whom and what was the nature of the feedback?

Conclusion

50. What would you say are the greatest strengths of the program?
51. What would you say most needs to be changed about the program?
52. Are you aware of opportunities to streamline any of the program activities? If so, which activities, and what changes would you like to see, and what would have to occur for those changes to be implemented?
53. Is there anything else about the program that we have not discussed that you feel should be mentioned?
54. As we talk to other stakeholders, including program participants and trade allies, what would you like to learn from them?

Those are all of my questions. Thank you very much for your time.

Appendix C: Trade Ally/Program Partner Interview Guide

Let's start with a few questions about your company.

Just to confirm, my information indicates that you have worked on Ameren Missouri [PIPE IN PROJECT TYPE: "new construction projects," "equipment replacement projects in existing buildings," OR "retro-commissioning projects"] and that you are [IF PP_STATUS= "TA" READ "a member of the Ameren Missouri Trade Ally Network"; IF PP_STATUS= "RSP" READ "an Ameren Missouri Retro-commissioning Service Provider"; IF PP_STATUS= "Not" READ "NOT a member of the Ameren Missouri Trade Ally Network"]. Is that correct? [AS NEEDED: Members are featured on Ameren Missouri's web site and can use the Network logo in marketing.]

[IF 'YES' OR 'DK,' PROCEED. IF 'NO' – THEN WE WILL INVESTIGATE AND CALL THEM BACK]

Firmographics

Let's start with a few questions about your company.

1. How many business locations do you have? [NUMBER BOX WITH CHECKBOX FOR DON'T KNOW]
2. How many employees work at all of your locations? Your best estimate is fine. [NUMBER BOX WITH CHECKBOX FOR DON'T KNOW]
3. Which of the following areas do you serve? [READ LIST ITEMS A-F; DO NOT READ G; SELECT ALL THAT APPLY; IF RESPONDENT SAYS 'STATEWIDE,' ASK IF THAT INCLUDES A-F]
   a. St. Louis Metro
   b. Kirksville
   c. Excelsior Springs
   d. Western suburbs (St. Peters/O'Fallon, Washington/Union; Park Hills/Bonne Terre)
   e. Central Missouri (Moberly, Jefferson City, Lake of the Ozarks)
   f. Southeastern Missouri (Cape Girardeau, Hayti/Caruthersville)
   g. [DO NOT READ] Statewide
   h. [DO NOT READ] Don't know

Recruitment (All Respondents, Except as Noted)

Let’s talk about Ameren Missouri efficiency programs and how you learned about them.

1. [QUESTION DELETED – ALREADY HAVE INFO IN DATABASE]

[DISPLAY Q2 IF PP_STATUS = ‘TA’ OR ‘RSP’]

2. How did you come to [IF PP STATUS = ‘TA,’ READ “join the Ameren Missouri Trade Ally Network?”; IF PP STATUS = ‘RSP,’ READ “become an Ameren Missouri Retro-commissioning Service Provider?”]

[Probes: Did the program implementer (Lockheed Martin) contact your firm? Did you hear about the network from some other source and contact Ameren Missouri or Lockheed Martin?]

[DISPLAY Q2A IF PP_STATUS = ‘NOT’]

2a. Before today, were you aware that companies like yours can apply to be part of the Ameren Missouri BizSavers Trade Ally Network? Members of the network are featured on Ameren Missouri’s web site and can use the Network logo in advertising and marketing materials. (Y/N)

[DISPLAY Q2B IF PP_STATUS = ‘NOT’ AND Q2A = ‘YES’]

2b. Have you considered applying to be a member of the network?

a. Yes, have applied

b. Yes, have considered

c. No

d. Don't know

e. Other (specify) _____

[DISPLAY Q2C IF PP_STATUS = ‘NOT’ AND Q2B = ‘NO’]

2c. What, if anything, has prevented you from applying to be a member of the Ameren Missouri Trade Ally Network? [OPEN END]

Awareness and Benefits

3. Ameren Missouri has held public events such as "lunch and learns" and "launch events" to introduce folks to its energy efficiency programs. Have you or anyone at your company attended this type of informational meeting? [SELECT ALL THAT APPLY]

a. Yes, self

b. Yes, someone else

c. No

d. Don't know

[DISPLAY Q4 IF Q3 = A. YES, SELF OR B. YES, SOMEONE ELSE AND PP_STATUS=TA OR RSP]

4. How did these informational meetings influence your company's decision on whether to [IF PP STATUS = 'TA,' READ "join the Ameren Missouri Trade Ally Network"; IF PP STATUS = 'RSP,' READ "become an Ameren Missouri Retro-commissioning Service Provider"]? (Open Ended)

[DISPLAY Q5 IF PP_STATUS = 'TA' OR 'RSP']

5. [IF PP STATUS = 'TA,' READ "Joining the Ameren Missouri Trade Ally Network"; IF PP STATUS = 'RSP,' READ "Becoming an Ameren Missouri Retro-commissioning Service Provider"] offers potential benefits. Using a scale from 0 to 10 where 0 is "not at all beneficial" and 10 is "extremely beneficial," please rate the extent to which joining has been beneficial…

a. For broadening your customer base (0-10, DK, N/A)

b. For increasing your sales (0-10, DK, N/A)

c. As a resource for information on marketing energy efficiency (0-10, DK, N/A)

d. Other (specify)_____ (0-10, DK, N/A) [PROGRAMMER NOTE: Review initial 5-10 interviews and add precodes to this question based on responses]

Training (All Respondents)

I'd like to hear a bit about any training you've received apart from the kinds of informal events I described just now.

6. [ASK ALL] Apart from any such informal events, have you, or anyone at your company attended any more formal training events to learn more about the Ameren Missouri BizSavers programs? [SELECT ALL THAT APPLY]

a. Yes, self How many training events have you attended?

b. Yes, someone else How many training events have they attended?

c. No

d. Don’t know

[DISPLAY Q8 TO Q11 IF Q6 = ‘YES, SELF’]

[QUESTION DELETED – INCORPORATED INTO Q6]

8. Which of the following program incentive pathways did the training cover? [READ AND SELECT ALL THAT APPLY]

a. The Standard incentive pathway for existing building retrofits

b. The Custom incentive pathway for existing building retrofits

c. New construction – Standard, custom, lighting, or whole building incentive

d. Retro-commissioning – standard and custom incentives

e. Don’t Know

9. And which of the following topics did the training cover? [READ AND SELECT ALL THAT APPLY]

a. General application requirements

b. Qualifying equipment

c. Calculating Standard savings and incentives

d. Calculating Custom savings and incentives

e. M&V requirements

f. How to sell the benefits of energy efficiency

g. Other-specify: ______________

10. Thinking of all of the trainings you’ve received from program staff, how much do you disagree or agree with these statements regarding the training? Please answer on a scale of 0 to 10, with 0 being “don’t agree at all” and 10 being “strongly agree.” (SELECT ONE RESPONSE PER LISTED OPTION – RANDOMIZE)

a. The information presented was clear

b. The correct level of detail was presented

c. All relevant topics were covered

d. The time was convenient

e. The length of time was appropriate

f. The location was convenient

11. What additional training, if any, would you have liked?

[Probe about specific program processes, technologies, rules, etc.]

Marketing and Customer Program Awareness

Now let's talk about your customers a bit.

For my next questions, even if you've done other types of jobs, I'd like you to focus on your customers with… [IF TA_TYPE = 'RCx,' READ "retro-commissioning projects"; IF TA_TYPE = 'NC,' READ "new construction projects"; IF TA_TYPE = 'OTHER' READ "equipment replacement projects in existing buildings"].

12. First, what specific business or building types or sectors do you work with? [READ LIST AS NECESSARY; SELECT ALL THAT APPLY]

a. Agricultural

b. Churches and other community organizations

c. Government agencies

d. Grocery stores

e. Health care/hospitals

f. Hotels/motels

g. Industrial/manufacturing plants

h. Multi-family residential

i. Office buildings

j. Restaurants

k. Retail (non-food)

l. Schools, colleges, or universities

m. Warehouses

n. Other, specify___________________

12a. [ASK IF MORE THAN ONE BUSINESS TYPE SELECTED] Of those you just mentioned, about what percentage of your work is with each type?

a. Agricultural

b. Churches and other community organizations

c. Government agencies

d. Grocery stores

e. Health care/hospitals

f. Hotels/motels

g. Industrial/manufacturing plants

h. Multi-family residential

i. Office buildings

j. Restaurants

k. Retail (non-food)

l. Schools, colleges, or universities

m. Warehouses

n. Other, specify___________________

13. When discussing the Ameren Missouri business incentives with your customers, what name or names do you use to refer to the program? [SELECT ALL THAT APPLY]

a. Business Energy Efficiency or BEE

b. ActOnEnergy

c. BizSavers

d. Other:_____________________________________

From here on, any time I refer to the Ameren Missouri business incentives, I'll use the name BizSavers, and keep in mind that I am referring specifically to Ameren Missouri programs.

14. Of your customers who applied for BizSavers incentives, about what percentage were aware that those incentives were available before you mentioned it to them?

____%/DK

15. In which business or building types you work with is awareness of BizSavers incentives the highest? ______

16. In which business or building types you work with is awareness of BizSavers incentives the lowest? ______

[DISPLAY Q17 IF Q9F (HOW TO SELL BENEFITS OF EE) IS SELECTED]

17. You indicated before that you had gotten some training on how to sell the benefits of energy efficient equipment. Has this helped you to get clients to install the higher efficiency equipment options, or not?

a. Yes

b. No

c. Don't know

[DISPLAY Q18 IF PP_STATUS = 'TA' OR 'RSP']

18. Is your firm using Ameren Missouri's logo for co-branding your services?

a. Yes → What benefit are you getting from co-branding?

b. No → Why not?

c. Don't know

19. What is your opinion of the marketing efforts Ameren Missouri is making to promote BizSavers incentives? [OPEN END]

Promotion of EE and BizSavers, Including Related Barriers (All Respondents, Except as Noted)

Now I'd like to hear how you have been marketing BizSavers incentives to clients in the past year or so – both those who have and have not applied for or received Ameren Missouri BizSavers incentives. Again, even if you've done other types of jobs, I'd like you to focus on your… [IF TA_TYPE = 'RCx,' READ "retro-commissioning projects"; IF TA_TYPE = 'NC,' READ "new construction projects"; IF TA_TYPE = 'OTHER' READ "equipment replacement projects in existing buildings"]

[DISPLAY Q20 & Q21 IF TA_TYPE = 'OTHER']

20. In about what percentage of those jobs did you propose equipment that could have qualified for BizSavers incentives? _____%/DK

21. And in about what percentage of those jobs did the client agree to most of the incentive-qualifying equipment you proposed? _____%/DK

[DISPLAY Q22 & Q23 IF TA_TYPE = 'OTHER']

[ONLY ASK Q22-23 IF Q21 < 100% OR =DK]

22. Thinking about those clients that did not agree to most of the incentive-qualifying equipment you proposed, what reasons did they give?

23. In what ways, if any, do the reasons given relate to the size or type of the client's business? [PROBE FOR BUSINESS SIZE, OWNERSHIP TYPE, AND BUSINESS TYPE]

[DISPLAY Q24 & Q24A IF TA_TYPE = 'OTHER']

24. Of those clients that accepted most of the incentive-qualifying equipment that you proposed, about what percentage applied for BizSavers incentives? _____%/DK

24a. In the absence of BizSavers incentives, about what percentage of your BizSavers customers would still have done more or less the same upgrade project? [If respondent is unclear, say: I mean they would have done an upgrade project and would have installed pretty much the same equipment that they did with the incentives.]

________%/DK

[DISPLAY Q25 & Q26 IF TA_TYPE = 'OTHER']

[ONLY ASK Q25-26 IF Q24 < 100% OR =DK]

25. Thinking about those clients that did not apply for incentives, what reasons did they give?

26. In what ways, if any, do the reasons given relate to the size or type of the client's business?

[PROBE FOR BUSINESS SIZE, OWNERSHIP TYPE, AND BUSINESS TYPE]

[DISPLAY Q27 IF TA_TYPE = 'OTHER' OR 'NC' OR 'RSP']

27. What works best to encourage clients to consider the higher efficiency options that are available, including efficient settings and equipment? [Probes, if needed: audits, the incentives, estimating savings, case studies, other]

[DISPLAY Q28 IF TA_TYPE = 'NC']

28. In what ways, if any, has going through the process to obtain Ameren Missouri New Construction incentives affected the design of your new construction projects?

[DISPLAY Q29 TO Q30 IF TA_TYPE = 'OTHER' OR 'NC' OR 'RSP']

29. How much flexibility do program rules give you to scope jobs that include all of the efficiency recommendations you'd like your client to consider?

[Probe about limitations or constraints]

30. What efficiency options, if any, that aren't currently incented would you or your clients like to see covered by the program?

[DISPLAY Q31 & Q31A IF TA_TYPE = 'NC']

31. The New Construction program provides multiple pathways for getting incentives – standard, custom, lighting, and whole building. In what ways has that helped or hindered you in designing or carrying out a new construction project?

[RECORD "HELPED" RESPONSES IN SEPARATE VARIABLE FROM "HINDERED" RESPONSES]

31a. Over the past year, to what degree, if any, has the program increased energy savings in new construction projects you have carried out? [OPEN ENDED]

Interactions with Program Staff (All Respondents, Except as Noted)

Now thinking about all of your incentive related jobs, I'd like to hear about your interactions with Ameren Missouri or Lockheed Martin staff who run the programs.

[DISPLAY Q32 IF TA_TYPE = 'NC' OR 'RSP']

32. Did any of your BizSavers jobs include…?

a. Running models to estimate savings Yes / No / DK

b. Using engineering calculations to estimate savings Yes / No / DK

[DISPLAY IF Q32 a. or b. = NO]

32a. What methods did you use to estimate savings? ___

33. What types of assistance did you seek, if any, from program staff during the process of completing applications and getting your proposed projects approved? [DO NOT READ LIST; SELECT ALL THAT APPLY]

a. Co-branding (logo) rules
b. General program information
c. Questions about how to fill out incentive application
d. Check on status of incentive application
e. Questions about the Trade Ally Network application
f. Check on status of Trade Ally Network application
g. Other, specify
h. None
i. Don't know
j. A coworker sought assistance
k. A customer/participant sought assistance

[DISPLAY IF 'NONE' OR DK ISN'T SELECTED IN Q33]

34. Were program staff able to give you the assistance you were looking for? Yes / No / DK

[DISPLAY Q35 IF Q34 = 'NO' OR 'DK']

35. What additional assistance would you have liked? ___

36. How useful were written program guidelines, including those provided to you in hard copy and those found on the web? ______

[Probes as needed to cover clarity and readability:

How clearly were they written?

How clearly were the reporting and approval processes outlined?

How clear were the program inspection guidelines?]

37. What, if anything, might make them easier to understand or comply with? ____

38. In what ways, if any, did complying with program rules and requirements affect the timing of projects? ___

Retro-commissioning Incentive Program (RSPs Only)

[DISPLAY Q39-43a IF TA_TYPE = RSP]

We're getting close to the end, thank you for being so helpful. Because Retro-commissioning is so different from the other BizSavers incentive options, I would like to learn a bit more about this program.

39. Ameren Missouri subsidizes the optimization of building, compressed air, and refrigeration systems. Which ones do you do? (Select all that apply)

a. Building optimizations

b. Compressed air optimization

c. Refrigeration optimization

d. Don't know

e. Other (specify) _____

40. How often have your retro-commissioning jobs presented the opportunity to pursue some combination of building, compressed air, and/or refrigeration optimization at one time?

All or almost all the time

More than half the time

About half the time

Less than half of the time

Never or almost never

Don't know

[DISPLAY Q41 IF Q40 = A, B, C, OR D]

41. How, if at all, do you go about encouraging a client to optimize more than one system at once? ___

42. How were the engineering audit requirements for the Retro-commissioning program?

[Probes: How effective? How easy to use? How well did they work for you?]

43. How well did the program compensate you for your efforts? [If needed: Did you think it was adequate or not?]

Q43a. Thinking of any retro-commissioning projects you worked on in the past year that received Ameren Missouri BizSavers incentives, what do you think the client would have done if such incentives had not been available? [OPEN ENDED RESPONSE]

[PROBES: Done the same thing, carried out a less thorough retro-commissioning, had an audit to identify upgrades to complete, completed upgrades, etc.]

Spillover and Market Effects

The next few questions are about your sales of high-efficiency equipment or upgrade services to customers that did NOT apply for BizSavers incentives for that equipment or services. This could include customers that applied for incentives at some other time as well as customers that never applied for incentives so far as you know. And by high-efficiency equipment, I mean the type of equipment that currently qualifies for BizSavers incentives. So, again, when you answer the next few questions, please try to focus on customers that did not apply for BizSavers incentives.

44. First, has there been any change in your sales of high-efficiency equipment to customers that did not apply for BizSavers incentives since Ameren Missouri began offering business energy efficiency incentives about three years ago?

a. Yes □ If so, what changes? [PROBE: Increase or decrease? What equipment types have you seen changes in? What about HVAC, motors and drives, lighting?]

b. No

c. Don’t know

45. [IF Q44 RESPONSE INDICATES INCREASE, ASK] About how much of an increase have you seen? ___________% ____DK

a. About how much of that increase, if any, is due to the BizSavers program? _____%

Percentage: _______%

Or open-end response if no percentage given: _____

46. [IF Q44 RESPONSE INDICATES INCREASE, ASK] Increased sales of high-efficiency equipment could have one of several impacts on your business – which of the following best describes the effect on your business? [READ ALL]

a. It increased overall sales without affecting high-efficiency equipment's share of sales

b. It increased high-efficiency equipment's share of sales without affecting overall sales

c. It increased both overall sales and the high-efficiency share

d. Or some other effect – if so, please specify: ______________

e. Don't know

[DISPLAY Q47 IF Q46 = A OR C]

47. Has your firm hired any additional staff to handle the increased sales of high-efficiency equipment?

[INTERVIEWER NOTE: FOR EXAMPLE, TWO STAFF AT 50% TIME EQUALS 1 FTE]

a. Yes → If so, how many full-time equivalent staff?

b. No

c. Don't know

Satisfaction (All Respondents, Except as Noted)

Except for a couple of closing remarks, we'll close with a few satisfaction questions to get an idea of your overall experience with program processes.

48. On a scale of 0 to 10 where 0 means "not at all satisfied" and 10 means "extremely satisfied," SAID VERY, IS EXTREMELY please rate how satisfied you are with . . .

… the program application process [Enter 0-10] IF SAY 7 OR 8, ASK FOR A SINGLE NUMBER

… the range of measures and products for which Ameren Missouri offers incentives

… the quality of those measures and products that qualify for incentives [IF N/A, INDICATE REASON HERE AND DONT ASSIGN VALUE]

… the communication with program staff [IF N/A, INDICATE REASON HERE AND DONT ASSIGN VALUE]

… the level of incentives offered

[DISPLAY Q53 IF Q48 <7 OR Q49 <7 OR Q50 <7 OR Q51 <7 OR Q52 <7]

49. You indicated some dissatisfaction. What in particular were you dissatisfied with?

___

Conclusion

50. What would you say is the best thing about the BizSavers programs you have worked with?

51. What about the programs would you most like to see changed?

52. Do you have any other comments or thoughts about the program that you think would be useful for Ameren Missouri to hear?

53. Thank you for taking the time to talk. Would it be alright for me to contact you via phone or email for any needed clarifications?

Appendix D: Training Evaluation Survey Form

Ameren Missouri Business Energy Efficiency

BizSavers Program

Please return this form to the **evaluator** to help us improve future events.

Date of event: ______________________________

Location of event: ______________________________

1. How did this event compare to your expectations? (Circle one response.)

	Fell Far Short	Fell Somewhat Short	Met	Somewhat Exceeded	Far Exceeded
	1	2	3	4	5

2. Read the statements below and indicate how much you disagree or agree.
(Circle **one** response per row.)

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
a. The information presented was clear	1	2	3	4	5
b. All relevant topics were covered	1	2	3	4	5
c. Supporting materials were helpful (handouts, slides, etc.)	1	2	3	4	5
d. Examples were relevant	1	2	3	4	5
e. The time was convenient	1	2	3	4	5
f. The length of time was appropriate	1	2	3	4	5

g. The location was convenient	1	2	3	4	5

3. Overall, how do you rate this event? (Circle one response.)

	Poor				Excellent
	1	2	3	4	5

4. Did today's event encourage you to work with the BizSavers program in the future, or not? (Circle **one** response.)

1. Yes	2. No	3. Not sure

5. Comments about this event: ____

____

6. What topic(s) would you like covered in future BizSavers events? ________________

____

About You

7. ***Before January 2013***, did your business or organization complete an energy efficiency project that received an incentive from the BizSavers program?

1. Yes	2. No	3. Not sure

8. What (if anything) might prevent you from working with the BizSavers program in the future?

____

9. Is your business or organization…? (Circle **one** response.)

1. A business customer of Ameren Missouri	2. A contractor or trade ally	3. Something else (Please specify)

10. BUSINESS CUSTOMERS: What is your type of business or organization? (Circle one.)

1. Industrial	6. Grocery and convenience
2. Restaurant (not fast food)	7. School
3. Fast food restaurant	8. Lodging

4. Retail	9. Warehouse
5. Office	10. Other (please specify)

11. **CONTRACTORS AND TRADE ALLIES:** What is your type of business or organization? (Circle **one**.)

1. Architect	11. Industrial services
2. Developer or builder	12. IT or data center services
3. Distributor	13. Manufacturer
4. Electrical contractor	14. Manufacturer's rep
5. Energy Auditor/Modeler	15. Mechanical contractor
6. Engineering	16. National account services
7. ESCO (Energy Service company)	17. Refrigeration services
8. Financial services	18. Retro-commissioning agent
9. Full service engineering	19. Sales Engineering
10. HVAC distributor	20. Other (please specify)

12. **CONTRACTORS AND TRADE ALLIES:** Is your business or organization a member of the Ameren Missouri Trade Ally Network? (Circle **one**.)

1. Yes	2. No	3. Not sure

Appendix E: Participant Online Survey

ROLE & ENERGY STRATEGIES

1. What is your job title or role?

1. Facilities Manager
2. Energy Manager
3. Other facilities management/maintenance position
4. Chief Financial Officer
5. Other financial/administrative position
6. Proprietor/Owner
7. President/CEO
8. Manager
9. Other (Specify) ____

2. Which of the following, if any, does your company have in place at [LOCATION]? [Select all that apply]

1. A person or persons responsible for monitoring or managing energy usage
2. Defined energy savings goals
3. A specific policy requiring that energy efficiency be considered when purchasing equipment
4. Carbon reduction goals
5. Other – please describe: ______________________________
6. None of the above

88. Don't know

AWARENESS

3. How did you learn about Ameren Missouri's incentives for efficient equipment or upgrades? (Select all that apply)

1. Received an informational brochure or newsletter
2. From an Ameren Missouri Key Account Representative
3. From an Ameren Missouri Customer Account Service Advisor
4. From a program representative or service provider
5. From Ameren Missouri's website

6. TV / radio ad’s sponsored by Ameren Missouri
7. Friends or colleagues
8. From an architect, engineer or energy consultant
9. From an equipment vendor or building contractor
10. Through past experience with the program
11. Other (please explain)
88. Don’t know

[DISPLAY Q4 ONLY IF INCENTIVE TYPE = STANDARD]

4. In addition to the incentives for specific standard equipment upgrades you received, did you know you could qualify for incentives by proposing a custom energy-upgrade project that fits your specific facility needs?

1. Yes
2. No
88. Don’t know

[DISPLAY Q5 ONLY IF Q4 = 1]

5. Why didn’t you choose the custom option that offers incentives for non-standard equipment? (Please select all that apply)

1. All of the equipment I was interested in was listed on the Standard application.
2. I’m interested in other equipment, but didn’t want to do two applications (a custom one in addition to the standard incentive application).
3. The custom application seems too complicated.
4. Some other reason, please specify:______________________

[DISPLAY Q6 ONLY IF PROJECT = STANDARD OR CUSTOM OR RETRO-COMMISSIONING]

6. Is your firm considering undertaking any new construction or major building renovation projects within the next five years? [Such as adding a new wing, gutting an existing building, or building an entirely new building.]

1. Yes → Are you in the design phase now? Yes/No/Don’t know
2. No
88. Don’t know

[DISPLAY Q 7 IF Q6 =1]

7. Are you familiar with the Ameren Missouri's New Construction Incentive program which currently expires 12/31/2015?

1. Yes
2. No

88. Don't know

[DISPLAY Q8 AND Q9 ONLY IF PROJECT = NEW CONSTRUCTION]

8. You recently received incentives through Ameren Missouri's New Construction program. Which of this program's incentive options are you aware of? (Select all that apply)

1. Whole Building Performance incentives
2. Standard Lighting incentives
3. Standard non-lighting incentives
4. Custom measure incentives
5. None of the above

9. How well did the New Construction program's range of incentive options fit your needs?

Not at all				Completely	Don't know
1	2	3	4	5	

[DISPLAY Q10 ONLY IF Q9 < 4]

10. What caused the range of incentive options offered to fail to meet your needs completely?_______

[DISPLAY Q11 and Q12 ONLY IF PROJECT = RETRO-COMMISSIONING]

11. You recently received incentives for a retro-commissioning project. Which of these other Ameren Missouri program incentives are you aware of?

1. New Construction and major building renovation incentives
2. Standard incentives for specific measures such as lighting, HVAC, refrigeration, and water heating equipment
3. Custom incentives for non-standard measures
4. None of the above

12. How well did the Retro-commissioning program's range of incentive options fit your needs?

Not at all Completely Don't know

1 2 3 4 5

[DISPLAY Q13 ONLY IF Q12 < 4]

13. In what way did the range of incentive options offered fail to meet your needs completely?_______

PROGRAM DELIVERY EFFICIENCY

Application Process

14. Regarding your organization's decision to participate in the incentive program, who initiated the discussion about the incentive opportunity? Would you say…

1. Your organization initiated it
2. Your vendor or contractor initiated it
3. The idea arose in discussion between your organization and your vendor or contractor
4. Some other way. Please describe: ______

88. Don't Know

15. Which of the following people worked on completing your application for program incentives (including gathering required documentation)? (Select all that apply)

1. Yourself
2. Another member of your company
3. A contractor
4. An equipment vendor
5. A designer or architect
6. Someone else – please define: ________________________________

88. Don't know

[DISPLAY Q16 through Q18 ONLY IF Q15 = MYSELF]

16. Which version of the application worksheet did you use?

1. MS Excel spreadsheet
2. PDF version
3. Other – please specify: ____

88. Don't know

17. And how did you submit your application worksheets?

1. As an email attachment

2. By fax
3. By postal mail
4. Other – please specify: ____

88. Don't know

18. Thinking back to the application process, please rate the clarity of information on how to complete the application…

Not at all clear				Completely clear	Don't know
1	2	3	4	5	

[DISPLAY Q1.19 ONLY IF Q18A OR 18B < 4]

19. What information, including instructions on forms, needs to be further clarified? _______

[DISPLAY Q20 ONLY IF Q15 = MYSELF]

20. Using a 5-point scale, where 1 = "completely unacceptable" and 5 = "completely acceptable," how would you rate . . .

a. …the ease of finding forms on Ameren Missouri's website

Completely unacceptable 1	2	3	4	Completely acceptable 5	Don't know	N/A – Did not get forms from website

b. …the ease of using the electronic application worksheets

Completely unacceptable 1	2	3	4	Completely acceptable 5	Don't know

c. …the time it took to approve the application

Completely unacceptable 1	2	3	4	Completely acceptable 5	Don't know

d. …the effort required to provide required invoices or other supporting documentation

Completely unacceptable 1	2	3	4	Completely acceptable 5	Don't know	N/A – No documentation required

e. …the overall application process

Completely unacceptable 1	2	3	4	Completely acceptable 5	Don't know

21. Did you have a clear sense of whom you could go to for assistance with the application process?

1. Yes

2. No
88. Don't know

[DISPLAY Q22 ONLY IF PROJECT = RETRO-COMMISSIONING]

22. Did you have a clear sense of who you could go to for assistance in finding a Retro-commissioning Service provider?

3. Yes
4. No
89. Don't know

[DISPLAY Q23 ONLY IF PROJECT = NEW CONSTRUCTION]

23. Did you have a clear sense of whom you could go to for information about Design Team meetings?

[DISPLAY Q24 ONLY IF PROGRAM = CUSTOM OR RETRO-COMMISSIONING OR NEW CONSTRUCTION]

24. After initial submission, were you (or anyone acting on your behalf) required to resubmit or provide additional documentation before your application was approved?

5. Yes
6. No
90. Don't know

[DISPLAY Q25 ONLY IF Q24=YES]

25. Which of the following were reasons that you had to resubmit your application? (Please select all that apply)

1. Issues related to how energy savings were calculated
2. [DISPLAY IF PROGRAM=RETRO-COMMISSIONING] Other issues related to the Audit
3. [DISPLAY IF PROGRAM=NEW CONSTRUCTION-WHOLE BLDG PERF] Other issues related to the Technical Analysis study
4. Issues related to additional supporting documentation such as invoices
5. Other issues – please specify: ____________
88. Don't know

26. How did the incentive amount compare to what you expected?

1. It was much less

2. It was somewhat less
3. It was about the amount expected
4. It was somewhat more
5. It was much more
88. Don't know

EQUIPMENT SELECTION

[DISPLAY Q27 IF PROJECT = STANDARD or CUSTOM]

27. How did each of the following types of people affect your decision to install the efficient equipment?

	Provided no input	Input did not affect decision	Small effect on decision	Moderate to large effect on decision	Critical effect – could not have made decision without it	Don't know
Vendor (retailer)	()	()	()	()	()	()
Contractor (installer)	()	()	()	()	()	()
Designer or architect	()	()	()	()	()	()
Utility staff member, such as an account representative	()	()	()	()	()	()
Someone else, please specify: _______________	()	()	()	()	()	()

[DISPLAY Q28 IF ANY RESPONSES TO Q27 = "Moderate to large effect" OR "Critical effect"]

28. What did they do that affected your decision? _____ [OPEN-ENDED RESPONSE]

[DISPLAY Q29 IF PROJECT = RETRO-COMMISSIONING]

29. How did each of the following types of people effect your decision to install the efficient equipment?

	Provided no input	Input did not affect decision	Small effect on decision	Moderate to large effect on decision	Critical effect – could not have made decision without it	Don't know
Audit results	()	()	()	()	()	()
Contractor (installer)	()	()	()	()	()	()
Your Retro-commissioning Service	()	()	()	()	()	()

Provider						
Ameren Missouri staff member, such as an account representative	()	()	()	()	()	()
Someone else, please specify: ______________	()	()	()	()	()	()

[DISPLAY Q30 IF ANY RESPONSES TO Q29 = "Moderate to large effect" OR "Critical effect"]

30. What did they do that affected your decision? _____ [OPEN-ENDED RESPONSE]

[DISPLAY IF PROJECT = NEW CONSTRUCTON]

31. How did each of the following types of people effect your decision to install the efficient equipment?

	Provided no input	Input did not affect decision	Small affect on decision	Moderate to large affect on decision	Critical affect – could not have made decision without it	Don't know
The "design team" process	()	()	()	()	()	()
General Contractor	()	()	()	()	()	()
Designer or architect	()	()	()	()	()	()
The Technical Analysis Study (energy modeling estimates)	()	()	()	()	()	()
Ameren Missouri staff member, such as an account representative	()	()	()	()	()	()
Someone else, please specify: ______________	()	()	()	()	()	()

[DISPLAY Q32 IF ANY RESPONSES TO Q31 = "Moderate to large effect" OR "Critical effect"]

32. What did they do that affected your decision? _____ [OPEN-ENDED RESPONSE]

[DISPLAY Q33 ONLY IF PROGRAM = STANDARD]

33. You were required to submit a completed application, along with invoices and other documentation within 180 days of installing your project. Does this time frame limit the types of projects, like HVAC, water heating or other standard upgrades that you might propose to do through the program?

10. No
11. Yes → What would you have done given more time? ______
88. Don't know

[DISPLAY Q34 ONLY IF PROGRAM = RETRO-COMMISSIONING]

34. The program expects retro-commissioning projects to have an estimated completion date within 6 months after project approval. Did this time frame limit the scope of the retro-commissioning project you undertook, like equipment upgrades or implementation of re-commissioning practices?

1. No
2. Yes → What would you have done given more time? ______

88. Don't know

[DISPLAY Q35 ONLY IF PROGRAM = STANDARD or CUSTOM OR RETRO-COMMISSIONING]

35. Did you work directly with a retailer to purchase the incentivized equipment?

1. Yes
2. No

88. Don't know

[DISPLAY Q35A IF (Q35= YES AND PROGRAM = STANDARD or CUSTOM) OR (PROGRAM = NEW CONSTRUCTION)]

35A. How long did you have to wait for the program-qualified equipment?

1. Readily available
2. Less than 1 week
3. 1-2 weeks
4. 3-4 weeks
5. 5-6 weeks
6. More than 6 weeks

88. Don't Know

36. Please rate your satisfaction with ….

	1 – Very Dissatisfied	2	3	4	5 – Very Satisfied	Not sure	Not applicable – no equipment installed
… the equipment that was installed	()	()	()	()	()	()	()
… the quality of the installation	()	()	()	()	()	()	()

[DISPLAY Q37 IF (PROGRAM = STANDARD or CUSTOM) OR (PROGRAM = RETRO-COMMISSIONING AND RETRO-COMMISSIONING CUSTOM = YES)]

37. Who installed your program-qualified equipment or efficiency upgrades?

1. Your own staff
2. A contractor you've worked with before
3. A contractor recommended by your Ameren Missouri Business Energy Efficiency program (registered trade ally)
4. A new contractor that someone else recommended
5. Other – specify: _____________

88. Don't know

MEASUREMENT AND VERIFICATION

38. After your project was completed, did a program representative inspect the work done through the program?

1. Yes
2. No

88. Don't know

[DISPLAY Q39 If Q23=1]

39. Using the scale provided, please rate your agreement with the following statements:

	1-Not at all agree	2	3	4	5-Completely agree	Don't know
a. The inspector was courteous	()	()	()	()	()	()
b. The inspector was efficient	()	()	()	()	()	()

CUSTOMER SATISFACTION

The following few questions pertain to your communications with the program staff. Program staff are anyone that reviewed your application, conducted site inspections, determined your incentive amount, or processed your incentive check. Program staff are not anyone hired by you to conduct an audit, design your system, or install your hardware.

40. In the course of doing this project did you have any interactions with program staff?

1. Yes
2. No

88. Not sure

[DISPLAY Q41 AND Q42 If Q40 = 1]

41. On the scale provided, please indicate how knowledgeable were program staff about the issues you discussed with them?

1 – Not at all knowledgeable	2	3	4	5 – Very knowledgeable	Not sure
()	()	()	()	()	()

42. On the scale provided, please indicate how satisfied are you with:

	1 – Not at all satisfied	2	3	4	5 – Very satisfied	Not sure	Not applicable – had no questions or concerns
how long it took program staff to address your questions or concerns	()	()	()	()	()	()	()
how thoroughly they addressed your question or concern	()	()	()	()	()	()	()

43. How satisfied are you with:

	1 – Not at all satisfied	2	3	4	5 – Very satisfied	Not sure
the steps you had to take to get through the program	()	()	()	()	()	()
the amount of time it took to get your rebate or incentive	()	()	()	()	()	()
the range of equipment that qualifies for incentives	()	()	()	()	()	()
the program, overall	()	()	()	()	()	()

[DISPLAY Q44 If Q41, Q42a or b, or Q43a, b, c, or d = 1 or 2]

44. Please describe the ways in which you were not satisfied with the aspects of the program mentioned above?_______

NET-TO-GROSS SECTION

Free-Ridership

45. Before you knew about the Business Energy Efficiency Program, had you purchased and installed any energy efficient equipment at this facility?

1. Yes
2. No

88. Don't know

46. Has your organization purchased any significant energy efficient equipment in the last three years for which you did not apply for a financial incentive through an energy efficiency program?

1. Yes. Our organization purchased energy efficient equipment but did not apply for incentive.

2. No. Our organization purchased significant energy efficient equipment and applied for an incentive. No significant energy efficient equipment was purchased by our organization.
3. Don't know

47. Before participating in the Business Energy Efficiency Program, had you installed any equipment or measure similar to energy efficient [Measure/Equipment Type] at this facility?

1. Yes
2. No

48. Did you have plans to install energy efficient [Measure/Equipment Type] at this facility before participating in the Business Energy Efficiency Program?

1. Yes
2. No

[DISPLAY Q49(16A.) IF Q48(16) = 1]

49. Would you have gone ahead with this planned installation even if you had not participated in the program?

1. Yes
2. No

50. How important was previous experience with the Business Energy Efficiency Program in making your decision to install energy efficient Measure/Equipment Type]?

1. Did not have previous experience with program
2. Very important
3. Somewhat important
4. Only slightly important
5. Not at all important
6. Don't know

51. Did a Business Energy Efficiency Program or other Ameren Missouri representative recommend that you install energy efficient [Measure/Equipment Type]?

1. Yes
2. No

[DISPLAY Q52 IF Q51 = 1]

52. If the Business Energy Efficiency Program representative had not recommended installing the equipment, how likely is it that you would have installed it anyway?

1. Definitely would have installed
2. Probably would have installed
3. Probably would not have installed
4. Definitely would not have installed
5. Don't know

53. Would you have been financially able to install energy efficient [Measure/Equipment Type] without the financial incentive from the Business Energy Efficiency Program?

1. Yes
2. No

54. If the financial incentive from the Business Energy Efficiency Program had not been available, how likely is it that you would have installed energy efficient [Measure/Equipment Type] anyway?

1 Definitely would have installed
2. Probably would have installed
3. Probably would not have installed
4. Definitely would not have installed
5. Don't know

55. We would like to know whether the availability of information and financial incentives through the Business Energy Efficiency Program affected the quantity (or number of units) of energy efficient [Measure/Equipment Type] that you purchased and installed at the [LOCATION].

Did you purchase and install more [Measure/Equipment Type] than you otherwise would have without the program?

1. Yes
2. No, program did not affect quantity purchased and installed.

56. We would like to know whether the availability of information and financial incentives through the Business Energy Efficiency Program affected the level of energy efficiency you chose for energy efficient [Measure/Equipment Type] at the [LOCATION].

Did you choose equipment that was more energy efficient than you would have chosen because of the program?

1. Yes

2. No, program did not affect level of efficiency chosen for equipment.

[DISPLAY 57 IF Q56 = 1]

57. How much more efficient [Measure/Equipment Type] did you install? (i.e., "xx% more efficient")

58. We would like to know whether the availability of information and financial incentives through the Business Energy Efficiency Program affected the timing of your purchase and installation of energy efficient [Measure/Equipment Type] at the [LOCATION].

Did you purchase and install energy efficient [Measure/Equipment Type] earlier than you otherwise would have without the program?

1. Yes
2. No, program did not affect did not affect timing of purchase and installation.

[DISPLAY Q59 IF Q58 = 1]

59. When would you otherwise have installed the equipment?

1. Less than 6 months later
2. 6-12 months later
3. 1-2 years later
4. 3-5 years later
5. More than 5 years later

Spillover

60. Because of your experience with the Business Energy Efficiency Program, have you bought, or are you likely to buy, energy efficient equipment without applying for a financial incentive or rebate?

1. Yes, have already bought non-incentivized efficiency equipment because of the experience with the program.
2. Yes, likely to buy efficiency equipment because of the experience with the program.
3. No
4. Don't know

[DISPLAY Q61 (IF Q60 = 2 OR 4]

61. We'd like to call you in a few months for a very short follow-up about other efficiency equipment purchases. If that would be all right. please provide us with the best person to contact and their phone number

Name

Phone number

[DISPLAY Q62 (IF Q60 = 1)]

62. What energy efficient equipment did you purchase?

63. What motivated you to install this equipment?

64. Was this equipment installed at the same facility (or facilities) as the equipment for which you received a rebate?

1. Yes
2. Don't know
3. No; Where was the equipment installed?: _________________

65. How important was your experience with the program to your decision to implement the additional energy efficiency measures?

1. Very important
2. Somewhat important
3. Neither important or unimportant
4. Somewhat unimportant
5. Unimportant
6. Don't know

66. How important was your past participation in any programs offered by Ameren Missouri to your decision to implement the additional energy efficiency measures?

1. Very important
2. Somewhat important
3. Neither important or unimportant
4. Somewhat unimportant
5. Unimportant
6. Don't know

67. Why didn’t you apply for or receive incentives for those items?

1. Didn't know whether equipment qualified for financial incentives
2. Equipment did not qualify for financial incentives
3. Too much paperwork for the financial incentive application

4. Financial incentive was insufficient
5. Didn't have time to complete paperwork for financial incentive application
6. Didn't know about financial incentives until after equipment was purchased
7. Other reason (please describe): _________________

Firmographic

68. Which of the following best describes the type of work that your firm or organization does at [LOCATION]?

1. Industrial
2. Restaurant (not fast food)
3. Fast food restaurant
4. Retail
5. Office
6. Grocery and convenience
7. School
8. Lodging
9. Warehouse
10. Other – specify: ____

88. Not sure

69. Including all the properties, how many separate work locations does your organization own or lease space in, in Ameren Missouri territory? (A work location may consist of multiple buildings in close proximity to each other, such as a university campus – please indicate the number of locations) ____________________________

70. How many square feet (indoor space) is the part of the property at [LOCATION] that your firm or organization occupies? (If your firm or organization occupies the entire property, indicate the total size of that property.)

1. Less than 5,000
2. 5,001 to 10,000
3. 10,001 to 20,000
4. 20,001 to 50,000
5. 50,001 to 75,000
6. 75,001 to 100,000

7. 100,001 to 250,000
8. 250,001 to 500,000
9. 500,001 to 1,000,000
10. More than 1,000,000

88. Not sure

Appendix F: New Construction Program Participant In-Depth Interview (IDI)

FIRM AND PROJECT DESCRIPTORS

First, I'd like to get a bit of background on the property in question and your role at the property.

I1. Can you please tell me your title or role?

I2. [Verify any database information on project - location, company name]

I2a. Which of these incentive paths sounds like the ones included in your project?

[ ] Whole Building Performance (WBP) – provides incentives for whole building energy modeling

[ ] Standard (S), including Lighting Standard (SL) - common, proven energy efficiency measures (e.g., lighting controls, appliances, refrigeration)

[ ] Custom (C) – all other things.

I2b. Which of the following best describes the kind of project you did?

[ ] No structure (NC) – that is, you built a completely new footprint.

[ ] Addition/expansion (AE)

[ ] Removal/redesign/replacement (RR) of energy consuming systems or process

[ ] "Warm shell" (WS) construction of building envelope, central mechanical systems and core lighting only

I3. What is your firm's role in the construction? [Probe to code as follows, e.g., "What aspects of the building's construction is your firm responsible for?"]

[ ] Building owner

[ ] Architect / design consultant

[ ] General contractor

[ ] Subcontractor: electrical/lighting

[ ] Subcontractor: HVAC

[ ] Subcontractor: shell

[ ] Subcontractor: other: ___

[ ] Other: ___

[ ] DK

I4. [If building owner:] Did your firm build the building at [LOCATION] to occupy for its own use or to sell or to lease to tenants?

[ ] Built to occupy for own use/occupation

[ ] Built to sell

[ ] Built to lease to tenants

[ ] Other: ___

I5. [If not building owner:] Was the building at [LOCATION] built for the owner's own use or to sell or to lease to tenants?

[ ] Built for owner to use

[ ] Built to sell

[ ] Built to lease to tenants

[ ] Other: ___

I6. [IF BUILT FOR OWNER'S USE:] What type of work does your [the building owner's] firm or organization do at [LOCATION]?

() Agricultural

() Churches and other community organizations

() Government agencies

() Grocery stores

() Health care/hospitals

() Hotels/motels

() Industrial/manufacturing plants

() Multi-family residential

() Office buildings

() Restaurants

() Retail (non-food)

() Schools, colleges, or universities

() Warehouses

() Other, specify____________________

I7. [IF BUILT TO SELL/LEASE:] What type of work is the building at [LOCATION] being built for?

() Agricultural

() Churches and other community organizations

() Government agencies

() Grocery stores

() Health care/hospitals

() Hotels/motels

() Industrial/manufacturing plants

() Multi-family residential

() Office buildings

() Restaurants

() Retail (non-food)

() Schools, colleges, or universities

() Warehouses

() Other, specify___________________

() Don't know

AWARENESS AND APPLICATION

A1. Please tell me how your firm came to apply for Ameren Missouri New Construction incentives, including how the discussion got started and who played what role in the decision:

[Probe about:

How they became aware of the New Construction incentives.

Who initiated discussion - program rep, vendor, designer, etc.

Role that vendors/retailers, contractors, designers, etc. played and how that affected decision]

A2. Including yourself, who all was involved in completing the application for New Construction incentives? What was each person's involvement?

A3. Please describe the application process:

[Probe about:

Version of form - Excel spreadsheet, PDF version, a paper version, or other format

Method of submitting - email, fax, mail, other

Where they got form - website, program rep, trade ally, etc.]

A4. And how was your experience with the application paperwork?

[Probe about:

Clarity of information on how to complete the application

Information that needs to be clarified

Ease of finding application]

A5. On a scale of 1 to 5, where 1 means “not at all clear” and 5 means “completely clear,” please rate the clarity of information on how to complete the application.

[Insert scale including “don’t know” and “not applicable” options]

A6. What suggestions do you have, if any, for the application forms?

A7. And what suggestions do you have, if any, for the approval process?

PROJECT DECISION MAKING

P1. How did your firm decide which efficiency measures to incorporate into the building design?

[Probe about influence of:

Vendor/retailer, contractor, designer, program rep

Information on savings potentials on application and associated documentation

Audit/Technical Analysis Study

Other program technical assistance

Incentive levels]

P2. Did your firm decide not to include any program-recommended energy efficiency equipment or construction practices in the building design? If so, what were they? Why did you decide not to include them?

P3. In addition to the incentives you received, are you aware of any other Ameren Missouri incentives for new and existing buildings? If so, which ones?

[Probe about existing buildings and other new construction incentives - e.g.,

"Did you know that there were different incentive paths available for new construction projects?"

Standard, Custom, Lighting Incentives or Whole Building Performance Path for NC]

P4. How well did the New Construction program’s range of incentive options or paths fit your needs?

P5. Did the program disqualify any equipment types or construction practices that you think would have saved energy? If so, what were they?

P6. What changes would you suggest to the range of equipment types or construction practices that qualify for program incentives?

P7. Why did you select the [PATH] incentive path that you chose rather than [OTHER PATHS]?

EXPERIENCE WITH PROCESSES, REQUIREMENTS, STAFF

E1. Overall, how was your experience with the New Construction program's processes and requirements?

[Probes:

What aspects of participation, if any, did you find surprising?

What aspects, if any, did you find challenging?

[If needed, mention: multiple meetings/stages, documentation requirements, inspections]

E2. On a scale of 1 to 5, where 1 means “not at all satisfied” and 5 means “very satisfied,” please rate your satisfaction with the following:

	Not at all satisfied 1	2	3	4	Very satisfied 5	DK	NA	Reason NA
The steps you had to take to get through the program	()	()	()	()	()	()	()	
The range of equipment that qualifies for incentives	()	()	()	()	()	()	()	
The number of design meetings with program staff	()	()	()	()	()	()	()	
The quality of your interactions with program staff	()	()	()	()	()	()	()	
The amount of documentation you were required to provide	()	()	()	()	()	()	()	
Any inspections the program carried out at your work site	()	()	()	()	()	()	()	
The program, overall	()	()	()	()	()	()	()	
Ameren Missouri	()	()	()	()	()	()	()	

E3. Did you know who to contact for information about any aspect of the application process or program requirements?

[Probe about: Design Team meetings]

E4. Please describe your experiences with getting information about the process or requirements.

[Probe about:

Staff knowledgeability

Speed of response

Thoroughness of response]

E5. What could the program do to keep you better informed about the process or requirements?

E6. Please tell me about your experience with the equipment you chose and the installation.

[Probe about: Any equipment delivery issues, equipment performance, quality of installation, range of incentive-qualifying equipment]

Equipment Installed	Experience with Equipment
Lighting:	
HVAC:	
Motors/controls:	
Shell:	
Other:	

E7. How did the incentive amount compare to what you expected? [Probe to code, do not read]

() More

() About as expected

() Less than expected

() Other/comments:______________________________

E8. In what ways, if any, did working with Ameren Missouri's New Construction program help improve the construction project?

[Probe about:

Financing

Finding contractors for the construction phase

Construction improvements other than energy efficiency]

E9. [IF NOT ALREADY ADDRESSED] In what ways could the program be improved?

[Probe about:

Financing support

Contractor selection

Construction methods]

SPILLOVER

I have a few questions about how your experience with the Ameren Missouri New Construction program may have influenced other decisions you have made about energy-using equipment.

S1. Because of your experience with the New Construction Program, have you bought, or are you likely to buy, energy efficient equipment without applying for a financial incentive or rebate from Ameren Missouri?

( ) Yes, have already bought non-incentivized efficiency equipment because of the experience with the program.

( ) Yes, likely to buy efficiency equipment because of the experience with the program.

( ) No

( ) Don't know

[IF DID NOT BUY NON-INCENTED EQUIPMENT, SKIP TO FIRMOGRAPHICS]

S2. What energy efficient equipment did you purchase? (Interviewer: Select each applicable type and record specific equipment)

[ ] Lighting:

[ ] HVAC:

[ ] Motors/controls:

[ ] Shell:

[ ] Other:

S3. Was this equipment installed at the same facility (or facilities) as the equipment for which you received a rebate, at [LOCATION]?

( ) Yes

( ) Don't know

( ) No; Where was the equipment installed?: _________________

S4. How important was your experience with the program on your decision to implement the additional energy efficiency measures?

( ) Very important

( ) Somewhat important

( ) Neither important or unimportant

( ) Somewhat unimportant

( ) Unimportant

( ) Don't know

S5. How important was your past participation in any programs offered by Ameren Missouri to your decision to implement the additional energy efficiency measures?

( ) Very important

( ) Somewhat important

( ) Neither important or unimportant

( ) Somewhat unimportant

( ) Unimportant

( ) Don't know

( ) Not applicable

S6. Why didn’t you apply for or receive incentives for those items?

( ) Didn't know whether equipment qualified for financial incentives

( ) Equipment did not qualify for financial incentives

( ) Too much paperwork for the financial incentive application

( ) Financial incentive was insufficient

( ) Didn't have time to complete paperwork for financial incentive application

( ) Didn't know about financial incentives until after equipment was purchased

( ) Other reason (please describe): _________________

( ) Don’t know

FIRMOGRAPHICS AND ENERGY PRACTICES

I’d like to learn a little more about your firm so we can better understand the market that the New Construction program serves.

F1. In total, how many buildings has your firm built in Ameren Missouri territory in the past two years and how many does it plan to build in the next few years?

F2. [IF PLANNING TO BUILD:] For how many is it in the design phase now?

F3. How many separate locations does your organization own or lease for its own use in Ameren Missouri territory?

F4. [IF INDICATED BUILDING PLANS ABOVE:] Will your firm again apply for Ameren Missouri incentives?

a. [IF NOT:] Why not?

b. [IF YES:] Which types of Ameren Missouri incentives do you expect to apply for in the future?

__Existing buildings (Standard or Custom) lighting

__Existing buildings non-lighting (specific measure)_________________

__New Construction

__Retro-Commissioning

__Not sure

F5. [IF WILL NOT APPLY FOR INCENTIVE:] Does your firm plan to design future buildings to at least the same level of energy efficiency as the building that received Ameren Missouri New Construction incentives?

[IF NOT:] Why not?

F6. How many square feet of indoor space is the property at [LOCATION] that your firm received New Construction incentives for?

F7. How many employees do you have at that location?F8. [IF BUILT TO LEASE:] What, if anything, does you company do monitor or manage energy use in buildings it leases to others?

[Probes:

Staff who monitor or manager energy use,

Any defined energy savings or carbon reduction goals,

Policy related to purchase of EE equipment]

F9. [ALL:] What, if anything, does your company do to monitor or manage energy use in buildings it occupies?

[Probes:

staff who monitor or manager energy use,

any defined energy savings or carbon reduction goals,

policy related to purchase of EE equipment]

That is all the questions I have. Thank you for your time.

Appendix G: Retro-commissioning Program Participant In-Depth Interview (IDI)

FIRM AND PROJECT DESCRIPTORS

First, I'd like to get a bit of background on the property in question and your role at the property.

I1. Can you please tell me your title or role?

I2. [Verify any database information on project - project type/path, location, company name.]

I3. Do you own, lease, or rent the facility at [LOCATION]?

[ ] Own

[ ] Lease/rent

I4. What type of work does your firm or organization do at [LOCATION]?

[ ] Agricultural

[ ] Churches and other community organizations

[ ] Government agencies

[ ] Grocery stores

[ ] Health care/hospitals

[ ] Hotels/motels

[ ] Industrial/manufacturing plants

[ ] Multi-family residential

[ ] Office buildings

[ ] Restaurants

[ ] Retail (non-food)

[ ]Schools, colleges, or universities

[ ] Warehouses

[ ] Other, specify___________________

AWARENESS AND APPLICATION

A1. Please tell me how your firm came to apply for Ameren Missouri Retro-commissioning incentives, including how the discussion got started and who played what role in the decision?

[Probe about:

How they became aware of the Retro-commissioning incentives.

Who initiated discussion - program rep, vendor, energy auditor, etc.?

Role that vendors, contractors, auditors, etc. played and how that affected decision]

A2. [IF NOT ALREADY ADDRESSED] Including yourself, who all was involved in completing the application for Retro-commissioning incentives? What was each person's involvement?

A3. Please describe the application process:

[Probe about:

Version of form - Excel spreadsheet, PDF version, a paper version, or other format

Method of submitting - email, fax, mail, other

Where they got form - website, program rep, trade ally, auditor, etc.]

A4. And how was your experience with the application paperwork?

[Probe about:

Clarity of information on how to complete the application

Information that needs to be clarified

Ease of finding application]

A5. On a scale of 1 to 5, where 1 means “not at all clear” and 5 means “completely clear,” please rate the clarity of information on how to complete the application.

() 1

() 2

() 3

() 4

() 5

() DK

() N/A – explain why:

A6. Do you have any suggestions for streamlining the application forms or the approval process?

PROJECT DECISION MAKING

Now I'd like to focus on your retro-commissioning project

P1. How did your firm decide what to do for your retro-commissioning project?

a. [IF NOT COVERED:] And how was your retro-commissioning project influenced by…

Retro-commissioning Service Provider?

Recommendations outlined in energy audit report?

Payback calculations for recommended upgrades

Incentive for select equipment?

b. What else influenced how you decided on the scope of your project?

P2. Did your firm decide not to pursue any of the efficiency opportunities recommended by your Retro-commissioning Service Provider? If so, what were they and why did you decide not to include them?

P3. In addition to the support you received for retro-commissioning, what other Ameren Missouri incentives for new or existing commercial buildings are you aware of?

[Probe about incentives for efficiency equipment for new or existing building - e.g.,

"Have you heard about incentives for lighting and other equipment upgrades for new construction projects or existing buildings?"]

P4. The Retro-commissioning program provided three optimization options - building optimization, compressed air optimization, and refrigeration optimization. How well did the range of options fit the needs at your facility?

[IF INCENTIVE PATH = "C" Custom measures included]

a. In addition to optimizing current equipment [with a payback of less than 18 months], you had some equipment installed that had an 18 month or longer payback. Before getting your audit report, did you know about the energy savings potential from equipment replacement? (Y/N with text boxes)

[ALL]

P5. Did the program disqualify any equipment types or optimization measures that you think would have saved energy? If so, what were they?

P6. What changes would you suggest to the range of equipment optimization or upgrades that qualify for Retro-commissioning program incentives?

[IF INCENTIVE PATH = "R" Retro-commissioning only

P7. Your project included optimizing current equipment, but not the replacement of any equipment that had a payback from energy savings greater than or equal to 18 months.

Did you know that the program also provides incentives for equipment replacement that save energy? [You might have heard about the option to do “custom” upgrades]

EXPERIENCE WITH PROCESSES, REQUIREMENTS, STAFF

Now I’d like to get your views on what it was like to do a project through Ameren Missouri MO’s program.

E1. Overall, please describe experience with the Retro-commissioning program's processes and requirements regarding the following aspects:

[Probes:

What aspects of participation (application, audit, meetings with RSP, inspections), if any, did you find surprising?

What aspects, if any, did you find challenging?

[If needed, mention: multiple stages, audit and documentation requirements, and inspections]

E2. On a scale of 1 to 5, where 1 means “not at all satisfied” and 5 means “very satisfied,” please rate your satisfaction with the following:

	Not at all satisfied 1	2	3	4	Very satisfied 5	DK	NA	Reason NA
The steps you had to take to get through the program	()	()	()	()	()	()	()	
The range of energy-saving measures that qualify for incentives	()	()	()	()	()	()	()	
The complexity of the process	()	()	()	()	()	()	()	
The quality of your interactions with program staff	()	()	()	()	()	()	()	
The amount of documentation you were required to provide	()	()	()	()	()	()	()	
The quality of the audit	()	()	()	()	()	()	()	
The program, overall	()	()	()	()	()	()	()	
Ameren Missouri	()	()	()	()	()	()	()	

E3. Did you know who you could go to for information about any aspect of the application process or program requirements?

[Probe about: knowing how to contact Retro-commissioning Service Provider (RSP) and other program representatives, or ability to get needed info from Ameren Missouri MO website]

E4. And can you tell me about any experience you had with getting information about the process or requirements?

[Probe about:

RSP knowledge of program requirements

Other program staff knowledge of program requirements

Speed of response to your questions

Thoroughness of response]

E5. What could the program or its representatives do, if anything, to keep you better informed about the process or requirements?

E6. Please tell me about your experience with the optimization work that was done as well as with any equipment you chose.

[Probe about:

Any equipment delivery issues

Equipment performance

Quality of installation

Range of incentive-qualifying equipment]

Optimization work:

Equipment type, note experience with each

Lighting:

HVAC:

Motors/controls:

Shell:

Other:

E7. How did the incentive amount compare to what you expected? [Do not read, probe to code]

() More

() About as expected

() Less

() Other: _______________

E8. In what ways, if any, did working with your Retro-commissioning Service Provider help you decide the best way to carry out the retro-commissioning project?

a. And how did the Retro-commissioning Service Provider help you going forward – that is, to maintain the improvements achieved at the time the optimization was initially completed?

[Probe about:

RSP training of facility staff

Provision of clear documentation

Finding contractors for monitoring and maintaining settings

Anything else?]

E9. In what ways could the program be improved?

[Probe about:

Financing support

RSP selection

Level of information provided in audit report

Equipment selection that qualified for incentives

Anything else?]

SPILLOVER

I have a few questions about how your experience with the Ameren Missouri Retro-commissioning program may have influenced other decisions you have made about energy-using equipment.

S1. Because of your experience with the Retro-commissioning Program, have you done, or are you likely to do, other optimization projects without applying for a financial incentive or rebate from Ameren Missouri?

( ) Yes, have already done other optimizing project(s) without an incentive because of the experience with the program

( ) Yes, likely to do other optimizing project(s) without an incentive because of the experience with the program

( ) Yes, have done both

( ) No

( ) Don't know

S2. Because of your experience with the Retro-commissioning Program, have you bought, or are you likely to buy, energy efficient equipment without applying for a financial incentive or rebate from Ameren Missouri?

( ) Yes, have already bought non-incentivized efficiency equipment because of the experience with the program

( ) Yes, likely to buy non-incentivized efficiency equipment because of the experience with the program

( ) No

( ) Don't know

S3. [IF LIKELY TO DO OPTIMIZATION PROJECT OR BUY NON-INCENTED EQUIPMENT] We'd like to call you in a few months for a very short follow-up about other efficiency equipment purchases. If that would be all right. please provide us with the best person to contact and their phone number

Name

Phone number

[IF DID NOT DO OTHER OPTIMIZATION PROJECT OR BUY NON-INCENTED EQUIPMENT BECAUSE OF THE PROGRAM, SKIP TO FIRMOGRAPHICS]

[ADAPT FOLLOWING QUESTIONS, AS NEEDED, TO WHAT THE RESPONDENT REPORTED IN FIRST TWO QUESTIONS OF THIS SECTION. FOR EXAMPLE, IF RESPONDENT DID OPTIMIZATION PROJECT BUT DID NOT BUY EQUIPMENT, ASK ABOUT THE OPTIMIZATION PROJECT; IF RESPONDENT DID BOTH, AS ABOUT BOTH]

S4. What energy efficient equipment did you purchase / optimizing projects did you do?

Optimization:

Lighting:

HVAC:

Motors/controls:

Shell:

Other:___________________

S5. Was this equipment installed / this project done at the same facility (or facilities) where the optimization work was done for which you received a rebate, at [LOCATION]?

( ) Yes

( ) Don't know

( ) No; Where was the equipment installed? _________________

S6. How important was your experience with the program to your decision to buy that equipment / do those projects?

( ) Very important

( ) Somewhat important

( ) Neither important or unimportant

( ) Somewhat unimportant

( ) Unimportant

( ) Don't know

S7. How important was your past participation in any programs offered by Ameren Missouri to your decision to implement the additional energy efficiency measures?

( ) Very important

( ) Somewhat important

( ) Neither important or unimportant

( ) Somewhat unimportant

( ) Unimportant

( ) Don't know

( ) Not applicable

S8. Why didn't you apply for or receive incentives for those items?

[ ] Didn't know whether equipment / project type qualified for financial incentives

[ ] Equipment / project type did not qualify for financial incentives

[ ] Too much paperwork for the financial incentive application

[ ] Financial incentive was insufficient

[ ] Didn't have time to complete paperwork for financial incentive application

[ ] Didn't know about financial incentives until after equipment was purchased / project was completed

[ ] Other reason (please describe): ________________

[ ] Don't know

FIRMOGRAPHICS AND ENERGY PRACTICES

I'd like to learn a little more about your firm so we can better understand the market that the Retro-commissioning program serves.

F1. How many separate locations does your organization own or lease for its own use in Ameren Missouri territory?

F2. In how many of these locations would retro-commissioning, or compressed air or refrigeration optimization be applicable?

F3. How many square feet of indoor space is the property at [LOCATION] that your firm received Retro-commissioning incentives for?

F4. How many employees do you have at that location?

F5. [IF MORE THAN ONE LOCATION] And how many employees at all locations, all together?

F6. What, if anything, does your company do to monitor or manage energy use in buildings it occupies?

[Probes:

staff who monitor or manager energy use,

any defined energy savings or carbon reduction goals,

policy related to purchase of EE equipment]

F7. Will your firm apply again for Ameren Missouri incentives?

a. [IF NOT:] Why not?

b. [IF YES:] Which types of Ameren Missouri incentives do you expect to apply for in the future?

__Existing buildings (Standard or Custom) lighting

__Existing buildings non-lighting (specify measure)_________________

__New Construction

__Retro-Commissioning

__Not sure

That is all the questions I have. Thank you for your time.

Appendix H: Standard and Custom Program Near-Participant In-Depth Interview (IDI)

FIRM AND PROJECT DESCRIPTORS

First, I'd like to get a bit of background on your role and the project or projects that you were looking into doing. All my questions will refer only to the project or projects that that you were looking into Ameren Missouri for incentives for and to the properties where you were planning to do those projects.

I1. Can you please tell me your title or role?

I2. [Verify location for each discontinued project]

I3. Do you own, lease, or rent the facility at those locations?

( ) Own

( ) Lease

( ) Rent

( ) Mix of own/lease/rent - explain: ________

( ) Don't know

I4. [IF NO INCENTIVE PATH INDICATED] I don't have details on the project you were looking into incentives for. Was it an equipment upgrade in an existing building, a new construction, or a retro-commissioning project?

( ) Equipment upgrade (Standard/Custom)

( ) New Construction (go to NC guide)

( ) Retro-commissioning (go to RCx guide)

( ) Other – specify: ______

( ) Don't know

I4a. [IF I4 = "Equipment upgrade (Standard/Custom)":] Ameren Missouri offers two ways to get incentives for equipment upgrades. One is the Standard incentive, which provides fixed incentives for common, proven energy efficient measures. The other is the Custom path, for non-standard efficiency measures, where the incentive is based on the estimated energy savings, which must be calculated specifically for each project. Which of those were you thinking about?

( ) Standard

( ) Custom

( ) Had not yet decided

( ) Other – specify: ______

[IF INCENTIVE PATH KNOWN/ASSIGNED, PIPE-IN/DISPLAY COMPANY'S INCENTIVE PATHS: _________________]

AWARENESS AND APPLICATION

A1. Please tell me how your firm came to apply for Ameren Missouri BizSavers incentives, including how the discussion got started and who played what role in the decision.

[Probe about:

How they became aware of the incentives.

Who initiated discussion - program rep, vendor, energy auditor, etc.

Role that vendors/retailers, contractors, auditors, etc. played and how that affected decision]

A2. Including yourself, who all was involved in completing the application for BizSavers incentives? What was each person's involvement?

A3. Please describe the application paperwork you completed.

[Probe about:

Version of form - Excel spreadsheet, PDF version, a paper version, or other format

Method of submitting - email, fax, mail, other

Where they got form - website, program rep, trade ally, etc.]

A4. And how was your experience with the application paperwork?

[Probe about:

Clarity of information on how to complete the application

Information that needs to be clarified

Ease of finding application]

A5. What suggestions, if any, do you have for streamlining the application forms or the approval process?

EXPERIENCE WITH PROCESSES, REQUIREMENTS, STAFF

E1. Please summarize the processes and steps your firm went through before deciding not to continue with the process.

E2. Overall, how was your experience with the Ameren Missouri BizSavers program's processes and requirements?

[Probes:

What aspects of participation [application, documentation requirements, etc.], if any, did you find surprising?

What aspects, if any, did you find challenging?

E3. On a scale of 1 to 5, where 1 means “not at all satisfied” and 5 means “very satisfied,” please rate your satisfaction with the following aspects of the program:

	Not at all satisfied 1	2	3	4	Very satisfied 5	DK	NA	Reason NA
The steps you had to take to get through the program	()	()	()	()	()	()	()	
The range of equipment that qualifies for incentives	()	()	()	()	()	()	()	
The quality of your interactions with program staff	()	()	()	()	()	()	()	
The amount of documentation you were required to provide	()	()	()	()	()	()	()	
Any inspections the program carried out at your work site	()	()	()	()	()	()	()	
The program, overall	()	()	()	()	()	()	()	
Ameren Missouri	()	()	()	()	()	()	()	

E4. And why did you decide not to continue with the process?

[Probe about:

- Program requirements (e.g., clarity, documentation, time)
- Staff (e.g., knowledgeability, responsiveness, courtesy)

- Equipment choice or range of program incentive options or paths (standard vs. custom, lighting vs. non-lighting)
- Incentive amounts
- Stage of process when they decided not to continue

E5. Did you discuss your reasons with anyone from the program? If so, how did program staff respond to your concerns?

E6. In addition to the incentives you were investigating, what other Ameren Missouri incentives for commercial buildings are you aware of?

> [Probe about incentives for efficiency equipment for new or existing building - e.g.,
>
> "Have you heard about incentives for lighting and other equipment upgrades for new construction projects or for retro-commissioning existing equipment?"]

E6a. [IF DID NOT CONSIDER CUSTOM INCENTIVE PATH] Are you aware that incentives are available for equipment that doesn't qualify for the Standard path, through the Custom incentive path?

E6b. [IF DID NOT CONSIDER STANDARD INCENTIVE PATH] Are you aware that incentives are available for certain lighting and non-lighting equipment through the Standard incentive path?

E7. [IF AWARE OF OTHER INCENTIVES] Have you applied for any of those incentives we have been talking about?

> IF NOT:
>
> Why not?

E8. In what ways could the program be improved?

> [Probe about:
>
> Equipment selection that qualified for incentives
>
> Anything else?]

SPILLOVER

I have a few questions about how your experience with program may have influenced other decisions you have made about energy-using equipment.

S1. Because of your experience with the BizSavers Program, have you bought, or are you likely to buy energy efficient equipment without applying for a financial incentive or rebate from Ameren Missouri?

( ) Yes, have already bought non-incentivized efficiency equipment because of the experience with the program

( ) Yes, likely to buy efficiency equipment because of the experience with the program

( ) No

( ) Don't know

[IF DID NOT BUY NON-INCENTED EQUIPMENT, SKIP TO FIRMOGRAPHICS]

S2. What energy efficient equipment did you purchase? Specify equipment

[ ] Lighting

[ ] HVAC

[ ] Motors/controls

[ ] Shell

[ ] Other:_______________

S3. Was this equipment installed at any of the properties that I was asking you about before? [IF NEEDED: I mean, at any of the properties for which you began, but did not complete, an application for Ameren Missouri incentives.]

( ) Yes

( ) Don't know

( ) No; Where was the equipment installed? __________________

S4. How important was your experience with the program to your decision to implement the additional energy efficiency measures?

( ) Very important

( ) Somewhat important

( ) Neither important or unimportant

( ) Somewhat unimportant

( ) Unimportant

( ) Don't know

S5. How important was your past participation in any programs offered by Ameren Missouri to your decision to implement the additional energy efficiency measures?

( ) Very important

( ) Somewhat important

( ) Neither important or unimportant

( ) Somewhat unimportant

( ) Unimportant

( ) Don't know

( ) Not applicable

S6. Why didn't you apply for or receive incentives for those items?

( ) Didn't know whether equipment qualified for financial incentives

( ) Equipment did not qualify for financial incentives

( ) Too much paperwork for the financial incentive application

( ) Financial incentive was insufficient

( ) Didn't have time to complete paperwork for financial incentive application

( ) Didn't know about financial incentives until after equipment was purchased

( ) Other reason (please describe): _________________

( ) Don't know

FIRMOGRAPHICS AND ENERGY PRACTICES

I'd like to learn a little more about your firm so we can know can better understand the market that the BizSavers program serves.

F1. How many separate locations does your organization own or lease for its own use in Ameren Missouri territory?

F2. In how many of these locations would the BizSavers incentive program be applicable?

F3. Will your firm consider applying for Ameren Missouri incentives in the future?

a. [IF NOT:] Why not?

b. [IF YES:] Which types of Ameren Missouri incentives do you expect to apply for in the future?

i. __Existing buildings (Standard or Custom) lighting

ii. __Existing buildings non-lighting (specify measure)________________

iii. __New Construction

iv. __Retro-Commissioning

v. __Not sure

F4. How many square feet of indoor space is the property or properties I was asking about? [IF NEEDED: I mean, at any of the properties for which you began, but did not complete, an application for Ameren Missouri incentives.]

F5. How many employees do you have at that property/those properties?

F6. What, if anything, does your company do to monitor or manage energy use in buildings it occupies?

[Probes:

staff who monitor or manager energy use,

any defined energy savings or carbon reduction goals,

policy related to purchase of EE equipment]

That is all the questions I have. Thank you for your time.

Appendix I: Cost Effectiveness - Critical Technical Data

The following appendix presents the critical technical data used to develop the cost effectiveness test results, at the portfolio and program level. ADM contracted with a third party, Morgan Marketing Partners (MMP), to conduct the cost effectiveness analysis. ADM worked closely with MMP to assess the appropriateness of the inputs and to interpret the results.

One of the key objectives of the economic modeling was to assure that the analysis was comparable to the Ameren MO's planning analysis. This allows Ameren MO to compare evaluated results with the expected numbers within the plan. To accomplish this several steps were taken. First, the same analysis tool was used, DSMore. Second, the economic and financial assumptions used for developing the model were obtained from Ameren MO. Some of those assumptions include:

- Discount Rate = 6.95%
- Line losses = 4.84%
- Summer Peak would occur during the 16th hour of a July day on average
- Avoided Electric T&D = $31.01/kW
- Escalation rates for different costs occur at the component level with separate escalation rates for fuel, capacity, generation, T&D and customer rates carried out over 25 years.

The third step was to acquire the "Batch Tools" used by Ameren MO for input into DSMore. These batch tools are the input data for the model to run. By starting with the original DSMore Batch Tool used by Ameren MO and only modifying appropriate cells with new data from the evaluation, consistency again occurs. In particular the assumptions in the model are driven by measure loadshapes which tells the model when to apply the savings during the day. This assures that the loadshape for that end use matches the system peak impacts of that end use and provides the correct summer coincident savings. Measure lifetime assumptions were based on the Ameren MO measures database or the Missouri TRM that was used for planning, which was also included in the Batch Tool. Incremental costs for the measures were also in the Batch Tools received and not altered from the original planning assumptions.

The fourth step in the process was to acquire the 2013 Ameren MO spending data. This is the actual spending for 2013 broken down into implementation (contractor costs), incentives and administration (other portfolio costs), as shown in Table I-4. These numbers are applied at the program level not the measure level. While applying incentives at the measure level is useful for planning purposes, it is unnecessary for the cost effectiveness modeling as the results are based on the program overall. This approach avoids any errors in application of the incentives by measure especially if incentives changed for a measure during the year. Administrative costs including Evaluation, Potential Study costs and Data Tracking were applied in the portfolio summary analysis, not by program as they apply to the whole effort.

Table I-4 Ameren Missouri Spending Data 2013

Ameren Missouri Energy Efficiency Expenses 2013			
C&I EE PROGRAM COSTS (2013)	**Contractor Costs**	**Incentive Costs**	**Total Costs**
Prescriptive	$1,293,655	$1,030,176	$2,323,831
Custom	$3,475,284	$3,106,047	$6,581,331
Retro-commissioning	$295,352	$25,282	$320,635
New Construction	$346,832	$18,162	$364,994
Business - Other			$0
Total C&I Programs	$5,411,123	$4,179,668	$9,590,791
OTHER PORTFOLIO COSTS (2013)			
Business Evaluation, Measurement, & Verification	$529,487		$529,487
Potential Study Costs	$379,918		$379,918
Data Tracking Costs	$96,066		$96,066
Total Other	$1,005,471	$0	$1,005,471
Total Portfolio Costs	**$6,416,594**	**$4,179,668**	**$10,596,261**

Each cost test provides a benefit-cost ratio that reflects the net benefit or cost to a specific stakeholder. For example, the Utility Cost Test (UTC) takes into account all program costs and benefits from the utility (or program administrator) perspective, to demonstrate how the program impacts the utility relative to other program stakeholders. If the ratio is less than one, the costs outweigh the benefits; if the ratio is greater than one, the benefits outweigh the costs. **Error! Not a valid bookmark self-reference.** below is a summary of benefit and cost inputs for each cost test.

Table I-5 Summary of Benefits and Costs Included in each Cost Effectiveness Test[41]

Test	Benefits	Costs
UTC	Perspective of utility, government agency, or third party implementing the program	
	▪ Energy-related costs avoided by the utility, ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution	▪ Program overhead costs ▪ Utility/program administrator incentive costs, ▪ Utility/program administrator installation costs
TRC	Benefits and costs from the perspective of all utility customers (participants and non-participants) in the utility service territory	
	▪ Energy-related costs avoided by the utility, ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution, ▪ Additional resource savings ▪ Applicable tax credits	▪ Program overhead costs, ▪ Program installation costs, ▪ Incremental measure costs (Whether paid by the customer of utility)
RIM	Impact of efficiency measure on non-participating ratepayers overall	
	▪ Energy-related costs avoided by the utility, ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution	▪ Program overhead costs, ▪ Utility/program administrator incentive costs, ▪ Utility/program administrator installation costs, ▪ Lost revenue due to reduced energy bills
PCT	Benefits and costs from the perspective of the customer installing the measure	
	▪ Bill savings, ▪ Incremental installation costs ▪ Applicable tax credits or incentives	▪ Incentive payments, ▪ Incremental equipment costs

*Incentives are considered incremental measure costs

The following sections provide a detailed review of the cost test results at the portfolio and program levels. The majority of costs and savings are presented on a net basis, meaning that the net-to-gross ratio was applied to account for the impact of free ridership and spillovers. However, the participant borne costs, as applied to the Participant Cost Test (PCT), are presented on a gross basis. For the PCT, the participant cost is based on what a single customer sees as the value times the number of participants.

[41] EPA, Understanding Cost-Effectiveness of energy efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers, 2008. http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf, pg. 3-2

BizSavers Portfolio Level Cost Test Inputs

The key financial benefit and cost inputs for the portfolio level Utility Costs Test (UCT) are provided below in Table I-6. Ameren MO's avoided cost of energy is $54 million (energy savings). Incentives and overhead totaled $10.6 million, which yields a benefit-cost ratio of 5.10. The UCT results show that the energy saved is approximately five and half times greater than the portfolio costs, from the utility perspective.

Table I-6 Utility Cost Test (UCT) Inputs and Results - Portfolio Level

UCT Calculations		
	Benefits	**Costs**
Avoided Electric Production	$38,953,516.21	
Avoided Electric Capacity	$10,601,021.07	
Avoided T&D Electric	$4,448,256.92	
Incentives		$4,169,133.36
Program overhead costs		$6,416,593.98
Total	$54,002,794.20	$10,585,727.34
UCT Benefit - Cost Ratio	5.10	

The TRC test results, shown in Table I-7, reflect the BizSavers Program impacts on all customers in the Ameren MO service territory, participants and non-participants. The program incentives, participant measure costs, and program overhead make up the total portfolio costs of $26.4 million. The benefits consist of the utility's total avoided costs of $54 million, which yields a benefit-cost ratio of 2.04. The results show that the overall portfolio benefits are more than twice as much as the costs.

Table I-7 Total Resource Cost Test (TRC) Inputs and Results - Portfolio Level

TRC Calculations		
	Benefits	**Costs**
Avoided Electric Production	$38,953,516.21	
Avoided Electric Capacity	$10,601,021.07	
Avoided T&D Electric	$4,448,256.92	
Incentives		$4,169,133.36
Participant Cost (Net)		$15,852,944.02
Program overhead costs		$6,416,593.98
Total	$54,002,794.20	$26,438,671.37
TRC Benefit - Cost Ratio	2.04	

The portfolio level RIM test reflects the program impacts on utility rates. Key inputs for the RIM test are displayed in Table I-8. The net benefits include the avoided utility costs of $54 million, and the costs of $64 million. The same costs are included in the RIM, as they are in the UCT and the TRC; however lost revenues from reduced energy bills are also included. The financial data for the RIM test yields a benefit-cost ratio of .84. The ratio suggests that rates have potential to increase over time. However, a RIM < 1 does not always mean that rates will increase, in the long term. Energy efficiency programs are designed to reduce the capacity needs of the system, which may increase or decrease rates depending on the level of capital costs saved.[42]

Table I-8 Ratepayer Impact Measure Test (RIM) Inputs and Results - Portfolio Level

RIM Calculations		
	Benefits	**Costs**
Avoided Electric Production	$38,953,516.21	
Avoided Electric Capacity	$10,601,021.07	
Avoided T&D Electric	$4,448,256.92	
Program overhead costs		$6,416,593.98
Incentives		$4,169,133.36
Lost Revenue		$53,426,676.18
Total	$54,002,794.20	$64,012,403.52
RIM Benefit - Cost Ratio	0.84	

The portfolio level PCT reflects the program impacts on the participants; the key financial inputs are displayed in Table I-9. The portfolio level benefits include the program incentives and energy bill savings, which total $61.4 million. The costs include measure incentives and gross participant costs; totaling $21.5 million and yielding a benefit-cost ratio of 2.86. The participants' energy bill savings are more than two and a half times the costs.

Table I-9 Participant Cost Test (PCT) Inputs and Results – Portfolio Level

PTC Calculations		
	Benefits	**Costs**
Bill Savings	$57,220,379.26	
Incentives	$4,169,133.36	
Incentives		$4,169,133.36
Participant Cost (Gross)		$17,328,921.16
Total	$61,389,512.62	$21,498,054.53
PTC Benefit - Cost Ratio	2.86	

[42] EPA, Understanding Cost-Effectiveness of energy efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers, 2008. http: //www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf, pg. 3-6

BizSavers Custom Program Cost Test Inputs

Each of the four cost tests were performed for each of the four BizSavers Programs, those results were rolled into the portfolio level analysis that was presented above. The following sections provide a more in-depth look at how each individual program performed from a cost-effectives perspective.

Key financial benefit and cost inputs for the custom program UCT are provided in Table I-10 below. The custom program attained $54 million in energy savings from avoided utility costs. Incentives and overhead totaled $6.6 million, which yields a benefit-cost ratio of 5.67. The UCT results show that the energy saved is approximately five and half times greater than the program costs, from the utility perspective.

Table I-10 Utility Cost Test (UCT) Inputs and Results – Custom Program

UCT Calculations		
	Benefits	**Costs**
Avoided Electric Production	$26,954,952.85	
Avoided Electric Capacity	$7,281,675.27	
Avoided T&D Electric	$3,051,448.55	
Incentives		$3,106,046.84
Program overhead costs		$3,475,283.92
Total	$37,288,076.67	$6,581,330.76
UCT Benefit - Cost Ratio	5.67	

The TRC test results, shown in Table I-11, reflect the custom program impacts on all customers in the Ameren MO service territory, participants and non-participants. The program incentives, participant measure costs, and program overhead total $19.5 million. The benefits consist of the utility's total avoided costs of $37.3 million, which yields a benefit-cost ratio of 1.93. The results show that the custom program benefits are almost twice as much as the costs.

Table I-11 Total Resource Cost Test (TRC) Inputs and Results - Custom Program

TRC Calculations		
	Benefits	**Costs**
Avoided Electric Production	$26,954,952.85	
Avoided Electric Capacity	$7,281,675.27	
Avoided T&D Electric	$3,051,448.55	
Incentives		$3,106,046.84
Participant Cost (Net)		$15,798,612.74
Program overhead costs		$3,475,283.92
Total	$37,288,076.67	$19,273,896.66
TRC Benefit - Cost Ratio	1.93	

The custom program RIM test reflects the program impacts on utility rates. Key inputs for the RIM test are displayed in Table I-12. The net benefits include the avoided utility costs of $37.3 million. The same costs are included in the RIM, as they are in the UCT and the TRC; however lost revenues from reduced energy bills are also included totaling $41.9 million. The financial data for the RIM test yields a benefit-cost ratio of .89. The ratio suggests that rates have potential to increase over time.

Table I-12 Ratepayer Impact Measure Test (RIM) Inputs and Results - Custom Program

RIM Calculations		
	Benefits	**Costs**
Avoided Electric Production	$26,954,952.85	
Avoided Electric Capacity	$7,281,675.27	
Avoided T&D Electric	$3,051,448.55	
Program overhead costs		$3,475,283.92
Incentives		$3,106,046.84
Lost Revenue		$35,340,282.55
Total	$37,288,076.67	$41,921,613.31
RIM Benefit - Cost Ratio	0.89	

The custom program PCT reflects the program impacts on the participants; the key financial inputs are displayed in Table I-9. The portfolio level benefits include the program incentives and energy bill savings, which total $41.3 million. The costs include measure incentives and gross participant costs; totaling $17.1 million and yielding a benefit-cost ratio of 2.42. The results indicate that participants' energy bill savings are more than two and a half times the costs.

Table I-13 Participant Cost Test (PCT) Inputs and Results – Custom Program

PTC Calculations		
	Benefits	**Costs**
Bill Savings	$15,798,612.74	
Incentives	$3,106,046.84	
Incentives		$3,106,046.84
Participant Cost (Gross)		$13,952,316.72
Total	$41,283,399.79	$17,058,363.56
PTC Benefit - Cost Ratio	2.42	

BizSavers Standard Cost Test Inputs

Key financial benefit and cost inputs for the standard program UCT are provided in Table I-14 below. The custom program attained $16.4 million in energy savings from avoided utility costs. Incentives and overhead totaled $2.3 million, which yields a benefit-cost ratio of 7.07. The UCT results show that the energy saved is approximately seven times greater than the program costs, from the utility perspective.

Table I-14 Utility Cost Test (UCT) Inputs and Results – Standard Program

UCT Calculations		
	Benefits	**Costs**
Avoided Electric Production	$11,786,734.98	
Avoided Electric Capacity	$3,272,736.57	
Avoided T&D Electric	$1,375,752.16	
Incentives		$1,030,176.22
Program overhead costs		$1,293,654.57
Total	$16,435,223.71	$2,323,830.79
UCT Benefit - Cost Ratio	7.07	

The TRC test results, shown in Table I-11, reflect the standard program impacts on all customers in the Ameren MO service territory, participants and non-participants. The program incentives, participant measure costs, and program overhead total $5.5 million. The benefits consist of the utility's total avoided costs of $16.4 million, which yields a benefit-cost ratio of 3.01. The results show that the custom program benefits are three as much as the costs.

Table I-15 Total Resource Cost Test (TRC) Inputs and Results - Standard Program

TRC Calculations		
	Benefits	**Costs**
Avoided Electric Production	$11,786,734.98	
Avoided Electric Capacity	$3,272,736.57	
Avoided T&D Electric	$1,375,752.16	
Incentives		$1,030,176.22
Participant Cost (Net)		$3,135,852.74
Program overhead costs		$1,293,654.57
Total	$16,435,223.71	$5,459,683.53
TRC Benefit - Cost Ratio	3.01	

The standard program RIM test reflects the program impacts on utility rates. Key inputs for the RIM test are displayed in Table I-16. The net benefits include the avoided utility costs of $16.4 million. The same costs are included in the RIM, as they are in the UCT and the TRC; however lost revenues from reduced energy bills are also included totaling $20.1 million. The financial data for the RIM test yields a benefit-cost ratio of .82. The ratio suggests that rates have potential to increase over time.

Table I-16 Ratepayer Impact Measure Test (RIM) Inputs and Results - Standard Program

RIM Calculations		
	Benefits	**Costs**
Avoided Electric Production	$11,786,734.98	
Avoided Electric Capacity	$3,272,736.57	
Avoided T&D Electric	$1,375,752.16	
Program overhead costs		$1,293,654.57
Incentives		$1,030,176.22
Lost Revenue		$17,767,568.45
Total	$16,435,223.71	$20,091,399.24
RIM Benefit - Cost Ratio	0.82	

The standard program PCT reflects the program impacts on the participants; the key financial inputs are displayed in Table I-17. The standard program benefits include the program incentives and energy bill savings, which total $19.7 million. The costs include measure incentives and gross participant costs; totaling $4.4 million and yielding a benefit-cost ratio of 4.50. The results indicate that participants' energy bill savings are four and a half times the costs.

Table I-17 Participant Cost Test (PCT) Inputs and Results – Standard Program

PCT Calculations		
	Benefits	**Costs**
Bill Savings	$18,643,305.02	
Incentives	$1,030,176.22	
Incentives		$1,030,176.22
Participant Cost (Gross)		$3,341,884.08
Total	$19,673,481.24	$4,372,060.30
PCT Benefit - Cost Ratio	4.50	

BizSavers New Construction Cost Test Inputs

Key financial benefit and cost inputs for the new construction program UCT are provided in Table I-18 below. The new construction program attained $172 thousand in energy savings from avoided utility costs. Incentives and overhead totaled $365 thousand, which yields a benefit-cost ratio of 0.47. The UCT results show that the new construction program was not cost effective from the utility perspective, with the costs almost twice as much as the energy savings.

Table I-18 Utility Cost Test (UCT) Inputs and Results– New Construction Program

UCT Calculations		
	Benefits	**Costs**
Avoided Electric Production	$119,840.59	
Avoided Electric Capacity	$36,075.11	
Avoided T&D Electric	$15,630.30	
Incentives		$18,161.96
Program overhead costs		$346,832.29
Total	$171,546.00	$364,994.25
UCT Benefit - Cost Ratio	0.47	

The TRC test results, shown Table I-19 reflect the new construction program impacts on all customers in the Ameren MO service territory, participants and non-participants. The program incentives, participant measure costs, and program overhead total $390 thousand. The benefits consist of the utility's total avoided costs of $172 thousand, which yields a benefit-cost ratio of 0.44. The results show that the new construction program costs are almost twice as much as the benefits (energy savings.)

Table I-19 Total Resource Cost Test (TRC) Inputs and Results - New Construction Program

TRC Calculations		
	Benefits	**Costs**
Avoided Electric Production	$119,840.59	
Avoided Electric Capacity	$36,075.11	
Avoided T&D Electric	$15,630.30	
Incentives		$18,161.96
Participant Cost (Net)		$24,525.39
Program overhead costs		$346,832.29
Total	$171,546.00	$389,519.64
TRC Benefit - Cost Ratio	0.44	

The new construction program RIM test reflects the program impacts on utility rates. Key inputs for the RIM test are displayed in Table I-20. The net benefits include the avoided utility costs of $172 thousand. The same costs are included in the RIM, as they are in the UCT and the TRC; however lost revenues from reduced energy bills are also included totaling $546 thousand. The financial data for the RIM test yields a benefit-cost ratio of 0.31. The ratio suggests that rates have potential to increase over time.

Table I-20 Ratepayer Impact Measurement Test (RIM) Inputs and Results - New Construction Program

RIM Calculations		
	Benefits	**Costs**
Avoided Electric Production	$119,840.59	
Avoided Electric Capacity	$36,075.11	
Avoided T&D Electric	$15,630.30	
Program overhead costs		$346,832.29
Incentives		$18,161.96
Lost Revenue		$180,943.13
Total	$171,546.00	$545,937.38
RIM Benefit - Cost Ratio	0.31	

The new construction program PCT reflects the program impacts on the participants; the key financial inputs are displayed in Table I-21. The new construction program benefits include the program incentives and energy bill savings, which total $211 thousand. The costs include measure incentives and gross participant costs, totaling $46 thousand and yielding a benefit-cost ratio of 4.64. The results indicate that participants' energy bill savings are approximately four and a half times the costs.

Table I-21 Participant Cost Test (PCT) Inputs and Results – New Construction Program

PTC Calculations		
	Benefits	**Costs**
Bill Savings	$192,901.44	
Incentives	$18,161.96	
Incentives		$18,161.96
Participant Cost (Gross)		$27,346.54
Total	$211,063.40	$45,508.50
PTC Benefit - Cost Ratio	4.64	

BizSavers Retro-Commissioning Cost Test Inputs

Key financial benefit and cost inputs for the retro-commissioning program UCT are provided in Table I-22 below. The retro-commissioning program attained $108 thousand in energy savings from avoided utility costs. Incentives and overhead totaled $321 thousand, which yields a benefit-cost ratio of 0.34. The UCT results show that the retro-commissioning program was not cost effective from the utility perspective, with the costs more than twice as much as the energy savings.

Table I-22 Utility Cost Test (UCT) Inputs and Results – Retro-Commissioning Program

UCT Calculations		
	Benefits	**Costs**
Avoided Electric Production	$91,987.79	
Avoided Electric Capacity	$10,534.11	
Avoided T&D Electric	$5,425.91	
Incentives		$14,748.34
Program overhead costs		$305,886.59
Total	$107,947.81	$320,634.93
UCT Benefit - Cost Ratio	0.34	

The TRC test results, shown Table I-19 reflect the retro-commissioning program impacts on all customers in the Ameren MO service territory, participants and non-participants. The program incentives, participant measure costs, and program overhead total $321 thousand. The benefits consist of the utility's total avoided costs of $108 thousand, which yields a benefit-cost ratio of 0.34. The results show that the retro-commissioning program costs are more than twice as much as the benefits (energy savings.)

Table I-23 Total Resource Cost Test (TRC) Inputs and Results – Retro-Commissioning Program

TRC Calculations		
	Benefits	**Costs**
Avoided Electric Production	$91,987.79	
Avoided Electric Capacity	$10,534.11	
Avoided T&D Electric	$5,425.91	
Incentives		$14,748.34
Program overhead costs		$305,886.59
Total	$107,947.81	$320,634.93
TRC Benefit - Cost Ratio	0.34	

The retro-commissioning program RIM test reflects the program impacts on utility rates. Key inputs for the RIM test are displayed in Table I-20. The net benefits include the avoided utility costs of $108 thousand. The same costs are included in the RIM, as they are in the UCT and the TRC; however lost revenues from reduced energy bills are also included totaling $458 thousand. The financial data for the RIM test yields a benefit-cost ratio of 0.24. The ratio suggests that rates have potential to increase over time.

Table I-24 Ratepayer Impact Measure Test (RIM) Inputs and Results – Retro-Commissioning Program

RIM Calculations		
	Benefits	**Costs**
Avoided Electric Production	$91,987.79	
Avoided Electric Capacity	$10,534.11	
Avoided T&D Electric	$5,425.91	
Incentives		$14,748.34
Program overhead costs		$305,886.59
Lost Revenue		$137,882.06
Total	$107,947.81	$458,516.99
RIM Benefit - Cost Ratio	0.24	

The retro-commissioning program PCT reflects the program impacts on the participants; the key financial inputs are displayed in Table I-25. The new construction program benefits include the program incentives and energy bill savings, which total $222 thousand. The costs include measure incentives and gross participant costs, totaling $22 thousand and yielding a benefit-cost ratio of 10.02. The results indicate that participants' energy bill savings are approximately ten times the costs.

Table I-25 Participant Cost Test (PCT) Inputs and Results – Retro-Commissioning Program

PCT Calculations		
	Benefits	**Costs**
Bill Savings	$206,819.85	
Incentives	$14,748.34	
Incentives		$14,748.34
Participant Cost (Gross)		$7,373.83
Total	$221,568.19	$22,122.17
PCT Benefit - Cost Ratio	10.02	

Cost of Conserved Energy (CCE)

The cost of conserved energy (CCE) by program describes the costs of acquiring the lifetime benefits of program energy savings. CCE takes into consideration the present value lifetime benefits (energy savings) produced by an energy efficiency program compared to the net present value of program costs. From a planning perspective, it is an indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice. Table I-26 provides the data inputs that were used to develop the BizSavers CCE figures.

Table I-26 BizSavers CCE Inputs and Results

Program	Lifetime savings kWh	NPV Program Costs	CCE $/kWh
Portfolio	$984,402,733.15	$10,596,261.48	$0.01
Custom	$663,274,050.42	$6,581,330.76	$0.01
Standard	$315,536,511.60	$2,323,830.79	$0.01
RCx	$2,345,922.59	$320,634.93	$0.14
NC	$3,246,248.54	$364,994.25	$0.11

Appendix J: Glossary of Terms

Adjustments: Modifications on ex ante analysis conditions (e.g. hours of lighting operation) because of observations made by ADM field technicians during the measurement and verification (M&V) on-site visit, which change baseline energy or energy demand values.

Baseline: The projected scenario where the subject project or program was not implemented. Baseline conditions are sometimes referred to as “business-as-usual” conditions. Baselines are defined as either project-specific baselines or performance standard baselines.

Confidence (level): A confidence level is a value that indicates the reliability of a calculated estimate from a sample. A higher confidence level indicates a stronger estimate that is more likely to lie within the population parameter. It is an indication of how close an estimated value derived from a sample is to the true population value of the quantity in question. The confidence level is the likelihood that the evaluation has captured the true impacts of the program within a certain range of values (i.e., precision).

Cost-effectiveness: The present value of the estimated benefits produced by an energy efficiency program compared to the estimated total costs to determine if the proposed investment or measure is desirable (e.g., whether the estimated benefits exceed the estimated costs from a societal perspective). It is an indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice.

Cost of Conserved Energy (CCE): The additional cost that must be invested in order to implement a long-term energy-saving strategy or feature; e.g., the cost to a homeowner to install a green roof on his house or a solar heater for his swimming pool. In these examples, CCE may include not only the cost of the installation itself but the interest on money borrowed to pay for it.

Deemed Savings: An estimate of the gross energy savings or gross energy demand savings for a single unit of an installed energy efficiency measure. This estimate (a) comes from data sources and analytical methods that are widely accepted for the particular measure and purpose, and (b) is applicable to the situation being evaluated.

Demand: The time rate of energy flow. Demand usually refers to electric power measured in kW (equals kWh/h) but can also refer to natural gas, usually as Btu/hr., kBtu/hr., therms/day, etc.

Effective Useful Life: An estimate of the median number of years that the efficiency measures installed under a program are still in place and operable.

Energy Efficiency: The use of less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way, or using less energy to perform the same function. “Energy conservation” is a term that has also been used, but it has the connotation of doing without a service in order to save energy rather than using less energy to perform the same function.

Energy Efficiency Measure: Installation of equipment, subsystems or systems, or modification of equipment, subsystems, systems, or operations on the customer side of the meter, for the purpose of reducing energy and/or demand (and, hence, energy and/or demand costs) at a comparable level of service.

Engineering Model: Engineering equations used to calculate energy usage and savings. These models are usually based on a quantitative description of physical processes that transform delivered energy into useful work such as heat, lighting, or motor drive. In practice, these models may be reduced to simple equations in spreadsheets that calculate energy usage or savings as a function of measurable attributes of customers, facilities, or equipment (e.g., lighting use = watts × hours of use).

Estimated Free Ridership Rate: I am not sure what this is exactly – mostly in regards to which level it is applied, like at the project/site level or program component level?

Estimated Net to Gross Ratio (NTG): See *Net to Gross Ratio (NTGR)*

Estimated Spillover Rate: I am not sure what this is exactly – mostly in regards to which level it is applied, like at the project/site level or program component level?

Evaluation: The performance of studies and activities aimed at determining the effects of a program. This includes any of a wide range of assessment activities associated with understanding or documenting program performance, assessing program or program-related markets and market operations; any of a wide range of evaluative efforts including assessing program-induced changes in energy efficiency markets, levels of demand or energy savings, and program cost-effectiveness.

Ex Ante: The saving calculated by the implementation contractor, Lockheed Martin, per the TRM. These numbers are developed prior to ADM's analysis.

Ex-Post: The savings that have been verified by the EM&V contractor. This includes adjustments for equipment that may not have been installed, calculation errors, and differences in assumptions.

Free Rider: A program participant who would have implemented the program measure or practice in the absence of the program incentive. Free riders can be total (who would have implemented all of the same measures without the incentives), partial (who would have implemented some of the same measures without the incentives), or deferred (who would have implemented the measures, but at some time in the future).

Gross Ex Ante kWh Savings: The estimation of electrical energy (kWh) expected to be saved by implementating energy efficiency measures, calculated by the implementation contractor before measures are enacted and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Gross Ex Ante Peak kW Savings: The estimation of electrical energy demand (kW) expected to be saved by implementating energy efficiency measures, calculated by the implementation contractor before measures are enacted and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Gross Ex Post kWh Savings: The estimation of electrical energy (kWh) saved by implementing energy efficiency measures, calculated by ADM, after measures were enacted, and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Gross Ex Post Peak kW Savings: The estimation of electrical energy demand (kW) saved by implementing energy efficiency measures, calculated by ADM, after measures were enacted, and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Gross kWh Savings Realization Rate: The ratio of ex post (or "realized") gross kWh savings over ex ante gross kWh savings.

Gross Peak kW Savings Realization Rate: The ratio of ex post (or "realized") gross kW savings over ex ante gross kW savings.

Gross Realization Rate: The ratio of ex post gross energy savings over ex ante gross energy savings

Gross Savings: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated.

Impact Evaluation: An evaluation of the program-specific, directly induced changes (e.g., energy and/or demand usage) attributable to an energy efficiency program.

Interactive Factors: Changes in energy use or demand occurring beyond the measurement boundary of the M&V analysis.

kWh Savings Target: The goal of energy savings for programs and their components set by utility companies before the programs began.

Market Effect: A change in the structure or functioning of a market, or the behavior of participants in a market, that results from one or more program efforts. Typically, the resultant market or behavior change leads to an increase in the adoption of energy efficient products, services, or practices.

Measure: Energy efficient equipment or service that is implemented to conserve energy.

Measurement: A procedure for assigning a number to an observed object or event.

Measurement and verification (M&V): The data collection, monitoring, observations, and analysis by field technicians used for the calculation of ex post gross energy and demand savings for individual sites or projects. M&V can be a subset of program impact evaluation.

Metering: The collection of energy-consumption data over time through the use of meters. These meters may collect information with respect to an end-use, a circuit, a piece of equipment, or a whole building (or facility). Short-term metering generally refers to data collection for no more than a few weeks. End-use metering refers specifically to separate data collection for one or more end-uses in a facility, such as lighting, air conditioning or refrigeration. Spot metering is an instantaneous measurement (rather than over time) to determine an energy-consumption rate.

Monitoring: Gathering of relevant measurement data, including but not limited to energy-consumption data, over time to evaluate equipment or system performance. Examples include chiller electric demand, inlet evaporator temperature and flow, outlet evaporator temperature, condenser inlet temperature, and ambient dry-bulb temperature and relative humidity or wet-bulb temperature, for use in developing a chiller performance map (e.g., kW/ton vs. cooling load and vs. condenser inlet temperature).

Net Ex Post kWh Savings: The estimation of electrical energy (kWh) savings from programs or measures after the measures have been installed and after adjusting for possible externalities, such as free ridership and spillovers.

Net Ex Post Peak kW Savings: The estimation of electrical energy demand (kW) savings from programs or measures after the measures have been installed and after adjusting for possible externalities, such as free ridership and spillovers.

Net Savings: The amount of energy reduced based on the particular project after subtracting the negative free ridership effects and adding the positive spillover effects. Therefore, net savings equal gross savings, minus free ridership, plus the summation of participant spillovers, non-participant spillovers, and other market effects. It is a better estimate of how much energy reductions occurred particularly because of the program incentive(s).

Net-to-Gross-Ratio (NTGR): A factor representing net program savings divided by gross program savings. It is applied to gross program impacts to convert gross program impacts into net program load impacts that are adjusted for free ridership and spillover. Net-to-Gross-Ratio (NTGR) = (1 – Free-Ridership % + Spillover % + Market Effects), also defined as Net Savings / Gross Savings.

Non-participant: A consumer who was eligible but did not participate in the subject efficiency program in a given program year. Each evaluation plan should provide a definition of a non-participant as it applies to a specific evaluation.

Participant: A consumer who received a service offered through the subject efficiency program in a given program year. The term "service" is used in this definition to suggest that the service can be a wide variety of services, including financial rebates, technical assistance, product installations, training, energy efficiency information or other services, items, or conditions. Each evaluation plan should define "participant" as it applies to the specific evaluation.

Peak Demand: The maximum level of metered demand during a specified period, such as a billing month or a peak demand period.

Peak kW Savings Target: The goal of energy demand savings set by the utility company for their program or program component before the program time frame begins.

Portfolio: Either (a) a collection of similar programs addressing the same market (e.g., a portfolio of residential programs), technology (e.g., motor-efficiency programs), or mechanisms (e.g., loan programs) or (b) the set of all programs conducted by one organization, such as a utility (and which could include programs that cover multiple markets, technologies, etc.).

Primary Effects: Effects that the project or program are intended to achieve. For efficiency programs, this is primarily a reduction in energy use per unit of output.

Process Evaluation: A systematic assessment of an energy efficiency program's process. The assessment includes documenting program operations at the time of the examination, and identifying and recommending improvements to increase the program's efficiency or effectiveness for acquiring energy resources while maintaining high levels of participant satisfaction.

Program: A group of projects, with similar characteristics and installed in similar applications. Examples could include a utility program to install energy-efficient lighting in commercial buildings, a developer's program to build a subdivision of homes that have photovoltaic systems, or a state residential energy efficiency code program.

Project: An activity or course of action involving one or multiple energy efficiency measures, at a single facility or site.

Ratepayer Impact Test (RIM): RIM tests measure the distributional impacts of conservation programs from the viewpoint of all of the utility's customers. The test measures what happens to average price levels due to changes in utility revenues and operating costs caused by a program. A benefit/cost ratio less than 1.0 indicates the program will influence prices upward for all customers. For a program passing the TRC but failing the RIM, average prices will increase, resulting in higher energy service costs for customers not participating in the program.

Regression Analysis: A statistical analysis of the relationship between a dependent variable (response variable) to specified independent variables (explanatory variables). The mathematical model of their relationship is the regression equation.

Reporting Period: The time following implementation of an energy efficiency activity during which savings are to be determined.

Secondary Effects: Unintended impacts of the project or program such as rebound effect (e.g., increasing energy use as it becomes more efficient and less costly to use), activity shifting (e.g., movement of generation resources to another location), and market leakage (e.g., emission changes due to changes in supply or demand of commercial markets). These secondary effects can be positive or negative.

Spillover: A positive externality related to a participant or non-participant enacting additional energy efficiency measures without an incentive because of a participant's experience in the program.. There can be participant and/or non-participant spillover rates depending on the rate at which participants (and non-participants) adopt energy efficiency measures or take other types of efficiency actions on their own (i.e., without an incentive being offered).

Stipulated Values: See "deemed savings."

Total Resource Cost Test (TRC): This test compares the program benefits of avoided supply costs against the costs for administering a program and the cost of upgrading equipment. This test examines efficiency from the viewpoint of an entire service territory. When a program passes the TRC, this indicates total resource costs will drop, and the total cost of energy services for an average customer will fall.

Uncertainty: The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall with some degree of confidence.

Utility Cost Test (UTC): Also known as the Program Administrator Test (PACT), this test measures cost-effectiveness from the viewpoint of the sponsoring utility or program administrator. If avoided supply costs exceed program administrator costs, then average costs will decrease.