Ameren Missouri PerformanceSavers Impact and Process Evaluation: Program Year 2013

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EXECUTIVE SUMMARY

Ameren Missouri engaged the Cadmus team (composed of Cadmus and Nexant) to perform annual process and impact evaluations of the PerformanceSavers program for a three-year period from 2013 through 2015. This annual report covers the impact and process evaluation findings for Program Year 2013 (PY13), the period from January 1, 2013, through December 31, 2013.

Program Description

Ameren added the PerformanceSavers pilot program to the residential Act On Energy® portfolio in PY13. This program is designed to encourage residents of single-family homes to reduce energy consumption by making improvements to: weatherization, lighting, HVAC, and water heating appliances fueled by natural gas. The program provides some energy-efficient measures at no cost to participants and offers rebates for other measures (air sealing, ceiling insulation, and energy-efficient windows). While all single-family homes receiving both electricity and natural gas from Ameren are eligible to participate, the program requires participants to pay $25 for an in-home energy audit.

The PerformanceSavers marketing message targets residences that have the greatest energy savings potential—high-use accounts in older homes. Through this program, Ameren seeks to achieve energy savings in three ways:

- Educating customers about their energy consumption via a detailed home energy audit report.
- Implementing these low-cost energy-efficiency measures during the home energy audit: setting back water heater thermostats and installing compact fluorescent lamps (CFLs), light-emitting diodes (LEDs), smart strips, faucet aerators, energy-efficient showerheads, and pipe wrap.
- Identifying energy-saving opportunities and recommending improvements to enhance the home's performance (such as infiltration improvements, insulation, and high efficient windows).

PerformanceSavers is implemented by the Honeywell Smart Grid Solutions Division (Honeywell).

Key Impact Evaluation Findings

In PY13, PerformanceSavers completed 694 audits. The Cadmus team calculated the measure-specific realization rates (see Table 1) by comparing the evaluated (*ex post)* savings with the program's planning estimate (*ex ante*) detailed in Ameren's technical resource manual (TRM).

We determined that the program's overall electric measures realization rate was 73.8%. Our evaluation revealed there was a lower-than-expected realization rates for windows (24.6%) and smart strips (28.8%) which negatively impacted the electric realization rate. For natural gas measures, we determined a similar overall realization rate of 75.1%. Our evaluation revealed that this realization rate was reduced by lower-than-expected rates for high-efficiency aerators (22.8%) and the water heater setback (59.6%). However, the greater-than-expected average savings for ceiling insulation (121.5%) and hot water pipe wrap (137.5%) offset these low values.

Table 1. PY13 Participation and *Ex Post* Program Gross Savings

Measure	PY13 Participation	*Ex Post* Per-Unit Savings	Realization Rate	Total *Ex Post* Savings
Electric Measures (kWh/year)				
CFLs	7,245	39.0	84.4%	282,735.1
LEDs	289	40.9	89.9%	11,815.9
Smart Power Strips	331	53.0	28.8%	17,529.8
Hot Water Setback Interactive Effect*	342	(15.6)	N/A	(5,343.9)
Ceiling Insulation (per home)	22	246.6	131.4%	5,424.9
Windows (per home)	10	271.4	24.6%	2,714.4
Air Sealing*	2	N/A	100.0%	895.0
Total	**8,241**	**-**	**73.8%**	**315,771.1**
Natural Gas Measures (therms/year)				
High Efficient Aerators	1,097	1.5	22.8%	1,699.0
High Efficient Showerheads	461	16.3	75.6%	7,496.8
Hot Water Pipe Wrap	522	14.7	137.5%	7,677.3
Hot Water Setback	342	6.4	59.6%	2,179.4
Ceiling Insulation (per home)[1]	22	122.2	121.5%	2,688.2
Windows (per home)	10	16.8	43.3%	168.3
Air Sealing[2]	2	N/A	N/A	95.0
Total	**2,456**	**-**	**75.1%**	**22,004.0**

[1]The realization rate listed for ceiling insulation represents a weighted average for all ceiling insulation measures active in the PY13. Individual realization rates per ceiling insulation measure are provided in Table 35.
[2]Air sealing was not included in the evaluation sample and could not be evaluated. We therefore assumed 100% realization rate for PY13.

Table 2 lists the program's total gross *ex post* energy savings for both fuel types.

Table 2. Program Gross Realization Rates by Fuel Type

Fuel Type	*Ex Ante* Program Savings[1,2]	Realization Rate	*Ex Post* Program Savings	Precision at 90% Confidence
Electricity (MWh/yr)	427.7	73.8%	315.8	8.9%
Natural Gas (therm/yr)	29,312.4	75.1%	22,004.0	9.8%

[1]Update *to ex ante* electric savings value provided by Ameren Missouri on May 15, 2014
[2]Natural gas *ex ante* program savings were revised by the Cadmus team to include savings resulting from the installation of rebated windows.

To estimate PY13 net-to-gross (NTG) ratios, we used the following formula:

NTG = 1.0 – Free Ridership + Participant Spillover + Nonparticipant Spillover + Market Effects

To determine NTG, we used the findings from our participant surveys regarding their likely actions independent of the program. Through these surveys, we determined that the highest levels of free ridership occurred for these measures: CFLs (35%), high-efficiency aerators (18%), and water heater pipe

wrap (21%). We identified two measures—both of which were rebated—that had very low free ridership rates: insulation (2.3%) and windows (0%). Overall, the free ridership rate for PerformanceSavers was 16.5%.

We determined that the participant spillover rate was 5.1%, and that the limited nonparticipant spillover was 1.7%. We could not estimate market effects, as the PerformanceSavers pilot is too new to have generated market change.

Table 3 lists our NTG findings and applies the results to the program's total *ex post* gross energy savings.

Table 3. Electricity and Natural Gas Net Savings

Fuel	*Total Ex Post* Gross Energy Savings	Free Ridership	Participant Spillover	Nonparticipant Spillover	NTG Ratio	Net Savings
Electricity (MWh/yr)	315.8	16.5%	5.1%	1.7%	90.3%	285.1
Natural Gas (therm/yr)	22,004.0	16.5%	5.1%	1.7%	90.3%	19,869.6

The Public Service Commission (PSC) proposes annual energy and demand savings targets for each program year. As shown in Table 4, the PY13 PerformanceSavers program realized 26.6% of its proposed net electric energy savings target (1,070 MWh) in Ameren's residential tariff and 3.4% of its net demand savings target (352 kW) for PY13.

Table 4. PerformanceSavers PY13 Savings Comparisons

Metric	MPSC-Approved Target[1]	*Ex Ante* Gross Savings Utility Reported (Prior to Evaluation)[2]	*Ex Post* Gross Savings Determined by EM&V[3]	*Ex Post* Net Savings Determined by EM&V[4]	Percent of Goal Achieved[5]
Energy (MWh)	1,070	428	316	285	27%
Demand (kW)	352	35	22	20	6%
Natural Gas (therm/yr)[6]	28,924	29,312	22,004	19,870	N/A

[1] https://www.ameren.com/sites/AUE/Rates/Documents/UECSheet191EEResidential.pdf

[2] Calculated by applying tracked program activity to TRM savings values.

[3] Calculated by applying tracked program activity to Cadmus' evaluated savings values.

[4] Calculated by multiplying Cadmus' evaluated gross savings and NTG ratio, which accounts for free ridership, participant spillover, nonparticipant spillover, and market effects.

[5] Compares MPSC Approved Target and *Ex Post* Net Savings Determined by EM&V

[6] Natural gas *ex ante* program savings were reviewed by the Cadmus team to include savings resulting from the installation or rebated windows.

Key Process Evaluation Findings

Overall, the program achieved 26.6% of its total program savings goal for PY13. Despite this underperformance in energy savings, both Ameren and Honeywell reported that the PerformanceSavers program performed well in its first year, surpassing its annual audit recruitment goal for PY13 by 22%. While the program had a slow start with regard to marketing activity and recruitment, requests for audits increased rapidly by summer, as Honeywell reached more customers with older-vintage homes.

Both Ameren and Honeywell felt the marketing efforts were successful, and they reported high rates of customer satisfaction with the audit process. However, both acknowledged that the program did not meet its energy savings PY13 goal due to of the low number of participants who installed the rebated measures (that is, the auditor-recommended measures of air sealing, ceiling insulation, and energy-efficient windows). Honeywell said that the upfront costs of these measures tended to deter customers from implementing them. Ameren said that using targeted marketing, committing more resources to enroll more customers, and engaging program contractors more effectively would increase the uptake of major measures.

Key Conclusions and Recommendations

Based on the impact and process evaluation findings, the Cadmus team offers the following conclusions and recommendations.

Conclusion 1. The program lacked uptake of major measures during PY13. The adoption rates were low for recommended windows (6.0%), air sealing (0.5%), and ceiling insulation (4.6%). Honeywell said that the upfront cost to customers was the main deterrent to installing major measures. This was confirmed in our surveys of participants: 41% said the initial high cost of installing the major measures was the primary barrier, and 25% said the upgrade was not necessary for their home, despite the energy and cost savings summary provided in their audit report.

Ameren said that targeting the marketing effort better, committing more resources to enroll more customers, and engaging program contractors effectively would increase the uptake of major measures. (We note that it is not unusual for a delay of a year or more to occur between the time a customer receives a recommendation to install a major measure and the subsequent installation date.)

> **Recommendation 1a. Market aggressively the major measures and direct the home-energy auditors to emphasize customer education on the benefits—both financial and non-financial—of installing the recommended measures.** When possible, describe the benefits of the major measure in terms specific to a participant's home; for example, report the ceiling-insulation energy savings based on the actual square footage of the home rather than on TRM values. Additionally, have auditors provide Honeywell with detailed records for each recommendation so that Honeywell staff can use this information in follow-up calls to participants and for soft leads to program contractors.

Recommendation 1b. Make the measures more affordable (by raising the rebate) or easier to purchase (through low-interest loans or on-bill financing).

Conclusion 2. There may be more opportunities to earn savings by changing current program design requirements. Specifically, the program offers four measures designed to reduce hot water consumption: high efficient aerators, energy efficient showerheads, hot water pipe wrap, and hot water set back. However, under the current program design, these measures are only available to customers with natural gas water heaters. Including electric water heaters would help offset negative interactive effects associated with the hot water set back.

Recommendation 2a. Determine whether it is feasible to expand hot water measures to customers with electric water heaters and to apply the savings from new windows to customers who heat their homes with natural gas. As the water heater measures comprise more than half of the direct install measures offered by the program, there are potentially large electricity savings that may be realized. With regard to windows, they have an impact on space heating because they are a shell measure, and we have identified this as an opportunity since all of the program participants in our sample had natural gas furnaces as their primary heating system.

Recommendation 2b. Update the Ameren TRM to account interactive effects related to water heater measures to achieve higher realization rates. Specifically, reducing the set point of the water heater set back measure (to 120 degrees Fahrenheit) reduces savings for energy savings achieved by high efficient aerators and showerheads as well as pipe wrap. Additionally, reducing the hot water set back creates a negative electric savings in homes that have dishwashers with internal electric booster heaters.

Conclusion 3. There is low awareness of PerformanceSavers among Ameren customers overall.

Recommendation 3a. Educate, engage, and motivate potential customers through channels such as community events, local retailers, fairs, and home shows. Through community outreach, educate customers and create brand recognition for the program. In addition to promoting the benefits of installing low-cost measures, educate customers on the incentives available to help pay for higher-cost improvements and quantify the payback. Use the various events to drive program, and provide customers with an opportunity to speak to auditors about the program

Recommendation 3b. Partner with local community organizations or neighborhood groups to promote "group" energy audits in their community or neighborhood.

Conclusion 4: All program managers agreed that participants have expressed satisfaction with the auditors and with the overall program.

Recommendation 4: Leverage customer satisfaction to serve as program marketing, using testimonials, case studies, local news features, and online channels. These could include: customer testimonials on Twitter or Facebook; a case study on the program website; or an interactive video-walking customers through the audit process. In the future, consider presenting an online forum for auditors and contractors to post questions, comments, and share testimonials from customers.

INTRODUCTION

Ameren Missouri engaged the Cadmus team to perform a process and impact evaluation of the PerformanceSavers program for a three-year period. This annual report covers the impact and process evaluation findings for Program Year 2013 (PY13), the period from January 1, 2013, through December 31, 2013.

Program Description

The PerformanceSavers pilot program encourages residents of single-family homes to reduce energy consumption by making improvements to: weatherization, lighting, HVAC, and water heating appliances fueled by natural gas. The program provides some energy-efficient measures at no cost to participants and offers rebates for other measures (air sealing, ceiling insulation, and energy-efficient windows).

Targeting high-use accounts in older homes (which have the greatest energy savings potential) and using a whole-house approach to saving energy, PerformanceSavers provides the following:

- Low-cost home-energy audits ($25) and some free direct-install measures;
- Marketing and education about existing Ameren energy-efficiency programs; and
- Lists of local contractors capable of completing measures identified in the audit.

The program is implemented by Honeywell.

Program Participants and Savings Approaches

All single-family residential homes receiving both electricity and natural gas from Ameren qualify to participate in PerformanceSavers. Through this program, Ameren seeks to achieve energy savings in three ways:

- Educating customers about their energy consumption via a detailed home energy audit report.
- Implementing these low-cost energy-efficiency measures during the home energy audit: setting back water heater thermostats and installing compact fluorescent lamps (CFLs), light-emitting diodes (LEDs), smart strips, faucet aerators, energy-efficient showerheads, and pipe wrap.
- Identifying energy-saving opportunities and recommending improvements—referred to in this report as “major measures”—to enhance the home’s performance (such as infiltration improvements, insulation, and high efficient windows).

Ameren customers receiving a home audit through the program are not required to implement additional measures recommended by the auditor, but Honeywell uses these strategies to encourage customers to implement these improvements:

- Following up with audit customers to reinforce education about energy savings opportunities and to answer customer questions.

- Providing estimates of measure cost, savings, and years-to-payback;
- Providing information about rebates offered through other programs in the Ameren residential portfolio
- Offering a list of certified contractors qualified to complete the recommended improvements.

Program Activity

In PY13, the PerformanceSavers program had 694 participants (Table 5).

Table 5. PerformanceSavers PY13 Program Activity

Measure	PY13 Participants	PY13 Measure Counts
Audits		
Level 1 Audit	678	n/a
Level 2 Audit	16	n/a
Direct Install Measures		
CFLs	660	7,245
LEDs	173	289
Faucet Aerators	506	1,097
Energy Efficient Showerheads	445	461
Hot Water Heater Pipe Insulation	522	522
Domestic Hot Water Temperature Setback	342	342
Smart Power Strips	331	331
Major Measures		
Air Sealing	2	2
Ceiling insulation (R-5 to R-30)	1	1,320 ft^2
Ceiling insulation (R-5 to R-49)	4	3,300 ft^2
Ceiling insulation (R-11 to R-49)	4	5,240 ft^2
Ceiling insulation (R-19 to R-49)	13	19,555 ft^2
Windows	10	91

EVALUATION METHODOLOGY

The Cadmus team identified these impact and process evaluation priorities for the PerformanceSavers pilot in PY13:

- Verifying the installation and impacts of the direct-install and major measures.
- Tracking the adoption of major measures over time.
- Refining net-to-gross (NTG) estimates, including spillover assessments.
- Assessing the impacts of design changes, marketing activities, and program processes.
- Assessing the program's achievements against goals.
- Examining participants' experience, satisfaction, and decision-making motivations.
- Assessing how well participants understand the educational information, audit reports, energy-savings opportunities, and implementation process.

Table 6 lists the evaluation activities conducted in PY13 to reach the above objectives, followed by a brief summary of each activity.

Table 6. PY13 Process and Impact Evaluation Activities and Rationale

Evaluation Activity	Process	Impact	Rationale
Review Technical Resource Manual		•	Review TRM values and assumptions and provide updated information through engineering analysis for future program years
Review Data Tracking	•	•	Provide ongoing support to ensure all necessary program data are tracked accurately; identify gaps for EM&V purposes
Review Program Marketing	•		Identify gaps and opportunities in the program's marketing and outreach strategies and activities
Survey Participants	•	•	Surveys with audit recipients to inform gross impacts, NTG, and process-related insights
Complete On-Site Inspections		•	Findings will be used to inform impact evaluation savings estimates for direct-install and recommended measures.
Interview Program Staff	•		Review program progress, issues, and needs from the perspective of Ameren program managers and implementation contractor.
Cost-Effectiveness Analysis		•	Measure the cost-effectiveness of the program through five standard perspectives: Total resource cost, utility cost, societal cost test, participant cost test, and ratepayer impact test.

Technical Resource Manual (TRM) Review

At the outset of the PY13 evaluation, the Cadmus team reviewed the algorithms used by Ameren (which were specified in its TRM for PerformanceSavers measures) and the algorithms in other TRMs for similar measures. Early in the program year, we benchmarked each measure's algorithm, assumptions, and savings against those from other TRMs. We then attempted to identify differences between the values Ameren assumed in the TRM and the values that may result from the formal evaluation process. Our goals were these: (1) to enhance our understanding of the specific measures that Ameren's implementer was delivering; and (2) to provide early feedback that could potentially allow Ameren's implementer to make mid-year course corrections for improving program delivery.

Data Tracking Review

In conjunction with the TRM review, the team also reviewed the PerformanceSavers tracking database. Specifically, we assessed whether Honeywell was gathering the data necessary to inform our evaluation and the algorithms detailed in the Ameren TRM. Because of the timing of our review—which included an assessment of data quality and completeness—we were able to notify Ameren and Honeywell early in the program about the issues we observed.

Program Manager Interviews

For the PerformanceSavers PY13 evaluation, the Cadmus team interviewed Ameren and Honeywell program managers in July and December 2013, as shown in Table 7. We designed these interviews to: (1) gather information on how effectively the program is operating; (2) identify the challenges encountered by program staff and the implementer; and (3) determine appropriate solutions. (Our program manager interview guide is contained in Appendix B).

Table 7.Completed Program Manager Interviews

Program Manager	Interviews Conducted
Ameren Missouri	3
Honeywell	2
Total	**5**

Marketing Review

In mid-2013, the Cadmus team reviewed the PerformanceSavers marketing materials. To enhance our understanding of the marketing planning, coordination, and outreach efforts, we also interviewed key marketing staff from Honeywell. Our assessment considered all aspects of the program marketing, such as strategy development, processes and planning, goals and objectives, target audience, messaging, marketing tactics, and metrics. We then synthesized our findings to assess the program's ability to: (1) reach the identified customer segments; and (2) efficiently generate program participation.

In a memorandum submitted to Ameren on November 13, 2013, we provided our initial feedback regarding the effectiveness of the program's marketing effort. This report includes information from

that memo and our conclusions and recommendations for improving the program's overall marketing approach.

PerformanceSavers Participant Surveys and Site Visits

In PY13, the Cadmus team completed 50 telephone surveys and 11 site visits with PerformanceSavers participants (Table 8). Based on total program population as of October 10, 2013, we generated a random sample of participants. We drew the sample on this date to ensure we had sufficient time to collect field data, conduct the savings analysis, and report findings to stakeholder by February 14, 2014.

Table 8. PerformanceSavers Participant Survey Summary

Target Audience	Field dates	Population*	Completed Surveys	Completed Site Visits	Sample
Audit/Direct Install Participants	Oct. – Nov.	421	50	-	50
Audit/Major Measure Participants	Nov. – Dec.	18	-	11	11
Total		437	50	11	61

*Population as of October 10, 2013 when sample was drawn. The overall audit population increased by approximately 58% to 694 in the last 80 days of the program year. Despite this dramatic increase in population, our sample size maintained targeted confidence and precision.

Our telephone surveys and site visits collected information for both our impact evaluation and our process evaluation, covering such topics as: measure verification, free ridership, spillover, participant awareness and decision-making, and satisfaction. After recruiting participants for site visits during our surveys, we conducted site visits on major measure installations to verify the details of the project installations and to validate work completed by program contractors. In total, we completed inspected seven insulation installations and four window installations.

Engineering Analysis

To estimate per-unit gross savings for each PerformanceSavers measure, the Cadmus team utilized the engineering algorithms and assumptions that are detailed in the Gross Impact Results section. These algorithms yield estimates of the difference between the energy usage of the rebated equipment and usage of similar or existing equipment. The baseline conditions of the existing equipment were well documented in the audit reports provided for each program participant. We gathered additional baseline information via our phone surveys and site visits, and we used the baseline data to develop our parameter inputs for each engineering algorithm.

Cost-Effective Analysis

Using final PY13 PerformanceSavers participation data, implementation data, and the *ex post* gross and net savings estimates presented in this report, Morgan Marketing Partners (MMP) determined the program's cost-effectiveness using DSMore.[1] MMP also calculated measure-specific cost-effectiveness.

[1] A financial analysis tool designed to evaluate the costs, benefits, and risks of DSM programs and services.

As shown in the Cost-Effectiveness Results section, we assessed cost-effectiveness using the five standard perspectives produced by DSMore:

- Total Resource Cost
- Utility Cost
- Societal Cost Test
- Participant Cost Test
- Ratepayer Impact Test

PROCESS EVALUATION FINDINGS

This section contains the Cadmus team's process evaluation findings for Ameren's PerformanceSavers pilot program. We have organized our findings into four sections: Program Design and Delivery, Marketing and Outreach, and Participant Feedback.

Program Design and Delivery

The program marketing targets customers who have the greatest savings potential—typically high-use accounts in older homes; however, all single-family residential homes receiving both electricity and natural gas from Ameren are eligible to participate in the PerformanceSavers program.

Due to contractual issues, Ameren launched the program slightly later (on March 1, 2013) than its other programs. The program is intended to serve 60,000 participants across the gas and electric regions of Ameren's territory.

Direct Install Measures

During the home-energy audit (for which customers pay $25), auditors may direct install energy-saving measures worth up to $200, at no additional cost to the customer. The list of direct install measures and the average quantity installed per home are listed in Table 9. While PerformanceSavers is a dual fuel program, the hot water-related measures—high-efficiency aerators, energy-efficient showerheads, hot water pipe wrap, and hot water thermostat setback—were not offered to customers who have electric water heaters. According to Ameren program managers, 14% of Ameren residential customers have electric water heaters.

Table 9.Direct Installed Measures

Measure	Average Quantity Installed per Home
High-efficiency faucet aerators	2
High-efficiency showerheads	1
Up to 10 feet of water heater pipe wrap	1
Water heater thermostat setbacks	1
ENERGY STAR® certified CFL light bulbs	11
ENERGY STAR® certified LED light bulbs	2
Smart power strips	1

PerformanceSavers Major Measures

The program's major measures and associated rebate amounts are listed in Table 10. When the program's home energy auditors recommend major measures, customers are eligible for a rebate on each installation if they use a PerformanceSavers certified contractor to do the work. (At the close of PY13, the program had 25 certified contractors available to perform the installations.)

Table 10.PerformanceSavers Rebated Measures

Measure	Rebate
ENERGY STAR® certified windows[1]	$500
Air sealing	$264
Ceiling insulation	$400

[1] A minimum of 5 windows and maximum of 10 windows may be installed at a rebate of $50 per window.

Progress Towards Goals

Ameren has portfolio-wide 2015 regulatory goals for energy savings. Although Ameren is not required to meet interim targets on an annual basis and at the program level, it is important for planning purposes to examine a program's achievements against stated goals. Ameren's integrated resource plan (IRP) informs the program's three-year energy-savings goals, which are contained in Ameren tariff. Program staff reported that annual goal-setting is a bottom-up process: Honeywell provides participation goals for each measure, and these goals are then multiplied by each measure's estimated savings (as specified in the TRM) to calculate an aggregate kWh/year target.

The program managers interviewed by the Cadmus team acknowledged that the program did not meet its energy savings PY13 goal due to the low number of participants who installed major measures (the auditor-recommended installations of air sealing, ceiling insulation, and energy-efficient windows).

Program Implementation Challenges and Solutions

The PerformanceSavers program is new to the Ameren portfolio in PY13, and is being operated as a pilot. Unlike the other six residential programs—which address electric measures program exclusively—this pilot requires that participants have both gas and electric in their homes. The challenges encountered program in PY13 may impact program participation and savings.

Lack of Uptake for Major Measures

Both Ameren and Honeywell expressed the greatest concern with the continued difficultly of convincing participants to install recommended major measures. Customer surveys administered by Honeywell reported participants were reluctant to make the financial commitment associated with those measures. However, Ameren believes the lack of uptake for major measures is a marketing issue, because the program's marketing effort focuses on promoting audits rather than the major measures.

Honeywell did make new efforts to increase the update of major measures by engaging program contractors (those providing insulation, air sealing, and energy-efficient windows) with promotion. The contractors emphasized to their customers the Ameren rebate and the federal tax credits. Contractors were also encouraged to provide installation coupons that the auditors could distribute directly to customers.

Ameren noted that additional engagement with contractors should occur, such as assisting contractors to follow up with soft leads from the audit reports. Also, based on customer feedback and data received from audit reports, Ameren believes the program needs to develop better and more-targeted

marketing. Ameren said this could be accomplished through customer segmentation based on data received from audit reports as well as customer feedback.

Backlog of Audits

In the summer of 2013, there was a rapid increase in customer requests for energy audits through the PerformanceSavers program.

In the July interviews with the Cadmus team, Ameren program managers expressed concern that the number of contracted auditors was not sufficient to meet the demand for program. Citing the backlog of audit requests and the long travel times for auditors to reach participants, Ameren said that the audit team needed to be expanded. Also, rather than having the audit team in one central location, Ameren felt there should be auditors based locations throughout the territory. Honeywell did contract an additional auditor, which successfully relieved the backlog.

Honeywell also expressed concern that the auditors were traveling long distances to serve participants across Ameren's territory, as this introduces scheduling issues. Honeywell has considered establishing region-specific auditors; however, it is unclear whether there is enough work for region-specific auditors in vicinities such as Jefferson City and Cape Giradeau.

Delivery Successes and Program Achievements

When the Cadmus teams asked which aspects of the program were working particularly well, the interviewed program managers offered the following information:

- **Auditors.** Ameren and Honeywell program managers felt that the auditors were successful at communicating information about energy-efficiency opportunities and implementing direct-install measures. Both reported that participants positively received the program's auditors, whom Honeywell contracts through the EarthWays Center.
- **Customer contact and recruitment.** Program managers noted efficient follow-up effective quality control by implementation staff, which resulted in very positive feedback from participants.
  - Both Ameren and Honeywell were very pleased with the response rate to the mailer (initial response to the mailer was low but increased during the summer and fall). Additionally, Ameren noted that Honeywell was able to make up for the late launch of the program by distributing a full year of expected mailers in just five months.
  - In surpassing its annual audit recruitment goal for PY13, Honeywell noted that part of this success was due to soliciting customers with older vintage homes that were in greater need of energy upgrades.

Marketing and Outreach

This section contains findings on PerformanceSavers marketing strategies and outcomes.

Strategy Overview and Planning

Honeywell, in collaboration with Ameren, developed the marketing plan for recruitment, enrollment, and customer education. Our interviews with program managers revealed that while the implementer developed and executed program-specific marketing strategies, the Ameren program manager and staff remained involved and supportive throughout the planning process.

In PY13, Honeywell primarily used direct mail to market the program. At the time of our July interviews, program managers reported that the participation was lower than anticipated and that the program was behind in its savings goals. Honeywell developed and executed a corrective marketing plan to determine and identify opportunities for increased program participation and customer engagement.

Marketing Design and Execution

Ameren provides program implementers with Act On Energy (Act On Energy) brand guidelines and marketing templates to ensure program and campaign materials have a consistent brand and message across all programs and advertisements. Program managers found the guidelines complete, comprehensive, and effective in developing PerformanceSavers materials.

As indicated in the marketing plan provided to the Cadmus team and through program manager interviews, the PerformanceSavers program primarily uses direct mail as a marketing channel. The program focuses on reaching customers living in single-family dwelling units, and receiving gas and electric service from Ameren Missouri in areas with high energy usage.

Due to the targeted nature of these efforts, the implementer indicated this program would not benefit from larger mass media efforts. The program marketing approach included plans to supplement direct mailings with public relations and community outreach; however, these tactics were not yet fully executed at the time of the marketing review. Specific tactics in the plan included: press releases; outreach to local media outlets (newspapers, radio and television); engagement with local community leaders; and attendance of community events to promote programs and drive leads.

The direct mail piece (brochure self-mailer) was sent out according to plan, however, did not return the anticipated response rates. (At the time of the July interviews, program managers indicated this mailing received a less than one percent response rate, around 0.65%, when it was expected to return at two or three percent.) However, response to the mailer did eventually increase resulting in rapid audit uptake.

During the time of the program manager interviews, we learned that Honeywell since developed a revised marketing strategy and was in the process of revising outreach tactics. The revised strategy was developed and proposed by Honeywell and revolved around market research that was conducted through a customer survey to non-participants (i.e., customers who received a mailer but did not respond). The purpose of this research was to understand barriers to participation in an effort to refine messaging to more effectively reach program targets.

Honeywell's program managers shared the following high-level findings from their survey, which identified these participation barriers:

- Audit cost and/or financial situation;
- High perceived cost of energy-efficient measures; and
- Belief that their house is already energy efficient.

Based on the above findings, Honeywell revised the plans as follows:

- **Revised Creative:** Changed the self-mailer format to a #10 letter package, as letters were shown to generate better response rates.
- **Revised Messaging:** Tailored the messaging in the direct-mail piece to address varied concerns found through the surveys. (Honeywell noted that while conducting message testing was the ideal, such testing could not be done at this point in the process and within the budget.)
- **Updated Website:** Added language explicitly stating that program addresses gas and electric customers (due to eligibility confusion noted during the July interviews). Other revisions included adding banner advertising to Ameren home page rotation and moving the PerformanceSavers link "above the fold."

Additionally, 20% of the non-participant customers contacted by Honeywell indicated they were interested in receiving an audit but had not followed up to schedule a time. Ameren believes this is evidence that Honeywell should be more proactive with follow-up customer calls. While Honeywell acknowledged the potential benefit to these follow-up customer calls, it indicated that the current program budget would not support this effort.

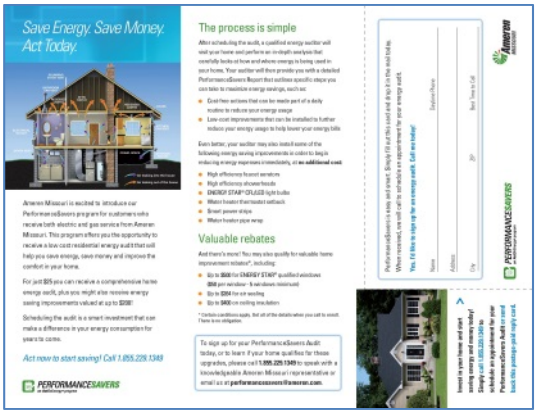
At the time of our follow-up interviews in December, program managers said their tracking indicates that incoming audit requests mainly come in response to direct mailing (87%). The remainder of participants who requested an audit learned of the program through word-of-mouth, the Ameren website, or contractors.

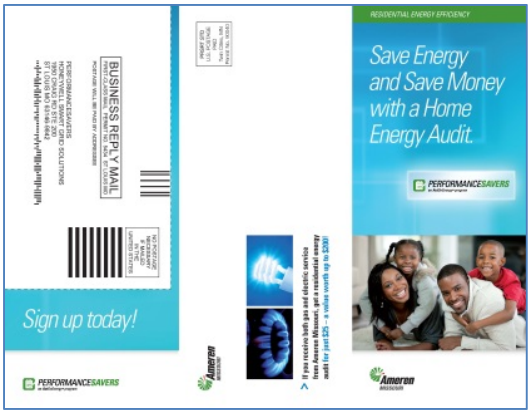
Marketing Plan and Materials Review

The Cadmus team received the original PY13 PerformanceSavers program marketing plan and the original direct-mail piece. As noted, the marketing plan that we obtained during data collection has been since updated to reflect a slightly revised strategy. However, we found that the marketing plan shared for this review was thorough, as it contained: an overview, a situation analysis, an objectives strategy, target audiences, and tactics. The plan also referenced Honeywell's capability to monitor program marketing efforts in real time so that it could adapt plans to respond to current conditions.

We reviewed the following program marketing resources, developed by Honeywell and provided to the Cadmus team by Ameren Missouri:

- 2013 Ameren Missouri PerformanceSavers Marketing Plan (Final – 4/10/2013)
- 2013 Marketing Materials:
    - Ameren PerformanceSavers Self Mailer





Overall, the mailer presents a look and feel consistent with other Act On Energy marketing efforts. The self-mailer brochure includes the Ameren and program logos as well as appropriate and relatable imagery (e.g., a family and home). The piece contains several calls-to-action: encouraging a telephone call, e-mail, or return of the reply card. While these options may provide customers' with a variety of choices to accommodate various, preferred communications methods, this could potentially cause confusion or weaken the prompt for action.

Cross-Program Promotion

Ameren has taken the lead in identifying opportunities for its implementers to collaborate in cross-promoting the various programs. For PerformanceSavers, program managers said that auditors received handouts for informing customers of other program offerings. However, the program manager wants the home-energy audit reports to include detailed recommendations for connecting participants to other Act On Energy programs. Honeywell could then follow up on these recommendations during a post-audit phone call.

Participant Feedback

The Cadmus team asked participants multiple questions regarding their satisfaction with the program and with Ameren as their utility.

Customer Program Satisfaction

We asked participants a battery of questions regarding their experience with various aspects of the program's operations (the website, communication with Ameren employees or contractors), the variety of rebated major measures, the performance of the auditor, and the performance of the major measure installation contractor. Overall, most participants indicated they were *very satisfied* or *somewhat satisfied* with the program's operations. However, we received limited responses regarding the program's website and the major measure installation contractors.

Website

Participants indicated that they did not make much use of the website. One participant mentioned it is sometimes difficult to navigate.

Communication with Ameren Employees or Contractors

While overall communication satisfaction was rated as high by participants, we received comments from some participants that there was too much communication from the program implementer regarding confirmation of appointments.

Variety of Rebate-Eligible Major Measures

Again, the majority of participants indicated high satisfaction with the variety of rebated major measures. However, some participants said they were not aware that the program offered rebates for major measures.

Auditor

Among the participants we surveyed, 84% rated themselves *as very satisfied* with the auditors. We receive comments from a few participants who rated themselves as *less satisfied* for various reasons such as: the quality of the audit report (customer felt the printed copy was of poor quality), their inability to receive certain direct-install measures due to auditor's discretion, and the lack of a thorough inspection of the customer's ceiling insulation.

The energy report was described by 61% of participants as *very easy* to understand, while 36% said the report was *somewhat easy* to understand. This aligns with Ameren and Honeywell program manager views that program participants are successfully interpreting the information provided by the auditors.

Major Measure Installation Contractor

Due to the low number of completed major measure installations, we received limited feedback on the installation contractors. Of the participants who did provide feedback, 70% reported a high level of satisfaction with the work performed.

Customer Satisfaction with Ameren

The Cadmus team asked participants about their overall experience as an Ameren customer and whether their opinion of the utility had changed since participating in the program.

- 52% said they were *very sat*isfied with their overall experience with Ameren;
- 41% were *somewhat satisfied*; and
- 8% were *not too satisfied*.

When we asked participants if their opinion had changed since participating in the PerformanceSavers program, 72% said their opinions of Ameren had improved, while 27% said their opinions had stayed about the same. Only 2% of participants said they had a lower opinion of Ameren.

Act On Energy Awareness

We asked participants about their awareness with regard to both the Act On Energy brand and the program name PerformanceSavers. Regarding Act On Energy, less than half (44%) said they had heard of the name, and only 12% reported being very familiar with the brand. Regarding PerformanceSavers, only 4% of participants reported being *very familiar* with the name.

When we asked participants what they associate with the name PerformanceSavers, most participants said they associated it with saving money, saving energy, and CFL light bulbs. We received similar responses with our follow-up question that asked what participants *feel* the name PerformanceSavers meant to them.

Suggestions to Improve the Program

When asked how the PerformanceSavers program could be improved, 13% of the surveyed participants said the program needs to do a better job of raising awareness and providing information on the rebates for major measures. An additional 3% said that the program needs to offer more rebated measures). Another suggestion that we received more than once was for additional advertising and marketing of the program. Only one participant said the cost of the audit should be reduced, and two participants suggested increasing the rebate incentives on major measures.

Major Measure Adoption

Table 11 lists the major measure adoption rate for each measure during PY13.

Table 11. PY13 Major Measure Adoption Rates

Major Measure	PY13 Completed Installations	PY13 Recommended Installations	Major Measure Adoption Rate
Air Sealing	2	430	0.5%
Ceiling Insulation	22	482	4.6%
Windows	10	166	6.0%

During the participant surveys, the Cadmus team asked all participants who received a recommendation to install a major measure about their plans to move forward with the installation. (It is not uncommon for home audit programs to experience a lag between the recommendation and actual installation of a rebated measure.) We also asked participants why they decided to install—or not to install—a recommended major measure.

- Among those participants who had installed only a portion of the major measures recommended by the auditor, 50% of the participants said they planned to install the remaining measures within the next two years.
- Among participants that had not yet taken any action to install recommended measures, 75% said they planned to install some of the measures within the next two years.

Both groups cited the high initial cost as the primary reason they did not follow through with an installation of recommended major measures (41%). The second most common reason (25%) participants gave was that they did not feel the upgrade was needed, despite the auditor's recommendation. Other common responses included not having sufficient time to complete the installs (13%) and having competing home improvement projects (9%).

Participants most often stated saving money or energy as the reason they completed installations of recommended major measures. Participants also cited increasing the comfort of their home, replacing

failing equipment (windows) or improving equipment (ceiling insulation), and availability of rebates and tax incentives as reasons for completing the installation of recommended measures.

CSR Summary

According to the Missouri Code of State Regulations (CSR),2 demand-side programs that are part of a utility's preferred resource plan are subject to ongoing process evaluations that address, at a minimum, the five questions listed in Table 12. While our process evaluation findings touched on each of these topics, Table 12 provides a summary response for each specified CSR requirements.

Table 12: Summary Responses to CSR Process Evaluation Requirements

CSR Requirement Number	CSR Requirement Description	Summary Response
1	What are the primary market imperfections common to the target market segment?	The primary market imperfection common to the target market is inadequate information and/or knowledge regarding the benefits of increasing energy efficiency within existing homes.
2	Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes, the current market segment is appropriately designed. The program may realize higher audit rates through segmentation and targeted marketing of the current target market.
3	Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Yes, the mix of end-use measures offered through the program is appropriate. However, the program sets specific restrictions (e.g., electric water heater customers not eligible for hot water measures) that should be reviewed for appropriateness.
4	Are the communication channels and delivery mechanisms appropriate for the target market segment?	Yes, current communication and delivery channels are appropriate.
5	What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Additional customer education and awareness is needed regarding the benefits, both financial and non-financial, of increasing the efficiency of their homes.

[2] http://sos.mo.gov/adrules/csr/current/4csr/4c240-22.pdf

GROSS IMPACT EVALUATION RESULTS

The Cadmus team conducted the PY13 impact evaluation activities to estimate the gross energy savings. This section details each measure's per-unit savings calculations and installation rates.

Measure Installation Verification

During participant phone surveys and site visits, the Cadmus team confirmed that direct install measures were still installed and operating. That is, the installation rate represents the percentage of measures that remain installed and operating after the auditor's visit.

For PY13, we will not apply installation rates to overall program savings. Instead, we will begin applying installation rates in PY14 after collecting two years of data confirming participant behaviors. While the installation rates will not be included for this year's evaluation, we show in Table 13 the installation rate for each program and the corresponding precision levels. Precision varies based on the total number of each measure included in the sample. Further, precision is not estimated for measures with no variance – in other words, those for which a 100% installation rate was determined.

Table 13. Direct-Install Measure Installation Rates

Measure	Percentage Installed and Operating Post Audit	Precision at 90% Confidence
CFLs	98.3%	8.9%
LEDs	100%	N/A
Faucet Aerators	96.3%	10.0%
Low-Flow Showerheads	95.6%	10.6%
Pipe Wrap	98.0%	10.1%
Domestic Hot Water Setback	69.4%	11.9%
Smart Power Strips	97.0%	12.5%
Ceiling Insulation (All Levels)	100%	N/A
Windows	100%	N/A

Measure-Specific Gross Savings

Using the engineering algorithms outlined in the PerformanceSavers evaluation plan, we estimated measure-specific savings for all program measures. The gross energy savings we determined for each measure is detailed below along with the algorithm and inputs used.

Table 14. Summary of Data Sources

Algorithm Inputs	Source
Audit Data	Honeywell collected a number of key parameters for each home that received an audit through the PerformanceSavers program.
Survey Data	Data gathered through PY13 evaluation activities.
Site Visit Data	Data gathered through PY13 evaluation activities.
Secondary Data	Secondary data sources accompany the algorithm descriptions.

CFLs and LEDs

We estimated energy savings based on bulb technology and wattage using the following algorithm:

$$Energy\ Savings\ (kWh/Year) = \frac{(WattINC - WattNEW) \times Hours \times Days}{1{,}000} \times WHF$$

Where:

- WattINC = wattage of the original incandescent bulb replaced by a PerformanceSavers lamp
- WattNEW = wattage of new bulb installed by PerformanceSavers
- Hours = the average hours of use per day
- Days = days used per year
- 1,000 = the conversion factor between Wh and kWh (Wh/kWh)
- WHF = Waste heat factor to account for interactive effects

Table 15. Lighting PY13-PY7 Savings Assumptions

Term	Value	PY13 Source
WattINC	Based on bulb	Program and audit data
WattNEW	Based on bulb	Program and audit data
Hours	2.45	PY10 LightSavers Metering Study and PY13 PerformanceSavers Survey Data
WHF	0.99	PY13 Engineering Simulation Modeling adjusted for heating and cooling saturations

For our analysis, we paid careful attention to the effect of the Energy Independence and Security Act (EISA), which mandated higher efficient technologies for incandescent bulbs. EISA mandated that 100 watt bulbs be manufactured with an energy consumption rate of 72 watt bulbs beginning January 1, 2012. Thus, we assumed a baseline energy consumption of 72 watts for 23-watt CFL. EISA also mandated that 75-watt incandescent bulbs be manufactured with an energy consumption rate of 53 watts beginning on January 1, 2013. To account for existing shelf stock of the 75- watt incandescent bulbs, we assumed the mandate would take full effect on July 1, 2013. Therefore, for any 18 watt CFLs installed by the program before July 1, our analysis used a baseline assumption of 75 watts, whereas for installations occurring after July 1, our analysis used a baseline assumption of 53 watts.

We estimated an hours of use per bulb of 2.45 hours. Our estimation was based on a combination of metering data obtained through an evaluation of the LightSavers program in PY10 (which provided hours of use data per room) and PerformanceSavers participant survey data, which indicated frequencies of bulb installation location by room.

To account for interactive effects, we applied a waste heat factor. We used an estimated waste heat factor of 0.99, which was based on our engineering simulation models. We populated the model with heating and cooling saturations based on audit data from the PerformanceSavers program.

Using our engineering algorithm described above, we determined an *ex post* energy savings value for each bulb type installed by the program (see Table 16 and Table 17). The difference between *ex ante* and *ex post* savings estimates is primarily due to lower hours of use and lower waste heat factor than those assumed by Morgan Measure Libraries.

On average, we found a weighted realization rate of 84.4% for CFLs.

Table 16. *Ex Ante* and *Ex Post* Comparison for CFLs

Bulb Type	*Ex Ante* Savings/Unit (Annual kWh)	*Ex Post* Savings/Unit (Annual kWh)	Realization Rate
13 Watt PRE-EISA	48.4	41.6	86%
13 Watt POST-EISA	31.5	26.6	84%
18 Watt POST-EISA	37.4	33.8	90%
23 Watt POST-EISA	51.2	43.4	85%
High Wattage CFL	113.0	139.6	124%
Specialty Bulb CFL	44.1	35.2	80%
Reflector CFL	44.1	38.1	87%

On average, we found a weighted realization rate of 89.9% for LEDs.

Table 17. *Ex Ante* and *Ex Post* Comparison for LEDs

Bulb Type	*Ex Ante* Savings/Unit (Annual kWh)	*Ex Post* Savings/Unit (Annual kWh)	Realization Rate
8 Watt Globe Light	32.0	28.8	90%
10.5 Watt Downlight	54.5	49.0	90%
12 Watt Dimmable	48.0	43.1	90%
15 Watt Flood PAR30 Bulb	35.0	31.5	90%
18 Watt Flood PAR80 Bulb	32.0	28.8	90%

High-Efficiency Showerheads

We estimated the savings from high-efficiency showerheads using the following algorithm:

$$Energy\ Savings\left(\frac{therm}{Year}\right) = \left(\frac{People \times ShowerTime \times Days \times \%Days \times \Delta GPM \times (T_{SHOWER} - T_{IN}) \times C_P \times Den}{EF_{gas} \times Total\ \#of Showerheads\ X\ 100{,}067}\right) \times \text{High Eff. Showerheads}$$

Where:

- People = the number of people taking showers (ppl/household)
- Shower Time = the average shower length (min/shower)
- Days = the number of days per year (day/yr)
- %Days = the number of showers per day, per person (shower/day-ppl)
- ΔGPM = the difference in gallons per minute for the base showerhead and the new showerhead (gal/min)
- T_{SHOWER} = the average water temperature at the showerhead (^{o}F)

- T_{IN} = the average inlet water temperature (°F)
- C_P = the specific water heat (BTU/lb-°F)
- Den = the water density (lb/gal)
- 100,067 = the conversion rate between BTU and therm
- EF_{gas} = the water heater's energy factor
- Total # of Showerheads = the number of showerheads per home
- High-Efficiency Showerheads = The number of low-flow showerheads installed by the program

Table 18: High-Efficiency Showerhead PY13 Savings Assumptions

Term	PY13 Value	PY13 Source
People	2.39	PerformanceSavers Audit Data[1]
ShowerTime	8.66	Secondary Source[2]
Days	365	Conversion Factor (day/yr)
%Days	0.66	Secondary Source[3]
ΔGPM	0.85	PerformanceSavers Audit Data and Secondary Source[4]
T_{SHOWER}	105	Secondary Source[5]
T_{IN}	61.3	Secondary Source[6]
EF_{gas}	0.52	PerformanceSavers Audit Data
C_P	1	Constant (BTU/lb-°F)
Den	8.33	Constant (lb/gal)
Number of Showerheads	2.05	PerformanceSavers Audit Data
High-Efficiency Showerheads	1.02	PerformanceSavers Audit Data

[1]Parameter values based on PerformanceSavers Audit Data are program averages. Impact analysis used actual participant values when calculating savings.
[2]DeOreo, William, P. Mayer, L. Martien, M. Hayden, A. Funk, M. Kramer-Duffield, and R. Davis (2011). "California Single-Family Water Use Efficiency Study." *Sponsored by*: California Department of Water Resources. pp. 90-91. http://www.aquacraft.com/sites/default/files/pub/DeOreo-%282011%29-California-Single-Family-Water-Use-Efficiency-Study.pdf.
[3]DeOreo, Op cit. %Days are calculated by the number of showers per day per household (1.96, pp. 90 of the DeOreo study) divided by the average number of people per household (2.95, pp. 182 of the DeOreo study).
[4]Program data confirmed retrofit showerheads are 1.5 GPM. Existing showerheads are assumed to consume 2.35 GPM based on average of DOE-reported values for homes with domestic water pressures of 60psi and 80psi. http://energy.gov/energysaver/articles/reduce-hot-water-use-energy-savings
[5]The Bonneville Power Administration measured average shower temperatures as 104–106.
[6]Ameren TRM. http://www.gfxtechnology.com/WaterTemp.pdf

Using this engineering algorithm, the Cadmus team determined an *ex post* energy savings value of 16.3 therm/year for each installed and retained showerhead. This value is approximately 76% of the program's *ex ante* value (21.5 therm/year).

The difference between *ex ante* and *ex post* savings estimates is primarily due to two factors:

- The TRM assumed that the showers per person per day (%showers) was one. The study we used to inform our input reported that the number of showers per person per day was 0.66.[3]
- The TRM assumed one showerhead per home. Primary data collected from the participant survey found that homes had an average of 2.0 showerheads per home.

Table 19 shows our *ex ante* and *ex post* savings.

Table 19. *Ex Ante* and *Ex Post* Comparison for High Efficient Showerheads

Ex Ante Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
21.5 therm/yr	16.3 therm/yr	76%

High-Efficiency Faucet Aerators

We estimated high-efficiency faucet aerators savings using the following algorithm:

$$Energy\ Savings\ (therm/Year) = \left(\frac{People \times FaucetTime \times Days \times \Delta GPM \times (T_{FAUCET} - T_{IN}) \times C_P \times Den}{EF_{gas} \times NumberofFaucets\ X\ 100{,}067}\right) \times High\ Eff.Aerators$$

Where:

- People = the number of people taking showers (ppl/household)
- Faucet Time = the average length of faucet use per day (min/day)
- Days = the number of days per year (day/yr)
- ΔGPM = the difference in gallons per minute between the base unitand the new unit (gal/min)
- T_{FAUCET} = the average water temperature out of the faucet (^oF)
- T_{IN} = the average inlet water temperature (^oF)
- C_P = the specific water heat (BTU/lb-^oF)
- Den = the water density (lb/gal)
- 100,067 = the conversion rate between BTU and therm
- EF_{gas} = the water heater's energy factor
- Number of Faucet Aerators = the number of faucets per home
- High-Efficiency Aerators = the number of low-flow aerators installed by the program

[3] DeOreo, William, P. Mayer, L. Martien, M. Hayden, A. Funk, M. Kramer-Duffield, and R. Davis (2011). "California Single-Family Water Use Efficiency Study." *Sponsored by*: California Department of Water Resources. pp. 90-91. http://www.aquacraft.com/sites/default/files/pub/DeOreo-%282011%29-California-Single-Family-Water-Use-Efficiency-Study.pdf.

Table 20: High-Efficiency Faucet Aerator PY13 Savings Assumptions

Term	PY13 Value	PY13 Source
People	2.39	PerformanceSavers Audit Data[1]
Faucet Time	3.0	Secondary Source[2]
Days	365	Conversion Factor (day/yr)
ΔGPM	0.7	PerformanceSavers Audit Data
T_{FAUCET}	80	Secondary Source[3]
T_{IN}	61.3	Secondary Source[4]
EF_{gas}	0.51	PerformanceSavers Audit Data[1]
CP	1	Constant (BTU/lb-oF)
Den	8.33	Constant (lb/gal)
Number of faucets	3.73	PerformanceSavers Survey Data[1]
High-Efficiency Aerators	2.18	PerformanceSavers Survey Data[1]

[1]Parameter values based on PerformanceSavers Audit Data or Survey Data are program averages. Impact analysis used actual participant values when calculating savings.
[2]Morgan Measure Library.
[3]Stipulated value from Ohio, Mid-Atlantic, Delaware, and New York TRMs.
[4]Ameren TRM: http://www.gfxtechnology.com/WaterTemp.pdf

Using this engineering algorithm, we determined an *ex post* energy savings value of 1.5 therm/year for each installed and retained aerator. This value is approximately 23% of the program's *ex ante* value (6.8 therm/year).

The difference between *ex ante* and *ex post* savings estimates is primarily due to two factors:

- The TRM assumed the outlet temperature at the faucet was 105°F. based on the 2009 Vermont TRM. Upon review, we found that the Vermont TRM cited 80°F for the multi-family sector but did not cite a temperature for single-family homes (the 105° was cited for showerhead temperatures in the Vermont TRM). Because the Cadmus team could not identify a single-family temperature for faucets in the Vermont TRM, we used the assumed temperature of 80°F based on the Mid-Atlantic, New York, Delaware, and Ohio TRMs.
- The TRM assumed average faucet time to be five minutes per day, based on a 1997 report by American Water Works Association Research Foundation. However, to remain consistent in its approach to deeming parameter inputs, we used the Morgan Measure Library (MML) cited average of three minutes per day.
- The TRM assumed 1.9 faucets per home, based on the PY10 MFIQ program site visits. The Cadmus team used program audit data per customer as the input in the algorithm; however, the average number of faucets was 3.7 per home.

Table 21 shows our *ex ante* and *ex post* savings.

Table 21. *Ex Ante* and *Ex Post* Comparison for High-Efficiency Faucet Aerators

Ex Ante Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
6.8 therm/yr	1.5 therm/yr	23%

Water Heat Pipe Wrap

We estimated the per-unit pipe wrap savings using the following algorithm:

$$Energy\ Savings\ (therm/Year) = \frac{\left(\left(\frac{1}{R_{EXIST}} - \frac{1}{R_{NEW}}\right) \times L \times C \times \Delta T \times 8{,}760\right)}{EF_{gas} \times 100067}$$

Where:

- R_{new} = R-value of new pipe insulation
- R_{exist} = R-value of existing insulation
- L = length of installed pipe insulation (ft)
- C = pipe circumference (ft)
- 8760 = hours per year (hr)
- ΔT = the difference temperature between the ambient room temperature and the hot water temperature (°F)
- EF_{gas} = the water heater's energy factor
- 100,067 = the conversion rate between BTU and therm

Table 22. Water Heater Pipe WrapPY13 Savings Assumptions

Term	PY13 Value	PY13 Source
R_{new}	3.3	PerformanceSavers Audit Data
R_{exist}	1.0	Secondary Source[1]
L	10	PerformanceSavers Audit Data
C	0.196	Calculated (assumed ¾" D)[2]
ΔT	57.1	PerformanceSavers Audit Data, Secondary Source[3]
8,760	8,760	Constant (Hours per year)
EF_{gas}	0.52	PerformanceSavers Audit Data[4]
100,067	100,067	Conversion Factor (Btu/therm)

[1]Navigant Consulting Inc. "Measures and Assumptions for Demand Side Management Planning; Appendix C Substantiation Sheets." April 2009. Pg. 77.
[2]3/4" is standard pipe diameter.
[3]Temperature delta is based on assumed water heater set point of 124.6˚F (weighted average temperature of water heaters in PerformanceSavers program that did and did not receive a setback during program audit) and the ambient room temperature. Ambient air temperature is 67.5 degrees based on: Department of Energy: Test Procedure for Water Heaters. May 11, 1998. http://www.gpo.gov/fdsys/pkg/FR-1998-05-11/pdf/98-12296.pdf.
[4]Values listed inTable 22 from PerformanceSavers Survey Data and Audit Data are program averages. Actual participant values were used to calculate energy savings.

Using this engineering algorithm, we determined an *ex post* energy savings value of 14.7 therms/year for pipe wrap installed on each water heater. This value is approximately 138% of the program's *ex ante* value (10.7 therm/year) (Table 23).

The difference between *ex ante* and *ex post* savings estimates is unclear because the TRM does not clearly document the assumptions behind the savings estimate.

Table 23. *Ex Ante* and *Ex Post* Comparison for Hot Water Pipe Wrap

Ex Ante Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
10.7 therm/yr	14.7 therm/yr	138%

Hot Water Setback

Turning down the temperature set-point on a water heater will generate savings because less energy is required to heat the inlet water to the reduced hot water temperature. There is also the benefit of lower standby losses due to a smaller temperature difference between the water tank and the surrounding air.

We calculated the savings for the hot water setback measure savings using the following algorithm:

$$Energy\ Savings\ (therm/Year) = \frac{HW_{day} \times 365 \times 8.3 \times (T_{base} - T_{new})}{EF_{gas} X\ 100{,}067}$$

Where:

- HW_{day} = the average hot water use per day (gal/day)
- 365 = the number of days per year (day/yr)
- 8.3 = the water density (lb/gal)
- T_{base} = the pre-setback water heater temperature (^{o}F)
- T_{new} = the post-setback water heater temperature (^{o}F)
- EF_{gas} = the water heater's energy factor
- 100,067 = conversion rate between BTU and therm

Table 24. Hot Water SetbackPY13 Savings Assumptions

Term	PY13 Value	PY13 Source
HW_{day}	7.32	Secondary Source[1]
T_{base}	135	Secondary Source[2]
T_{new}	120	PerformanceSavers Audit Data
EFg_{as}	0.52	PerformanceSavers Audit Data
365	365	Days/year
8.3	8.3	Density of water
100,067	100,067	Btu/therm

[1]PennsylvaniaTechnical Reference Manual. 2013.
[2]Ameren TRM.

While most hot water end uses (showers, sinks, washing machines) will not be affected by the new, lower hot water temperature, dishwashers that contain an internal heating element to increase the temperature of incoming hot water will require additional energy consumption. This technology, called a booster heater, will heat incoming water to 140°F, regardless of the incoming water temperature, to ensure the appliance does an effective job washing each load of dishes.

To calculate the incremental increase in electricity usage used by the booster heater to increase the hot water temperature, the Cadmus team used the following algorithm.

$$Energy\ Consumption\ (kWh/Year) = \frac{HW_{dishwasher} \times Cycles \times 8.3 \times (T_{base} - T_{new})}{dishwasher\ X\ 3{,}413} \times \%Homes \times \%Booster\ Heater$$

Where:

- $HW_{dishwasher}$= Amount of hot water used per dishwasher cycle
- Cycles = Number of dishwasher cycles per year
- $EF_{dishwasher}$= Efficiency of electric dishwasher heating element
- 3,413 = Conversion factor (Btu/kWh)
- %Homes = Homes in Ameren's service territory that have a dishwasher (%)
- %Booster Heater = Dishwashers in Ameren's service territory that include booster heater (%)

Table 25. Hot Water Interactive Effects PY13 Assumptions

Term	PY13 Value	PY13 Source
$HW_{dishwasher}$	4.36	Secondary Source[1]
Cycles	215	Secondary Source[1]
$EF_{dishwasher}$	1.0	Assumption
3,413	3,413	Btu/kWh
%Homes	84%	Secondary Source[2]
%Booster Heater	54%	Secondary Source[3]

[1]PennsylvaniaTechnical Reference Manual. 2013.
[2]Ameren Potential Study.
[3]The penetration of booster heater technology was developed by the Cadmus team by applying a Bass Curve over 20 years to estimate market penetration.

In addition to quantifying the interactive effect, we considered two questions about how this savings adjustment should be applied specifically to Ameren's service territory.

- What percentage of Ameren's customers owns a dishwasher?
- What is the prevalence of this booster heater technology across the dishwashers currently installed in customer's homes?

Each of these questions attempts to quantify the savings adjustment, as homes without a dishwasher (or a dishwasher without booster heater technology) will have zero increased energy use. Ameren provided the Cadmus team a penetration value for dishwashers, based on the Ameren potential study

that cited 84% of homes in the service territory contain a dishwasher. To estimate the penetration of the booster heater technology throughout the customer base, we used multiple sources. Based on the most recent Residential Energy Consumption Survey (RECS), which was compiled in 2009, we obtained a breakdown of dishwasher vintages installed in Missouri homes, as shown in Table 26.

Table 26. Age of Dishwashers in Missouri Residential Homes[1]

Age of Dishwasher (years)	% of Missouri Residential Homes
Fewer than 2	13.3
2 – 4	26.7
5 – 9	33.3
10 – 14	13.3
15 – 19	6.7
20 or greater	6.7

[1]Residential Energy Consumption Survey, US Energy Information Administration, 2009.

We assumed that the age of dishwashers installed in 2013, in Missouri homes, is comparable to the data from 2009 and that the statewide data can be used a proxy for Ameren's service territory. Our additional sources[4] stated that "… all modern dishwashers have booster heaters and manufacturers do not allow the feature to be disabled." Thus, for all dishwashers less than five years old, we set the market penetration rate of the technology to 100%. We were unable to determine when the booster heater technology first entered the residential dishwasher market, but we assumed 20 years before the market was saturated. We made use of a Bass Curve to estimate market penetration over that time frame. Applying the penetration rate of dishwasher booster heater technology to the age of dishwashers in Missouri homes, we estimated that 54.4% of homes in Ameren's service territory contain a dishwasher that includes a booster heater.

To estimate the increased electricity usage attributed to dishwasher booster heaters in homes where a domestic hot water temperature set-back was applied to the water heater, we applied the dishwasher and booster heater penetration rates to the algorithm provided above (Table 25).

Using these data, we calculated an *ex post* therms savings of 6.4 therms/yr and an *ex post* kWh consumption of 15.6 kWh for water heaters that received a setback. With regard to the therm savings, this value is approximately 60% of the program's *ex ante* value (10.7 therms/yr) (Table 27).

Table 27. *Ex Ante* and *Ex Post* Comparison for Water Heater Setback

Fuel Type	*Ex Ante* Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
Natural Gas	10.7 therms/yr	6.4 therms/yr	60%
Electricity	N/A	(15.6) kWh/yr	N/A

[4] Hoak, D., Parker, D., Hermelink, A., "How Energy Efficient are Modern Dishwashers", Proceedings of ACEEE 2008 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Washington, DC, August 2008. http://www.fsec.ucf.edu/en/publications/pdf/FSEC-CR-1772-08.pdf

Smart Power Strips

The Cadmus team used a combination of primary data and deemed per-unit savings to estimate savings for smart power strips. Our primary data provided information on what type of peripherals were served by the smart power strips. These peripherals were categorized as either home entertainment or home office devices. To establish deemed savings for the peripherals, we reviewed over 20 studies on advanced power strips and examined their assumptions for different equipment types (home office and home entertainment). The notable differences between the studies were the average number of controlled devices assumed in each equation and the type of smart-strip technologies used.

After this detailed review, we determined that a 2011 study conducted by NYSERDA combined the most in-depth research with the most reasonable assumptions for calculating energy savings for load-sensing smart power strips.[5] Table 28 shows the per-unit savings determined by NYSERDA for home office and home entertainment applications.

Table 28. NYSERDA Savings Values and PerformanceSaver Saturations

Smart Strip Location	Savings/Unit	Saturations
Home Office	28 kWh/yr	36%
Home Entertainment	67 kWh/yr	64%

Using these data, we calculated a weighted average *ex post* savings of 52.0 kWh/yr for smart power strips. This value is approximately 29% of the program's *ex ante* value (184 kWh/yr) (Table 29).

Table 29. *Ex Ante* and *Ex Post* Comparison for Smart Power Strips

Ex Ante Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
184 kWh/yr	53 kWh/yr	29%

Window Replacement

We estimated electric savings for installation of high-efficiency windows using the following algorithm:

$$\Delta kWh = Square\ Feet\ of\ Windows\ Replaced * Savings\ per\ Square\ Foot$$

- Where:
- ΔkWh = electric energy savings

[5] Lockheed Martin and Energy Solutions, 2011. "Advanced Power Strip Research Report," prepared for the New York State Energy Research and Development Authority (NYSERDA). Available at www.nyserda.ny.gov.

Table 30: High-Efficiency WindowPY13 Savings Assumptions

Term	PY13 Value	PY13 Source
Square feet of Installed Windows	111	PerformanceSavers Survey Data[1]
Home vintage (old/average/new)	25%/75%/0%	PerformanceSavers Audit Data[2]
Home type (SF/MF/Manufactured)	100%/0%/0%	PerformanceSavers Audit Data
HVAC system – CAC & Gas Furnace	100%	PerformanceSavers Audit Data

[1]This is a program average value. Actual values per participant were used in evaluation analysis.
[2]Vintage classifications are defined in the MML as the following: "old" refers to homes built pre-1950s; "average" refers to homes built 1950-2004; and "new" refers to homes built after 2004.

We sourced the savings-per-square-foot based on the assumptions provided in the MML (see Table 31). The savings are reflective of homes that have central air conditioning and gas furnaces, which is representative of the PerformanceSavers participants who installed windows.

Table 31. MML Window Savings Values

Home Vintage[1]	kWh Savings/Unit	therm Savings/Unit
Old	2.77 kWh/sqft/yr	0.30 therm/sqft/yr
Average	2.33 kWh/ sqft/yr	0.10 therm/sqft/yr
[1]There were no homes built after 2004 ("new" vintage) that installed windows.		

Using this engineering algorithm, we determined an *ex post* energy savings value of 271.4 kWh/year for each home that installed windows. This value is approximately 25% of the program's *ex ante* value (1103.4 kWh/year).

Table 32. *Ex Ante* and *Ex Post* Comparison for High-Efficiency Windows

Ex Ante Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
1103.4 kWh/yr	271.4 kWh/yr	25%
38.9 therm/yr	16.8 therm/yr	43%

The difference between *ex ante* estimates and *ex post* savings estimates is due to the assumed installed square footage, segment, vintage, and heating and cooling equipment fuel type, as described below.

- The Ameren TRM assumes each home that installs new windows will install a total of 350 square feet. Based on the site visit data we collected, we verified an average total installation of 111 square feet per home.
- The Ameren TRM assumes a segment mix of 83% single-family, 13% multi-family, and 4% manufactured home for homes installing windows through the PerformanceSavers program. After collecting survey and audit data, we found that all homes that installed windows were single-family.
- The Ameren TRM assumes the vintage mix of homes that install windows is 19% old, 70% average, and 10% new. Based on the program audit data, we found the vintage mix was 25% old and 75% average (no new vintage homes installed windows through the program).

- The Ameren TRM assumes the following mix of heating and cooling equipment type and fuel source:
  - Central air conditioning with electric furnace: 21%
  - Central air conditioning with gas furnace: 59%
  - Central air source heat pump: 4%
  - Central dual fuel heat pump: 4%
  - Electric furnace no air conditioning: 3%
  - Gas furnace no air condition: 9%

However, we found that all customers who installed windows had central air conditioning with a gas furnace for their primary heating and cooling systems.

Air Sealing

When we pulled our sample in October, no air sealing measures had been implemented. However, two customers did complete air sealing in November. Because these customers were outside of the sample, we were unable to collect data for this measure and, therefore, could not complete a savings analysis. Thus, we deferred to the Ameren TRM savings for air sealing in PY13.

Table 33. *Ex Ante* Electric and Gas Savings for High Air Sealing

Fuel Type	*Ex Ante* Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
Electric	447.5 kWh/yr	N/A	N/A
Gas	47.5 therms/yr	N/A	N/A

Ceiling Insulation

We calculated the energy savings resulting from replacing or adding ceiling insulation using the following algorithms:[6]

$$\Delta kWh_{cool} = \frac{\left\{\left(\left(\frac{1}{R_{exist}} - \frac{1}{R_{new}}\right) * A_{attic} * \left(1 - \frac{Framing_{factor}}{2}\right)\right) * 24 * CDD * DUA\right\}}{(SEER \times 1000)}$$

$$\Delta therms = \frac{\left\{\left(\left(\frac{1}{R_{exist}} - \frac{1}{R_{new}}\right) * A_{attic} * \left(1 - \frac{Framing_{factor}}{2}\right)\right) * 24 * HDD\right\}}{(\eta Heat \times 100{,}067)}$$

Where:

- R_{new} = R-value of new attic assembly (including all layers between inside air and outside air)

[6] The savings protocol for Insulation measure was adopted from the 2012 Illinois TRM.

- R_{exist} = R-value of existing assembly and any existing insulation; minimum of R-5 for uninsulated assemblies
- A_{attic}= Total area of insulated ceiling/attic (ft^2)
- $Framing_{factor}$= Adjustment to account for area of framing
- 24 = Converts hours to days
- CDD = Cooling Degree Days
- DUA= Discretionary Use Adjustment (reflects that people do not always operate their air conditioners when conditions may call for it)
- 1000= Btu to kBtu conversion
- SEER = Seasonal Energy Efficiency Ratio of cooling system (kBtu/kWh)
- 3412 = Btu to kWh conversion
- HDD = Heating Degree Days
- ηHeat= Efficiency of gas furnace
- 100,067 Btu to therm conversion

Cooling savings and heating savings result from insulation measures for a home with a central air conditioning and a natural gas furnace. All of the homes we sampled that installed insulation contained this cooling and heating configuration. Table 34 lists the inputs we used for each algorithm.

Table 34. Insulation PY13 Savings Assumptions

Term	PY13 Value	PY13 Source
R_{new}	49	PerformanceSavers Survey Data
R_{old}	5 - 19	PerformanceSavers Survey Data
A_{attic}	1000-1784	PerformanceSavers Survey Data[1]
$Framing_{factor}$	15%	Secondary Source[2]
DUA	0.75	Secondary Source[3]
SEER	10.2-14.5	PerformanceSavers Audit Data[1]
ηHeat	65% - 100%	PerformanceSavers Audit Data[1]
CDD	1646	Secondary Source[4]
HDD	4535	Secondary Source[4]

[1]Values listed in Table 34 from PerformanceSavers Survey Data and Audit Data are program averages. Actual participant values were used to calculate energy savings.
[2]Based on Oak Ridge National Lab, Technology Fact Sheet for Wall Insulation. The factor is used directly for walls, but reduced by one-half for attics, assuming the average joist is 5.5" and R-38 requires 11" of cellulose; therefore, at each joist, one-half the thickness of insulation has been added between the joists.
[3]This factor's source is: Energy Center of Wisconsin, May 2008 metering study; "Central Air Conditioning in Wisconsin, A Compilation of Recent Field Research," p31.
[4]Ameren Missouri TRM

Using the engineering algorithm, we calculated an *ex post* electric and therm savings values for various levels of insulation installed at program homes (see Table 35 and Table 36).

Table 35. *Ex Ante* and *Ex Post* Electric Savings Comparison for Insulation

Insulation Level	*Ex Ante* Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
R5 – R30	433.9 kWh/yr	N/A[1]	N/A
R5 – R49	467.6 kWh/yr	715.7 kWh/yr	153%
R11 – R49	183.6 kWh/yr	133.3 kWh/yr	73%
R19 – R49	83.9 kWh/yr	122.7 kWh/yr	146%

[1]One participant upgraded their ceiling insulation from R5 to R30 after the evaluation sample was drawn. Therefore, the Cadmus team could not collect data for this measure.
[2]Weighted average based on total installations.

Table 36. *Ex Ante* and *Ex Post* Therm Savings Comparison for Insulation

Insulation Level	*Ex Ante* Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
R5 – R30	227.6 therm/yr	N/A[1]	N/A
R5 – R49	251.1 therm/yr	352.3 therm/yr	140%
R11 – R49	98.6 therm/yr	74.7 therm/yr	76%
R19 – R49	45.1 therm/yr	57.9 therm/yr	128%

[1]One participant upgraded their ceiling insulation from R5 to R30 after the evaluation sample was drawn. Therefore, the Cadmus team could not collect data for this measure.
[2]Weighted average based on total installations.

The difference between *ex ante* and *ex post* savings estimates as well as the varying realization rates is due to the assumed heating and cooling efficiencies as well as the total area insulated as described below:

- The Ameren TRM assumes a SEER efficiency of 10 and a natural gas furnace efficiency of 70%. Based on program audit data, we found an average SEER efficiency of 12 and an average furnace efficiency of 86% for homes that installed insulation.
- The Ameren TRM assumes that each home installs 950 square feet of insulation. However, based on program audit and survey data, we calculated the average installed insulation per home at 1,337 square feet.

Summary

The Cadmus team calculated the measure-specific realization rates (see Table 37) by comparing the evaluated (*ex post)* savings with the program's planning estimate (*ex ante*) detailed in Ameren's technical resource manual (TRM).

Table 37. Comparison of *Ex Ante and Ex Post* Per-Unit Gross Savings

Measure	*Ex Ante* Savings per Unit	*Ex Post* Savings per Unit	Realization Rate
Electric Measures (kWh/yr)			
CFLs	46.3	39.0	84.4%
LEDs	45.5	40.9	89.9%
Smart Power Strips	184.0	53.0	28.8%
Hot Water Setback Interactive Effect*	0.0	(15.6)	N/A
Ceiling Insulation (per home)	187.7	246.6	131.4%
Windows (per home)	1103.4	271.4	24.6%
Air Sealing[1]	447.5	N/A	100.0%
Overall	-	-	**73.8%**
Natural Gas Measures (therms/yr)			
High-Efficiency Aerators	6.8	1.5	22.8%
High-Efficiency Showerheads	21.5	16.3	75.6%
Hot Water Pipe Wrap	10.7	14.7	137.5%
Hot Water Setback	10.7	6.4	59.6%
Ceiling Insulation (per home)	100.6	122.2	121.5%
Windows (per home)	38.9	16.8	43.3%
Air Sealing[1]	47.5	N/A	100.0%
Overall	-	-	**75.1%**

[1]Air Sealing was not included in the evaluation sample and could not be evaluated. The evaluation therefore assumes 100% realization rate.

We determined that the program's overall electric measures realization rate was 73.8%. Our evaluation revealed there was a lower-than-expected realization rates for windows (24.6%) and smart strips (28.8%) which negatively impacted the electric realization rate.

We determined that the overall realization rate for natural gas measures was 75.1%. Our evaluation revealed that this realization rate was reduced by lower-than-expected rates for high-efficiency aerators (22.8%) and the water heater setback (59.6%). However, the greater-than-expected savings for ceiling insulation (121.5%) and hot water pipe wrap (137.5%) offset these low values.

Table 38 and Table 39 applies these per-unit values to the PerformanceSavers' PY13 participation rates to estimate the program's total *ex post* gross energy savings.

Table 38. Electric *Ex Post* Program Gross Savings

Measure	PY13 Participation	*Ex Post* Savings per Unit (kWh/yr)	Total *Ex Post* Savings (kWh/yr)
Electric Measures			
CFLs	7,245	39.0	282,735.1
LEDs	289	40.9	11,815.9
Smart Power Strips	331	53.0	17,529.8
Hot Water Setback Interactive Effect*	342	(15.6)	(5,343.9)
Ceiling Insulation (per home)	22	246.6	5,424.9
Windows (per home)	10	271.4	2,714.4
Air Sealing	2	N/A	895.0
Total	**8,241**	**-**	**315,771.1**

Table 39. Natural Gas *Ex Post* Program Gross Savings

Measure	PY13 Participation	*Ex Post* Savings per Unit (therm/yr)	Total *Ex Post* Savings (therm/yr)
Natural Gas Measures			
High-Efficiency Aerators	1,097	1.5	1,699.0
High-Efficiency Showerheads	461	16.3	7,496.8
Hot Water Pipe Wrap	522	14.7	7,677.3
Hot Water Setback	342	6.4	2,179.4
Ceiling Insulation (per home)	22	122.2	2,688.2
Windows (per home)	10	16.8	168.3
Air Sealing	2	N/A	95.0
Total	**2,456**	**-**	**22,004**

Table 40 lists the program's total gross *ex post* energy savings for both fuel types.

Table 40. Program Gross Realization Rates by Fuel Type

Fuel Type	*Ex Ante* Program Savings[1,2]	Realization Rate	*Ex Post* Program Savings	Precision at 90% Confidence
Electricity (MWh/yr)	427.7	73.8%	315.8	8.9%
Natural Gas (therm/yr)	29,312.4	75.1%	22,004.0	9.8%

[1]Update *to ex ante* electric savings value provided by Ameren Missouri on May 15, 2014
[2]Natural gas *ex ante* program savings were revised by the Cadmus team to include savings resulting from the installation of rebated windows.

NET IMPACT EVALUATION RESULTS

This section discusses the Cadmus team's methodology for calculating net savings by measure for PerformanceSavers.

We calculated the program net-to-gross (NTG) ratio using the following formula:

$$NTG = 1 - Freeridership + Participant\ Spillover + Nonparticipant\ Spillover + Market\ Effects$$

We could not estimate market effects, as the PerformanceSavers pilot is too new to have generated market change.

Table 41 lists the program's net electricity impacts.

Table 41. PY13 Electricity Net Impact Results

Measure	*Ex Post* Gross Savings (MWh/yr)	Free Ridership	Participant Spillover	Nonparticipant Spillover	NTG Ratio	Net Savings (MWh/yr)
Electricity	315.8	16.5%	5.1%	1.7%	90.3%	285.1

Table 42 lists the program's net natural gas impacts.

Table 42. PY13 Therm Net Impact Results

Measure	*Ex Post* Gross Savings therm/yr)	Free Ridership	Participant Spillover	Nonparticipant Spillover	NTG Ratio	Net Savings (therm/yr)
Natural Gas	22,004.0	16.5%	5.1%	1.7%	90.3%	19,869.6

Major Measure Free Ridership

The Cadmus team determined free ridership using a self-report approach in which a sample of participants was asked a standard battery of questions:

- Had the participant already purchased the product before learning about the incentive?
- Was the participant planning to purchase the same product before learning about the incentive?
- Would the participant have purchased a product that was just as energy-efficient without the incentive?
- Would the participant have purchased the product at the same time as when they went through the PerformanceSavers program?

We then applied a free ridership score, ranging from 0% to 100%, to all participants individually, based on their collective responses to the survey questions. (In Appendix A, a flow chart illustrates our free ridership scoring approach.) Our process for determining the free ridership score is as follows:

- We categorized customers as 0% free riders in the following instances: (1) they had no plans to install the measure in the absence of the program's incentives and would not have installed the

measure within one year in the absence of the program; (2) they had considered installing the measure before learning about the program but would not have done so without program incentives; or (3) in absence of the program incentives, they would have purchased or installed less-efficient equipment.

- We categorized customers as 100% free riders if they had installed the measure before learning about the program or if they would have installed the same measure at the same time without the program.
- We assigned a partial free ridership score (ranging from 12.5% to 75%) to customers who said they already had plans to install the measure but their decision about which product to purchase or when they would purchase it was influenced by the program. For customers who were highly likely to install an energy-efficient measure right away and for whom the program had less influence over their decision, we assigned a higher free ridership percentage than for those who said the program may not have been as large an influence or whose purchase may have occurred later in the absence of the program.

After translating survey responses into each participant's free ridership score, we used the evaluated energy savings in calculating a weighted average free ridership estimate for each incented measure. (Appendix F shows the conversion of each raw survey response into the free ridership scoring matrix values with the free ridership score combinations and scoring legend we used to categorize customer survey responses for incented measures.)

Major Measure Free Ridership Results

Table 43 provides free ridership by measure for added insulation and windows. Appendix F contains the full set of unique free ridership survey response combinations, the free ridership score assigned to each combination, and the number of responses. Responses of "Yes," "No," or "Partial" relate to whether or not the specific response is indicative of free ridership.

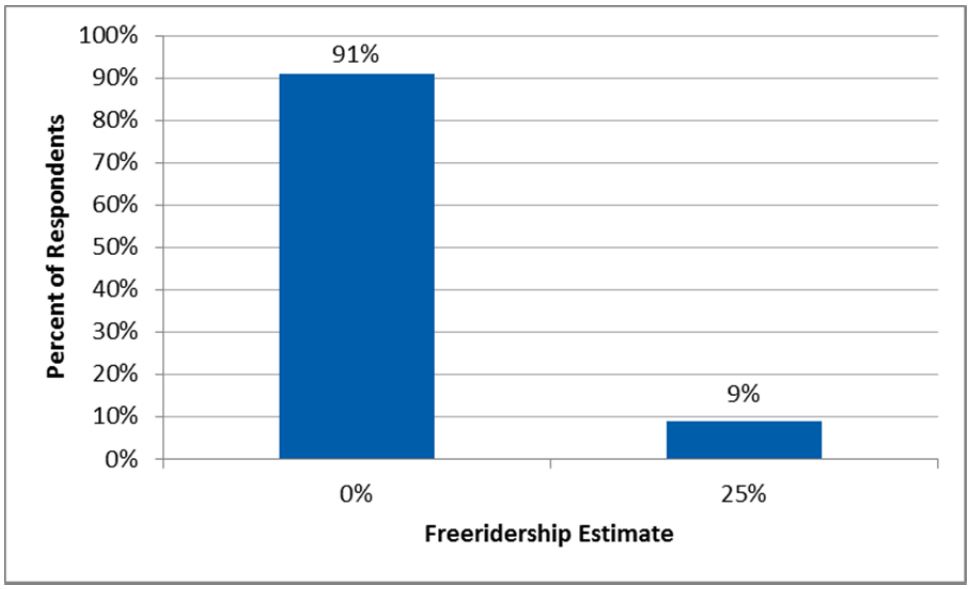
Table 43. PerformanceSavers Incented Measure Free Ridership Results

Program Measure	Sample Size	Free Rider Estimate	Free Rider Absolute Precision
Insulation	7	2.3%	±5.3%
Windows	4	0.0%	±0.0%

Distribution of Free Ridership Scores

Figure 1 shows the distribution of the insulation and windows free ridership scores. Approximately 91% of the survey respondents were scored as 0% free riders, while 9% were scored as 25% free riders. No respondents were estimated as true free riders (100%).

Figure 1. Overall Distribution of PerformanceSavers Incented Measures Free Ridership Scores



Direct Install Measure Free Ridership

The Cadmus team estimated free ridership for the PerformanceSavers direct install measures.

CFL Free Ridership

Our method for assigning free ridership ratios for direct install CFLs was based on survey responses, and we used a free ridership curve and drew upon diffusion of innovation product-adoption concepts.[7] As shown in Table 44, we placed at one end of the curve those respondents who had installed no CFLs before they received them through the program, and we assigned them a free ridership score of 0% for pre-installation of CFLs. At the other end of the curve, we placed respondents who had installed 14 or more CFLs before receiving the audit and assigned them a free ridership score of 100%.

[7] Previous NTG analyses (such as analyses performed in Indiana and Maryland) have used this approach with a free ridership curve (also referred to as a "Bass curve"). The Bass model consists of a simple differential equation that describes the process of how new products get adopted in a population.

Table 44. CFL Pre-Installation Free Ridership Determined by Diffusion of Innovation Product Adoption

Number of Pre-Installed CFLs	Free Ridership Pre-Installation	Number of Customers with Pre-Installed CFLs
0	0%	11
1	0%	3
2	5%	5
3	10%	1
4	20%	6
5	30%	4
6	40%	5
7	50%	1
8	60%	1
9	70%	4
10	80%	4
11	90%	0
12	95%	3
13	98%	1
14 or more	100%	11

In addition to applying the pre-installation free ridership percentage, we determined a planned-purchase free ridership percentage, based on the respondents 'reported intention to purchase CFLs for their homes *before* they received the audit. Table 45 shows the percentages used in our analysis.

Table 45. Number of Participants Cross-Referenced by Pre-Installed CFLs and Planned-Purchase Free Ridership

If you had not received free CFLs during the Act On Energy PerformanceSavers in-home audit, do you think you would you have bought CFLs on your own within the next year?	Planned-Purchase Free Ridership
Yes, at roughly the same time	100%
Yes, within a few months	50%
Yes, within a year	25%
No	0%

In Table 46, the number of participants is cross-referenced with the free ridership results in Table 44 and Table 45.

Table 46. Number of Participants Cross-Referenced by Pre-Installed CFLs and Planned-Purchase Free Ridership

Number of Pre-Installed CFLs	Free Ridership Pre-Installation	Number of Participants per Planned-Purchase Free Ridership			
		100% (n=0)	50% (n=12)	25% (n=25)	0% (n=23)
0 (n=11)	0%	0	3	0	8
1 (n=3)	0%	0	0	1	2
2 (n=5)	5%	0	1	2	2
3 (n=1)	10%	0	0	0	1
4 (n=6)	20%	0	1	3	2
5 (n=4)	30%	0	0	3	1
6 (n=5)	40%	0	1	3	1
7 (n=1)	50%	0	0	1	0
8 (n=1)	60%	0	0	0	1
9 (n=4)	70%	0	0	4	0
10 (n=4)	80%	0	0	4	0
12 (n=3)	95%	0	1	1	1
13 (n=1)	98%	0	1	0	0
14 or more (n=11)	100%	0	4	3	4

Using a weighted average, we combined the pre-installation percentage with the planned-purchase percentages (shown in Table 44 and Table 45). We gave past actions (the pre-installation free ridership percentages) twice as much weight as the planned action percentages (planned-purchase free ridership).From these per-participant weighted averages, we then calculated an overall average weighted by verified kWh savings across all of the 60 respondents. The result was a 31.4% free ridership level at ±6.4% absolute precision.

LED Free Ridership

The Cadmus team's method for assigning free ridership ratios for direct install LEDs was based on participant survey responses. Our approach used a free ridership curve and drew upon diffusion of innovation product-adoption concepts. As shown in Table 47, we placed at one end of the curve those respondents who had installed no LEDs before they received them through the program, and we assigned them a free ridership score of 0% for pre-installation of LEDs. At the other end of the curve, we placed those respondents who had installed 14 or more LEDs before receiving the audit, and we assigned them a free ridership score of 100%.

Table 47. LEDs Pre-Installation Free Ridership Determined by Diffusion of Innovation of Product Adoption

Number of Pre-Installed LEDs	Free Ridership Pre-Installation	Number of Customers with Pre-Installed LEDs
0	0%	21
1	0%	1
2	5%	0
3	10%	1
4	20%	0
5	30%	0
6	40%	0
7	50%	0
8	60%	0
9	70%	0
10	80%	0
11	90%	0
12	95%	0
13	98%	0
14 or more	100%	0

We also determined a planned-purchase free ridership percentage, based on the respondents' reported intention to purchase LEDs for their homes *before* they received the audit. Table 48 shows the percentages used in this analysis.

Table 48. Number of Participants Cross-Referenced by Pre-Installed LEDs and Planned-Purchase Free Ridership

If you had not received free LEDs during the Act On Energy PerformanceSavers in-home audit, do you think you would you have bought LEDs on your own within the next year?	Planned-Purchase Free Ridership
Yes, at roughly the same time	100%
Yes, within a few months	50%
Yes, within a year	25%
No	0%

In Table 49, the number of participants is cross-referenced against the free ridership results shown in Table 47 and Table 48.

Table 49. Number of Participants Cross-Referenced by Pre-Installed LEDs and Planned-Purchase Free Ridership

Number of Pre-Installed LEDs	Free Ridership Pre-Installation	Number of Participants per Planned-Purchase Free Ridership			
		100% (n=0)	50% (n=0)	25% (n=3)	0% (n=20)
0 (n=21)	0%	0	0	1	20
1 (n=1)	0%	0	0	1	0
2 (n=0)	5%	0	0	0	0
3 (n=1)	10%	0	0	1	0
4 (n=0)	20%	0	0	0	0
5 (n=0)	30%	0	0	0	0
6 (n=0)	40%	0	0	0	0
7 (n=0)	50%	0	0	0	0
8 (n=0)	60%	0	0	0	0
9 (n=0)	70%	0	0	0	0
10 (n=0)	80%	0	0	0	0
12 (n=0)	95%	0	0	0	0
13 (n=0)	98%	0	0	0	0
14 or more (n=0)	100%	0	0	0	0

Using a weighted average, we combined the pre-installation percentage with the planned-purchase percentages (shown in Table 47 and Table 48). We gave past actions (the pre-installation free ridership percentages) twice as much weight as the planned action percentages (planned-purchase free ridership).From these per-participant weighted averages, we then calculated an overall average weighted by verified kWh savings across all of the 23 respondents. The result was a 1.3% free ridership level at ±1.2% absolute precision.

Faucet Aerators Free Ridership

For each respondent who reported that at least one of the faucet aerators installed by the auditor was still installed, we assigned both a pre-installation free ridership score and a planned-installation free ridership score and then combined these scores using a weighted average.

Pre-Installation Free Ridership Scores

Of the 48 respondents who had at least one of the faucet aerators currently installed, 12 (25%) reported that they had already installed an aerator in their home before they received the audit. Therefore, we assigned these respondents a pre-installation free ridership score of 100%.

We gave a pre-installation free ridership score of 0% to the remaining respondents because they either did not have a faucet aerator installed prior to receiving the audit or they did not know if they had an aerator installed.

Planned-Purchase Free Ridership Scores

The Cadmus team gave a planned-purchase free ridership score of 0% to the 42 respondents who currently had at least one of the faucet aerators installed *but* were not planning to buy a faucet aerator within the next year.

We gave a 100% planned-purchase free ridership score to one respondent who had planned to purchase a faucet aerator at roughly the same time.

We gave a 25% planned-purchase free ridership score to five respondents because they planned to purchase a faucet aerator within a year.

Calculation Methodology

For each respondent who had at least one faucet aerators installed at the time of the survey, we calculated the free ridership score by taking a weighted average of the two scores described above, giving twice as much weight to the score for past actions as to the score for planned actions.

Using the free ridership score for the 48 respondents, we calculated the total average free ridership for the measure, weighing the scores based on verified energy savings. Across these respondents, the resulting free ridership percentage for the installed aerators averaged 18.2%, with a precision rate of ±9.0%. Table 50 presents the faucet aerator free ridership scoring.

Table 50. Faucet Aerator Free Ridership Scoring*

How many high-efficiency faucet aerators were you already using in your home, if any, before you received the audit?		If you had not received free faucet aerators during the Act On Energy PerformanceSavers in-home audit, how many, if any, would you have bought on your own within the next year?				
		Response	At roughly the same time (n=1)	Within a few months (n=0)	Within a year (n=5)	More than a year (n= 42)
		Score	100%	50%	25%	0%
Response	Score					
No or Don't Know (n=)	0%		33% (n=1)	(n=0)	8% (n=5)	0% (n=30)
Yes (n=12)	100%		(n=0)	(n=0)	(n=0)	67% (n=12)
Average Free Ridership**						18.2%

*While the question asks respondents how many high-efficiency faucet aerators are installed, the reported quantity was translated to whether or not they had installed the measure at all.

**Weighted average based on verified energy savings.

Showerheads Free Ridership

For each of the respondents reporting that at least one of the showerheads installed by the auditor was still installed, we assigned both a pre-installation free ridership score and a planned-installation free ridership score and then combined these scores using a weighted average.

Pre-Installation Free Ridership Scores

Of the 10 respondents who had at least one of the program's high-efficiency showerhead currently installed, 10% reported having already installed a high-efficiency showerhead in the home before receiving the audit. Therefore, we gave this respondent a pre-installation free ridership score of 100%.

We gave a pre-installation free ridership score of 0% to the remaining respondents because they either did not have a high-efficiency showerhead installed prior to receiving the audit or they did not know whether they had one installed.

Planned-Purchase Free Ridership Scores

We gave a planned-purchase free ridership score of 0% to the seven respondents who currently had at least one of the showerheads installed *but* who were not planning to buy a high-efficiency showerhead for their home within the next year.

We gave a 50% planned-purchase free ridership score to one respondent who planned to purchase a showerhead within the next few months.

We gave a 25% planned-purchase free ridership score to five respondents because they planned to purchase a showerhead within a year.

Calculation Methodology

For each respondent who had at least one high-efficiency showerhead installed at the time of the survey, we calculated the free ridership score by taking a weighted average of the scores described above, giving twice as much weight to the score for past actions as to the score for planned actions.

Using the free ridership score for the 10 respondents, we calculated the total average free ridership for the measure, weighing the scores based on verified energy savings. Across these respondents, the resulting free ridership percentage for the installed showerheads averaged 10.0%, with a precision rate of ±12.2%. Table 51 presents the showerhead free ridership scoring.

Table 51. Showerhead Free Ridership Scoring*

How many high-efficiency showerheads were you already using in your home, if any, before you received the audit?		If you had not received high-efficiency showerheads during the Act On Energy PerformanceSavers in-home audit, how many, if any, would you have bought on your own within the next year?				
		Response	At roughly the same time (n=0)	Within a few months (n=1)	Within a year (n=2)	More than a year (n= 7)
		Score	100%	50%	25%	0%
Response	Score					
No or Don't Know (n=9)	0%		(n=0)	17% (n=1)	8% (n=1)	0% (n=7)
Yes (n=1)	100%		(n=0)	(n=0)	75% (n=1)	(n=0)
Average Free Ridership**						10.0%

*While the question asks respondents how many high-efficiency showerheads are installed, the reported quantity was translated to whether or not they had installed the measure at all.
**Weighted average based on verified energy savings.

Smart Strips Free Ridership

For each of the respondents reporting that at least one of the smart strips installed by the auditor was still installed, the Cadmus team assigned both a pre-installation free ridership score and a planned-installation free ridership score and then combined these scores using a weighted average.

Pre-Installation Free Ridership Scores

Of the 29 respondents who had at least one of the smart strips currently installed, 17% reported that they had installed the item in their home before they received the audit. Therefore, the Cadmus team gave these five respondents a pre-installation free ridership score of 100%.

We gave a pre-installation free ridership score of 0% to the remaining respondents because they either did not have a smart strip installed prior to receiving the audit or they did not know if they had one installed.

Planned-Purchase Free Ridership Scores

We gave a planned-purchase free ridership score of 0% to the 26 respondents who currently had at least one of the smart strips installed *but* who were not planning to buy a smart strip for their home within the next year.

We gave a 50% planned-purchase free ridership score to three respondents because they planned to purchase a smart strip within the next few months.

Calculation Methodology

For each respondent who had at least one smart strip installed at the time of the survey, we calculated the free ridership score by taking a weighted average of the two scores described above, giving twice as much weight to the score for past actions as to the score for planned actions.

Using the free ridership score for the 10 respondents, we calculated the total average free ridership for the measure, weighing the scores based on verified energy savings. Across these respondents, the resulting free ridership percentage for the installed smart strips averaged 13.2%, with a precision rate of ±0.8%. Table 52 presents the showerhead free ridership scoring.

Table 52. Smart Strip Free Ridership Scoring*

How many smart strips were you already using in your home, if any, before you received the audit?		If you had not received free smart strips during the Act On Energy PerformanceSavers in-home audit, how many, if any, would you have bought on your own within the next year?				
		Response	At roughly the same time (n=0)	Within a few months (n=3)	Within a year (n=2)	More than a year (n= 26)
		Score	100%	50%	25%	0%
Response	**Score**					
No or Don't Know (n=24)	0%		(n=0)	(n=0)	(n=0)	0% (n=24)
Yes (n=5)	100%		(n=0)	83% (n=3)	(n=0)	67% (n=2)
Average Free Ridership**						**13.2%**

*While the question asks respondents how many smart strips are installed, the reported quantity was translated to whether or not they had installed the measure at all.

**Weighted average based on verified energy savings.

Water Heat Pipe Wrap Free Ridership

For each of the respondents reporting that water heat pipe wrap installed by the auditor was still installed, the Cadmus team assigned both a pre-installation free ridership score and a planned-installation free ridership score and then combined these scores using a weighted average.

Pre-Installation Free Ridership Scores

Of the 45 respondents who had the water heat pipe wrap currently installed, 24% reported that they had already had water heater pipe wrap installed before they received the audit. Therefore, we gave these 11 respondents a pre-installation free ridership score of 100%.

We gave a pre-installation free ridership score of 0% to the remaining respondents because they either did not have water heater pipe wrap installed prior to receiving the audit or they did not know if they had it installed.

Planned-Purchase Free Ridership Scores

We gave a planned-purchase free ridership score of 0% to 39 respondents who currently had the water heater pipe wrap installed *but* who were not planning to buy water heat pipe wrap within the next year.

We gave a 100% planned-purchase free ridership score to six respondents because they had planned to purchase water heater pipe wrap at roughly the same time of the installation.

Calculation Methodology

For each respondent who had water heater pipe wrap installed at the time of the survey, the Cadmus team calculated the free ridership score by taking a weighted average of the two scores described above, giving twice as much weight to the score for past actions as to the score for planned actions.

Using the free ridership score for the 45 respondents, we calculated the total average free ridership for the measure, weighing the scores based on verified energy savings. Across these respondents, the resulting free ridership percentage for the installed water heat pipe wrap averaged 20.7%, with a precision rate of ±8.6%. Table 53 presents the water heater pipe wrap free ridership scoring.

Table 53. Water Heater Pipe Wrap Free Ridership Scoring

Did you already have water heater pipe wrapping installed before you received the Act On Energy PerformanceSavers in-home audit?		If you had not received the free water heater wrap during the Act On Energy PerformanceSavers in-home audit, would you have bought it on your own within the next year?				
		Response	At roughly the same time (n=6)	Within a few months (n=0)	Within a year (n=0)	More than a year (n= 39)
		Score	100%	50%	25%	0%
Response	Score					
No or Don't Know (n=34)	0%		33% (n=2)	-- (n=0)	-- (n=0)	0% (n=32)
Yes (n=11)	100%		100% (n=4)	-- (n=0)	-- (n=0)	67% (n=7)
Average Free Ridership*					20.7%	

*Weighted average based on verified energy savings.

Water Heater Setback Free Ridership

For each of the respondents who reported that their water heat temperature was turned down by the auditor and the settings were still in place, we estimated a planned-installation free ridership score.

Planned-Purchase Free Ridership Scores

We gave a planned-purchase free ridership score of 0% to 18 respondents who had their hot water temperature turned down by the auditor *but* who were not planning turn it down themselves within the next year in the absence of the audit.

We gave a 50% planned-purchase free ridership score to two respondents because they planned to turn down the temperature on their hot water heater within the next few months.

Calculation Methodology

For each respondent whose water heater temperature was still turned down at the time of the survey, we calculated the free ridership score by using the planned-purchase free ridership score.

Using the planned-purchase free ridership score for the 21 respondents, we calculated the total average free ridership for the measure, weighing the scores based on verified energy savings. The resulting free

ridership percentage for hot water temperature turndown averaged 9.5%, with a precision rate of ±9.2%. However, we are not using the self-report survey-based free ridership score estimated for water heater temperature turndown because it is a no-cost measure and presumably auditors only turned down water heaters that were not already turned down. We are assuming free ridership is 0% for net impact purposes.

Participant Spillover

To calculate spillover, the Cadmus team asked PerformanceSavers participants if they had undertaken any additional energy-efficient actions since participating in the program. Then we asked them to rate how important receiving the in-home audit was to their decision to purchase any subsequent energy-efficient equipment.

We considered measures to be attributable to program spillover only if the respondent's answer to the question was *important*. Three survey respondents reported they installed additional energy-efficient measures for which their participation in the PerformanceSavers program was *important* to their purchasing decision. These measures were a refrigerator, freezer, and two insulation installations.

We also eliminated any responses that indicated the respondent had received an incentive through another Ameren Missouri program in order to avoid double-counting savings already counted by a concurrent program.

Several respondents indicated they had purchased CFLs or LED bulbs. However, we did not include these lighting measures in our analysis to avoid double-counting savings. The lighting spillover analysis from the home inventory study will account for non-program bulbs purchased by Ameren customers.

Additionally, site visits conducted by the Cadmus team confirmed that four participants who received windows measures had installed more windows than they received rebates for. All four completed the free ridership battery, and we estimated their free ridership as 0%. We attributed the savings resulting from the additional windows (for which they did not receive an incentive) to program spillover because the windows would not have been installed in the absence of the program. (The PerformanceSavers program capped the incentive at 10 windows per customer.)

We applied deemed savings estimates to the refrigerator, freezer, insulation, and non-rebated windows measures, arriving at a total survey sample spillover savings.

Next, we divided the sample spillover savings by the program gross savings from the survey sample, as described in this equation:

$$Spillover\ \% = \frac{\sum[Net\ spillover\ measure\ BTU\ savings\ for\ all\ survey\ respondents]}{\sum[Gross\ program\ measure\ BTU\ \ for\ all\ survey\ respondents]}$$

This yielded a program-level spillover estimate of 5.1%, and the details are presented in Table 54.

Table 54. Participant Spillover by Data Collection Method and Measure

Program Measure	Participant Spillover BTU Savings	Total Survey Sample Program BTU Savings	Spillover
ENERGY STAR® Refrigerator	1,706,071	298,436,939	5.1%
ENERGY STAR Freezer	208,141		
Insulation	10,338,077		
Windows – Non rebated	3,095,116		
All	**15,347,405**	**298,436,939**	**5.1%**

Nonparticipant Spillover

Effective program marketing and outreach generates program participation *and* increases general energy-efficiency awareness among customers. The cumulative effect of sustained utility program marketing (which often occurs concurrently for multiple programs) can affect customers' perceptions of their energy usage and, in some cases, motivates customers to take efficiency actions outside of the utility's program. This phenomenon—called nonparticipant spillover (NPSO)—results in energy savings caused by but not rebated through a utility's demand-side management activity.

During PY13, Ameren Missouri spent over $1.6 million dollars to market individual residential efficiency programs and the portfolio-wide Act on Energy campaign. To understand whether Ameren's program-specific and general Act On Energy marketing efforts generated energy-efficiency improvements outside of Ameren's incentive programs, the Cadmus team implemented a general population survey of residential customers. We will repeat the survey for both PY14 and PY15 as we continue monitoring nonparticipant activity and tracking potential long-term changes in energy-efficiency awareness among Ameren's residential customers.

Methodology

Using Ameren's entire residential customer information system as the sample frame, the Cadmus team randomly selected and surveyed 401 customers. We determined that our sample contained a small number of customers (n=36) who self-reported that they participated in an Ameren residential program in 2013. When estimating NPSO, we excluded these customers from our analysis, focusing on the 365 identified nonparticipants to avoid the potential double-counting of program-specific spillover.

We limited our NPSO analysis to the same efficiency measures rebated through Ameren programs (known as "like" spillover), with the notable exception of lighting products. Even though lighting is a "like" spillover measure, the analysis excluded it to avoid double-counting NPSO lighting savings already captured through the upstream LightSavers program market affects analysis.

To confirm a relationship between Ameren's energy-efficiency programs and the Act On Energy awareness campaign and actions taken by nonparticipants, the Cadmus team's survey asked about nonparticipants' familiarity with Ameren's energy-efficiency programs and Act On Energy. To be

included in the NPSO analysis, nonparticipating respondents had to indicate: a) they were familiar with Ameren's campaign; and b) Ameren's efficiency messaging motivated their purchasing decisions.

Results

Of 365 nonparticipants surveyed, 11 cited Ameren's marketing as either "very important" or "somewhat important" in their decisions to purchase non-rebated, high-efficiency measures during 2013:8

- Among nonparticipants citing their knowledge of Ameren's energy-efficiency programs or the Act On Energy campaign as "very important," we counted *ex post,* gross, per-unit savings, determined through the PY13 evaluation towards the NPSO analysis.
- If nonparticipants said Ameren was "somewhat important" in their decisions, we applied a 50% decrement and applied one-half of the *ex post* energy savings for the specified measure.

The analysis excluded the responses of nonparticipants who said that Ameren's programs or Act On Energy were "not very important" or "not at all important" to their efficiency actions.

Table 55 shows measures and gross evaluated kWh savings attributed to Ameren, with average savings per spillover measure of 242 kWh.

[8] This translates to approximately 3% of the general population with a range of 90% confidence of 1.54% to 4.49%. Despite the range, the middle point of 3% remains the most likely value. With 3% of the population undertaking actions on their own, the sample size needed to detect such a level with ±10% is nearly 10,000 surveys, a clearly prohibitive undertaking.

Table 55. NPSO Response Summary

Individual Reported Spillover Measures	Influence of Ameren Information on Purchase	Measure Savings (kWh)*	Allocated Savings	Total kWh Savings	Avg kWh Per Spillover Measure
Water Heater	Very	245.7†	100%	245.7	
Central Air Conditioner (CAC)	Somewhat	288*	50%	144.0	
Installed Programmable Thermostat	Somewhat	105†	50%	52.7	
Installed Programmable Thermostat	Somewhat	105†	50%	52.7	
Installed Programmable Thermostat	Somewhat	105†	50%	52.7	
Installed Programmable Thermostat	Somewhat	105†	50%	52.7	
Installed Programmable Thermostat	Somewhat	105†	50%	52.7	
Removed Refrigerator	Very	1,013ˆ	100%	1,013	
Scheduled CAC Tune-Up	Somewhat	993**	50%	496.5	
Water Heat Pipe Wrap	Very	363.8†	100	363.8	
Windows	Somewhat	271***	50%	136	
Total (n=11)				**2,662**	**242**

†Based on savings calculated for the RebateSavers program.
*Assumption used for the CoolSavers program's gross evaluated savings, based on a 2.5-ton unit rated at 15 SEER, with a baseline of 13 SEER.
ˆBased on savings calculated for the ApplianceSavers program.
**Assumption used for the CoolSavers program's gross evaluated savings, based on a 3-ton unit and a 7.7% efficiency improvement in heating and cooling for condenser cleaning.
***Based on savings calculated for the PerformanceSavers program.

To arrive at a single savings estimate (Variable A in), the Cadmus team used the numbers in the Total kWh Savings column to calculate an average for the 11 measures assessed for nonparticipant spillover. Thus, the estimate of 242 kWh represents the average nonparticipant energy savings per respondent who attributed spillover to Ameren's residential programs.

To determine the total NPSO generated by Ameren marketing in 2013, we used the following variables (as shown in 56):

- **A** is the average kWh savings per NPSO response.
- **B** is the number of NPSO measures attributed to the program.
- **C** is the number of nonparticipants contacted by the survey implementer.
- **D** is Ameren's total residential customer population.
- **E** is NPSO energy savings extrapolated to the customer population, calculated by dividing B by C and then multiplying this result by A and D.

- **F** is the total evaluated savings for the 2013 program year, for ApplianceSavers, CoolSavers, LightSavers, PerformanceSavers, and RebateSavers. (The analysis did not include CommunitySavers and ConstructionSavers.)[9]
- **G,** representing NPSO as a percentage of total evaluated savings, is the nonparticipant percentage used in the NTG calculations.

We estimated overall NPSO at 2.8% for the portfolio level, as shown in .

Table 56. NPSO Analysis

Variable	Metric	Value	Source
A	Average kWh Savings per Spillover Measure	242	Survey Data/Impact Evaluation
B	Number of Like Spillover Nonparticipant Measures	11	Survey data
C	Number Contacted	365	Survey disposition
D	Total Residential Population	1,040,928	Customer database
E	Non-Part SO MWh Savings Applied to Population	7,592	(((B÷C)×A) × D)/1000
F	Total Evaluated Savings (MWh)	267,918	2013 Program Evaluations
G	NPSO as Percent of Total Evaluated Savings	2.8%	E ÷ F

In some jurisdictions, evaluators apply NPSO as an adjustment at the portfolio-level. Though a reasonable approach, it inherently assumes all programs contributed equally to generating the observed NPSO. However, given the significant differences between the programs' marketing tactics and budgets as well as the programs' designs and scales, an alternate approach is likely to produce better estimate of attribution.

The Cadmus team considered the following three approaches for allocating total observed NPSO to individual programs:

1. **Even Allocation**: The most straightforward approach allocates NPSO evenly across the residential programs (i.e., makes a 2.8% adjustment to each program's NTG). Doing so, however, is equivalent to applying NPSO at the portfolio-level, and therefore, as noted, assumes all programs contribute equally to generating NPSO.
2. **"Like" Programs:** Another approach allocates NSPO savings to specific programs, based on the measure installed by the nonparticipant or by the action they took. For example, one nonparticipant reported tuning up their CAC, based on energy-efficiency messaging from Ameren. Using this approach, we would assign NPSO savings associated with the tune-up to CoolSavers. While this approach establishes a clear connection between a reported NPSO measure and Ameren's program that promotes that measure, our research found this direct measure-program relationship did not prove as straightforward as it appeared. Specifically,

[9] The Cadmus team excluded CommunitySavers and ConstructionSavers as both programs exclusively employ very targeted marketing; so marketing for these programs would likely generate little NPSO. For CommunitySavers, the program works directly with property managers of low-income buildings. For ConstructionSavers, most program marketing targets regional builders.

while our study found all 11 respondents reporting NPSO were familiar with Act on Energy or Ameren's energy-efficiency messaging, only nine could cite specific program names. Further, just over one-half of the customers (6 of 11) who reported NPSO measures were unfamiliar with the program or the programs corresponding to the measure they installed. These findings indicated that Ameren generated NPSO through the cumulative effects of various program-specific and portfolio-level marketing efforts, and mapping NPSO measures solely to the program offering that measure could undervalue the overall impact of cumulative and sustained energy-efficiency messaging.

3. **Marketing Budget and Program Size.** The final allocation approach we considered—and eventually chose to use—assigns overall NSPO as a function of each program's marketing and program budget. This approach remains consistent with the theory that NPSO results from the cumulative effect of program-specific and Act On Energy marketing and program activity over a period of time, not necessarily by a single, program-specific marketing effort. In addition, while NPSO is most commonly associated with mass media marketing campaigns, the scale of program activity also proves to be a factor. For example, even without a significant marketing campaign, a program's size can drive NPSO through word-of-mouth and in-store program messaging. We believe this approach accurately reflects and attributes NSPO to programs, ensuring those total costs (including marketing) and total benefits (net savings including NPSO) are properly accounted for when assessing overall program cost-effectiveness.

The Cadmus team then distributed the portfolio-level result of 7,592 MWh NPSO to Ameren's residential programs (excluding CommunitySavers and ConstructionSavers). As noted, we considered both the PY13 program size (in terms of total gross *ex post* MWh savings) and each program's marketing budget (shown in 7) when allocating NPSO across programs.

Table 57. Program-Specific Savings and Marketing

Program	Program *Ex Post* Gross Savings (MWh)	Percentage of Portfolio Savings	Total Marketing	Percentage of Total Marketing
ApplianceSavers	**6,963**	2.6%	**$542,242**	**35.1%**
CoolSavers	25,098	9.4%	$824,949	**53.4%**
LightSavers	227,132	**84.8%**	$33,146	2.1%
PerformanceSavers	316	0.1%	$73,145	4.7%
RebateSavers	8,409	3.1%	$71,788	4.6%
Total	**267,918**	**100%**	**$1,545,270**	**100%**

The results of this approach (shown in 58 and 59) reflect the impact of each program on the nonparticipant population, based on marketing expenditures and program magnitudes in the marketplace.

Table58. Combined Savings and Marketing Allocation Approach

Program	*Ex Post* Gross Energy Savings (A)	Marketing Spending (B)	Combined Savings/Marketing (AxB)	Percentage of Combined Savings/Marketing
ApplianceSavers	2.6%	35.1%	0.9%	11.6%
CoolSavers	9.4%	53.4%	5.0%	63.4%
LightSavers	**84.8%**	2.1%	1.8%	23.1%
PerformanceSavers	0.1%	4.7%	0.006%	0.07%
RebateSavers	3.1%	4.6%	0.1%	1.8%
Total	**100%**	**100%**	**7.9%**	**100%**

Two programs are credited with the greatest NPSO: CoolSavers (accounting for one-half of all marketing dollars) at 4,816 MWh; and LightSavers (accounting for more than 80% of total energy savings) at 1,751 MWh. As NPSO impacts program-specific NTG results,[10] all NPSO estimates have been reported as a percentage of each program's total gross energy savings.

As shown in 59, we allocated 5 MWh of NPSO to PerformanceSavers, representing 0.07% of the combined residential portfolio savings and marketing expenditure. This resulted in a 1.7% adjustment to the program's PY13 NTG.

Table 59. NPSO by Program

Program	Program Gross Savings (MWh)	Total NPSO (MWh)	Percentage of Combined Savings/Marketing	Program-Specific NPSO (MWh)	NPSO as a Percentage of Gross Savings
ApplianceSavers	**6,963**		11.6%	**878**	**12.6%**
CoolSavers	25,098		63.4%	4,816	19.2%
LightSavers	227,132	**7,592**	23.1%	1,751	0.8%
PerformanceSavers	316		0.07%	5	1.7%
RebateSavers	8409		1.8%	140	1.7%
Total	**267,918**		**100%**	**7,592**	**2.8%**

Ex Post NTG

To estimate the overall program NTG ratio, the Cadmus team used total population *ex post* gross kWh savings to weight results for each measure type in order. 61 shows the components of each program measure's NTG estimate (free ridership and spillover) as well as the percentage of total program savings related to each measure.

[10] NTG = 1 – Free Ridership + Participant Spillover + NPSO + Market Effects

We used the percentage of total program savings and NTG ratios specific to each measure to arrive at a savings-weighted NTG estimate of 91.7% for the program overall.

Table 59. NTG by Measure

Measure	% of Program Savings	Free Ridership	Participant Spillover	Nonparticipant Spillover	NTG
CFL	21.2%	35.0%	5.1%	1.7%	70.2%
LED	2.2%	1.3%			103.8%
Faucet Aerator	8.1%	18.2%			86.9%
Showerhead	28.7%	10.0%			95.1%
Smart Strips	2.4%	13.2%			91.9%
WH Pipe Wrap	20.8%	20.7%			84.4%
WH Temperature Turn Down	6.7%	0.0%			105.1%
Insulation - Incented	4.7%	2.3%			102.8%
Windows - Incented	5.1%	0.0%			105.1%
Total	**100%**	**16.5%**	**5.1%**	**1.7%**	**90.3%**

BENCHMARKING

The Cadmus team researched other utilities that offered similar measures as Ameren Missouri's PerformanceSavers program. Table 60 and Table 61 compare—by measure type—the participation levels and gross and net savings of those utilities with Ameren.

On a savings-per-participant metric, the PerformanceSavers program performed very well, at 0.40 MWh/yr per participant. Only the program implemented by Georgia Power had a higher savings per participant (1.17 MWh/yr per participant). The Georgia Power program began operating in 2007, which has allowed the program to build recognition. The design of the Georgia Power program is also different in that it offers only rebated measures as well as rebates for whole-house energy reduction performance. Therefore, each measure implemented by Georgia Power's program achieves greater savings than compared to most measures implemented by PerformanceSavers.

Table 60. PerformanceSavers Benchmarking Results: Electricity Saving

State or Utility	Participation	*Ex Post* Savings (MWh/yr)	NTG	Net Savings (MWh/yr)
Ameren Missouri	694	315.8	0.92	285.1
Midwest Utility A[1]	769	234.6	0.76	201.1
Midwest Utility B[1]	4,627	1,904.6	0.92	1,753.0
Midwest Utility C[1]	4,944	1,131.4	0.73	824.4
Georgia Power[2]	4,949	7,332.7	0.79	5,803.8

[1]Report is not publicly available.
[2]Impact Evaluation of Georgia Power Company's 2011 DSM Programs. Nexant, Inc. December 21, 2012.

Table 61. PerformanceSavers Benchmarking Results: Natural Gas Saving

State or Utility	Participation[1]	*Ex Post* Savings (therm/yr)	NTG	Net Savings (therm/yr)
Ameren Missouri	2,456	22,004	0.91	19,870
Ameren Illinois[2]	1,455	4,816	N/A	N/A
Idaho Power Company	650[3]	1,904.6	0.92	1,753.0
East North Central Utility[4]	415[3]	43,545	0.81	35,272

[1]Represents implemented measures unless otherwise noted.
[2]2008 program year.
[3]Participation represents program participants.
[4]Report is not publicly available.

COST-EFFECTIVENESS RESULTS

Morgan Marketing Partners (MMP) utilized DSMore to analyze the cost-effectiveness of the PY13 PerformanceSavers program. MMP assessed cost-effectiveness using the following five tests as defined by the California Standard Practice Manual[11]:

- Total Resource Cost (TRC) test
- Utility Cost test (UCT)
- Ratepayer Impact Measure (RIM)
- Participant test (PART)
- Societal test

DSMore takes hourly prices and hourly energy savings from the specific measures installed through PerformanceSavers, and correlates both prices and savings to 30 years of historic weather data. Using long-term weather ensures the model captures the low probability, but high consequence weather events and appropriately values them. As a result, the model's produces an accurate evaluation of the demand side efficiency measure relative to other alternative supply options.

Key assumptions include these:

- Discount Rate = 6.95%
- Line Losses = 5.72%
- 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.

In addition, MMP leveraged the "Batch Tools" (model inputs) used by Ameren in their original analysis as input into the *ex post* DSMore analysis. By starting with the original DSMore Batch Tool used by Ameren and only modifying with new data from the evaluation (PY13-specific PerformanceSavers participation counts, per-unit gross savings and NTG), consistency is assured. 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. MMP used measure lifetime assumptions and incremental costs based on the program's database, the Ameren Missouri TRM, or the original Batch Tool.

A key step in the analysis process was acquiring PY13 Ameren program spending data: actual spending broken down into implementation, incentives and administration costs. MMP applied these numbers at the program level, not the measure level. While applying incentives at the measure level is useful for

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

planning purposes, it is unnecessary for the cost effectiveness modeling as the results are based on the program overall. MMP applied administrative costs (evaluation, potential study costs, and data tracking) in the portfolio summary analysis, not by program as they apply to the whole residential effort.

Table 62 summarizes the cost-effectiveness findings by test. Any benefit/cost score above 1.0 passes the test as cost-effective. The table also includes the cost of conserved energy (CCE) which describes the costs of acquiring those savings based on the lifetime benefits. In addition, the table includes the present value of the net lifetime benefits (net avoided costs minus program costs). As seen in the table, the PerformanceSavers program passes the TRC, UCT, PART, and Societal TRC tests. The CCE is nearly twelve and half cents per kWh and net lifetime benefits are -$59,182.

Table 62. Cost-Effectiveness Results (PY13)

	TRC	UCT	RIM	PART	Societal	CCE - $/kWh	Net Lifetime Benefits
PerformanceSavers	0.82	0.73	0.36	4.15	1.02	$0.124	-$59,182

APPENDIX A. *EX POST* DEMAND REDUCTIONS

Cadmus determined *ex post* demand reductions using the *ex post* energy savings estimated in this PY13 report and DSMore (using load shapes provided by Ameren).

Table 63. PY13 Summary: Net *Ex Post* Per-Unit Demand Reductions

Measure	PY13 Participation	Per-Unit Net *Ex Post* Demand Reduction (kW)	Total Net *Ex Post* Savings (kW)*
CFLs	7,245	0.001	10.53
LEDs	289	0.002	0.45
Smart Power Strips	331	0.008	2.42
Ceiling Insulation	22	0.049	2.17
Windows	10	0.493	4.93
Air Sealing	2	0.067	0.13
Total	**7,899**	**-**	**20**
*May not sum to total due to rounding			

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APPENDIX B. PROGRAM MANAGER INTERVIEW GUIDE

A. Introduction

1) What are your main responsibilities for Ameren Missouri's PerformanceSavers Program?

2) What percent of your time is dedicated to PerformanceSavers?

3) What tasks do you regularly spend the majority of your time on?

B. Program Design and Implementation

4) How is communication, both formal and informal, between Honeywell and Ameren conducted?

5) How does Honeywell communicate with home energy auditors and installation contractors?

6) Can you describe how the program's tracking database is populated and what level of detail is collected?

7) How do you feel the tracking database has performed to date? Do you anticipate any updates or changes to the database?

8) Can you provide a summary of how the program is intended to perform?

9) What would you say is working particularly well so far in PY5? Why is that?

10) Conversely, what is not working as well as anticipated? Why is that?

11) Have there been any lessons learned from the PY5 launch?

12) Were there any aspects of the program's design that caused practical challenges during the implementation?

13) Have there been any changes to the program design since the launch of the PerformanceSavers program?

14) What do you think have been the most influential factors to convert audits to installations of high impact measures? [**Probe with possible answers if needed**: rebates, direct install measures, assessment process, assessment report, etc.?]

C. Program Goals

15) What are the program's participation and savings goals for PY5?

16) How were these goals determined?

17) Does the program have any process or non-impact goals for PY5? (**Probe**: trade ally participation, increased awareness, education of trade allies, minimization of logistical problems, cancelation rates)?

18) How were these goals determined?

19) In your opinion, how has the program performed so far in PY5 (in terms of both process and savings/participation goals)?

20) Why do you think this is?

21) Are there benchmarks in place to monitor progress throughout the year?

22) Have you identified the triggers for contingency plans in case goals are not being met?

D. Measures

23) How did Ameren determine which measures to rebate?

24) Do you expect any new measures to be added this year, or later in the cycle?

25) In your opinion, should any additional measures be considered for inclusion in future programs? If so, what measures? Did HVAC contractors regularly request a specific measure not included in the program? If so, what measure? Did home-owners?

26) Conversely, should any current measures be excluded?

27) How were incentive amounts determined?

E. Marketing Efforts

26) The PerformanceSavers program targets high-use, dual fuel customers. What is the current methodology for identifying and reaching out to this market segment?

27) Have there been any challenges engaging this target market segment? What do you think can be done to more effectively engage these customers?

28) Have you been satisfied with the response to PerformanceSavers marketing efforts so far?

29) What are the marketing plans for the rest of PY5?

30) PerformanceSavers has the potential to educate customers about other programs in Ameren's residential portfolio. Have you had any indications from other program implementers that PerformanceSavers customers are taking advantage of rebates within these other programs?

31) What do you think could be done to encourage more cross-program promotion for audit recipients?

F. Retail Channel

32) We understand that the home energy audit report provided gives participants a list of certified local contractors who can complete the recommended improvements. How many contractors are currently certified by the program? Are there plans to qualify additional contractors?

33) What feedback have you received on the performance of the program certified contractors? (Either positive or negative)

34) What have been the key challenges and lessons in engaging qualified contractors and retailers?

35) Which retailers are used for the direct install measures provided to program participants? Can you tell me about this partnership to date? Are product pricing and inventory levels satisfactory?

G. Quality Control

36) In your own words, please explain how the program's quality control process works.

37) Does Ameren perform any ride-alongs or independent quality control checks? Please explain.

H. Customer Feedback

38) Have customers expressed opinions about the $25 audit fee? What about the incentive amounts for the rebated measures?

39) Do you think your customers understand the energy-related recommendations presented to them in the home energy audit report?

40) Are there any recurring or common customer praises or complaints? If so, what are they?

41) Has anything else made it difficult for you to enroll participants and/or carry out program requirements? If so, what have you done to address these difficulties?

I. Summary

42) From your perspective, what are the biggest challenges facing the program in PY5?

43) Is there anything else you'd like us to know about your experience administrating/implementing the program so far this year?

44) Nexant is reaching out to program stakeholders earlier in the year for PY5 to figure out how each stakeholder group can best benefit from the program evaluation process. Is there anything specific you were hoping to learn from this evaluation?

45) Is there anything else you'd like us to know?

APPENDIX C. PARTICIPANT SURVEY INSTRUMENT

Hello, I'm [INSERT NAME on behalf of Ameren Missouri.

May I speak with [CONTACT NAME]?

[If contact is not available, schedule a time to call back.]
[If the contact refuses, thank and terminate]

[Once contact is reached] Hello, my name is _____ and I'm calling on behalf of Ameren Missouri. I am calling to ask some questions about your household's participation in Ameren Missouri's program where you received a home energy audit. All your answers are confidential. Are you the correct person to speak to about this? **[IF NO, ASK FOR CORRECT PERSON]**

[IF NEEDED] If you have any questions, you may contact _____ with Ameren at _____

Screener

1. Our records show that you participated in Ameren's "PerformanceSavers Audit Program".

Since there are many ways Ameren customers can participate in the program, please tell me about your participation by answering yes or no to each question. Did you:

a) Receive an in-home energy audit, where an energy advisor assessed your home's energy use? [If no, skip audit questions]
b) Have free energy saving products such as CFL bulbs, faucet aerators, or showerheads installed in your home? [If no, skip direct install questions]
c) Receive a rebate for other upgrades such as insulation or energy efficient windows? [If no, skip upgrade questions]

Program Awareness

2. Have you ever seen or heard the term 'Act of Energy'?

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

3. How familiar are you with Ameren's energy efficiency brand, Act on Energy? Would you say…

a) Not at all familiar
b) Not too familiar
c) Somewhat familiar
d) Very familiar
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

4. How did you first learn about Ameren's PerformanceSavers program?

a) Bill insert
b) Radio
c) Family, friend, co-worker
d) Online research
e) Ameren website
f) Billboard
g) Contractor
h) Other. Please specify: ____
i) DON'T KNOW **[DO NOT READ]**
j) REFUSED **[DO NOT READ]**

5. How familiar are you with the term PerformanceSavers?

a) Not at all familiar
b) Not too familiar
c) Somewhat familiar
d) Very familiar
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

6. What do you associate with PerformanceSavers? [open-ended]

7. What does the term PerformanceSavers mean to you? [open-ended]

8. What was the primary reason for your participation in the program?

a) To replace broken equipment
b) To replace aging equipment

c) To improve the comfort of my home
d) To save money on energy costs
e) To help the environment
f) To learn more about your home's energy efficiency
g) Other. Please specify: _____
h) DON'T KNOW **[DO NOT READ]**
i) REFUSED **[DO NOT READ]**

9. **You received an audit report on the energy usage in your home and the opportunities to save energy. Was the information in the audit report very easy to understand, somewhat easy to understand, not too easy to understand, not at all easy to understand?**

a) Very easy to understand
b) Somewhat easy to understand
c) Not too easy to understand
d) Not at all easy to understand
e) Did not receive an audit report
f) DON'T KNOW **[DO NOT READ]**
g) REFUSED **[DO NOT READ]**

10. **[If 9 = c or d]** How could the information be made more understandable? **[Record response]**

11. **Did the auditor provide you with any written information about the PerformanceSavers program or other energy efficiency programs being offered by Ameren Missouri? [Probe about other program or measure recommendations]**

a) Tear sheet on ActOnEnergy programs
b) ActOnEnergy brochure or flyer
c) Other, please describe:_____
d) No written information provided **[SKIP TO…]**
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

Impact

Now we would like to ask you some questions about the free energy saving products that were installed in your home.

12. Our records indicate you had [INSERT NUMBER] faucet aerators installed, is that correct?

a) Yes
b) No
c) **[IF 12=b]** How many aerators were installed? **[Record response]**
d) DON'T KNOW **[DO NOT READ]**
e) REFUSED **[DO NOT READ]**

13. How many of the aerators installed by the auditor are still installed? [Record response]

14. [If 13<12/12.c)], Why did you remove the aerators?; **[If 13>12/12.c)]** Why did you install additional aerators? **[Record response]**

15. [IF NUMBER OF AERATORS IS ≥0] Where are the faucet aerators installed? [Allow multiple responses]

a) Kitchen, how many?
b) Bathroom, how many?
c) Other (Specify): _____, how many?

16. How many high efficiency faucet aerators were you already using in your home, if any, before you received the ActOnEnergy PerformanceSavers in-home audit? [NUMERIC OPEN END] *[NTG]*

a) None
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

17. If you had not received free faucet aerators during the ActOnEnergy PerformanceSavers in-home audit, how many, if any, would you have bought on your own within the next year? *[NTG]*

a) [RECORD #]
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

[IF 17=0, b or c, SKIP TO 19]

18. And, when would you have purchased those faucet aerators on your own, would it be…*[NTG]*

a) At roughly the same time
b) Within a few months
c) Within a year
d) More than a year **[DO NOT READ]**
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

19. Our records indicate you had [INSERT NUMBER] high efficient showerheads installed, is that

correct?

a) Yes
b) No
c) **[IF 19=b]** How many high efficient showerheads were installed? **[Record response]**
d) DON'T KNOW **[DO NOT READ]**
e) REFUSED **[DO NOT READ]**

20. **How many of the high efficient showerheads installed by the auditor are still installed? [Record response]**

21. **[If 20<19/19.c)],** Why did you remove the high efficient showerhead?; **[If 20<19/19.c)]** Why did you install additional high efficient showerheads? **[Record response]**

22. **How many high efficiency showerheads were you already using in your home, if any, before you received the ActOnEnergy PerformanceSavers in-home audit? [NUMERIC OPEN END]** ***[NTG]***

a) None
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

23. **If you had not received high efficiency showerheads during the ActOnEnergy PerformanceSavers in-home audit, how many, if any, would you have bought on your own within the next year?** ***[NTG]***

a) [RECORD #]
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

24. **[IF 23=0, b or c, SKIP TO 26]**

25. **And, when would you have purchased those showerheads on your own, would it be…*[NTG]***

a) At roughly the same time
b) Within a few months
c) Within a year
d) More than a year **[DO NOT READ]**
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

26. **Our records indicate you had [INSERT NUMBER] ENERGY STAR® certified CFL light bulbs installed, is that correct?**

a) Yes
b) No
c) **[IF 26=b]** How many CFLs were installed? **[Record response]**
d) DON'T KNOW **[DO NOT READ]**
e) REFUSED **[DO NOT READ]**

27. **How many of the CFLs installed by the auditor are still installed? [Record response]**

28. **[If 27<26/26.c)] Why did you remove some of the installed bulbs? [If 27<26/26.c)] Why did you install additional bulbs? [Record response]**

29. **[Only ask if information is not provided with audit documents] Where did the auditor install the CFLs ? [Allow multiple responses, CHECK THAT SUM OF 29 add up to 27 and if not probe for where remaining CFLs are located]**
    a) Living room – How many?
    b) Bedroom – How many?
    c) Kitchen – How many?
    d) Bathroom – How many?
    e) Den – How many?
    f) Garage – How many?
    g) Hallway – How many?
    h) Basement – How many?
    i) Outdoors – How many?
    j) Other (Specify): _____, how many?

30. **How many of the CFLs currently installed replaced:**

    a) Incandescent or the traditional light bulb type
    b) Existing CFL
    c) Another type of fluorescent light bulbs?
    d) **[IF SUM of 30a-c< 27]** How many replaced another light bulb type?, What kind? **[CHECK TO MAKE SUM OF 30 add up to 27 and if not probe for what remaining CFLs replaced]**

31. **How many CFLs were installed in your home, if any, before the ActOnEnergy PerformanceSavers audit**? **[RECORD #]** ***[NTG]***
32. **If you had not received free CFLs during the ActOnEnergy PerformanceSavers in-home audit, how many CFLs, if any, do you think you would you have bought on your own within the next year?** ***[NTG]***

    a) **[RECORD #]**
    b) DON'T KNOW **[DO NOT READ]**
    c) REFUSED **[DO NOT READ]**

[IF 32=0, b or c, SKIP to 34]

33. **And, when would you have purchased those CFLs on your own, would it be…*[NTG]***

    a) At roughly the same time
    b) Within a few months
    c) Within a year
    d) More than a year **[DO NOT READ]**
    e) DON'T KNOW **[DO NOT READ]**
    f) REFUSED **[DO NOT READ]**

34. **Will you describe in your own words how the ActOnEnergy PerformanceSavers in-home audit affected how you purchase and use CFLs. [RECORD VERBATIM] _____ *[NTG]***

35. **Our records indicate you had [INSERT NUMBER] ENERGY STAR® certified LED light bulbs installed, is that correct?**
    a) Yes
    b) No
    c) **[IF 35=b]** How many LEDs were installed? **[Record response]**
    d) DON'T KNOW **[DO NOT READ]**
    e) REFUSED **[DO NOT READ]**

36. **How many of the LEDs installed by the auditor are still installed? [Record response]**

37. **[If 36<35/35.c)] Why did you remove some of the installed bulbs? [If 36<35/35.c)] Why did you install additional bulbs?**

38. **[Only ask if information is not provided with audit documents] Where did the auditor install the LEDs? [Allow multiple responses CHECK THAT SUM OF 38 add up to 36 and if not probe for where remaining LEDs are located]**

    a) Living room – How many?
    b) Bedroom – How many?
    c) Kitchen – How many?
    d) Bathroom – How many?
    e) Den – How many?
    f) Garage – How many?
    g) Hallway – How many?
    h) Basement – How many?
    i) Outdoors – How many?
    j) Other (Specify): _____, how many?

39. **How many of the LEDs currently installed replaced:**
    a) Incandescent or the traditional light bulb type?
    b) A CFL?
    c) Another type of fluorescent light bulbs?
    d) [IF SUM of 6.f.1-3 < 5c] How many replaced another light bulb type?, What kind? **[CHECK TO MAKE SUM OF 39a-cadd up to 36 and if not probe for what remaining LEDs replaced]**

40. **How many LEDs were installed in your home, if any, before the ActOnEnergy PerformanceSavers audit? [RECORD #] *[NTG]***

41. **If you had not received free LEDs during the ActOnEnergy PerformanceSavers in-home audit, how many LEDs, if any, would you have bought on your own within the next year? *[NTG]***

    a) 1. [RECORD #]
    b) 8. (Don't know)
    c) 9. (Refused)
    d) **[IF 41=0, a or b, SKIP TO 43]**

42. **And, when would you have purchased those LEDs on your own, would it be…*[NTG]***

a) 1. At roughly the same time
b) 2. Within a few months
c) 3. Within a year
d) 4. (More than a year)
e) 98. (Don't know)
f) 99. (Refused)

43. Will you describe in your own words how the ActOnEnergy PerformanceSavers in-home audit affected your purchase and use of LEDs. [RECORD VERBATIM] _____ *[NTG]*

44. Our records indicate that the auditor lowered the temperature setting on the water heater during the ActOnEnergy PerformanceSavers in-home audit, is that correct? *[NTG]*

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

45. [IF 44=YES] Are those temperature settings made by the auditor still in place? *[NTG]*

a) Yes
b) No
c) **[If 45=b],** why did you change the temperature settings made by the auditor? **[Record response]**
d) DON'T KNOW **[DO NOT READ]**
e) REFUSED **[DO NOT READ]**

46. How likely is it that you would have set back the temperature of your water heater on your own within the next year, had you not heard about Ameren's ActOnEnergy PerformanceSavers in-home audit. Would you say, very likely, somewhat likely, not too likely or not at all likely? *[NTG]*

a) Very likely
b) Somewhat likely
c) Not too likely
d) Not at all likely
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

47. Our records indicate you had insulation installed around your water heater piping, is that correct? *[NTG]*

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

48. [If 47=a], Approximately how many feet of piping was covered with insulation? [Record response]

49. [If 47=a], Is the pipe wrap still in place? *[NTG]*

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

50. [If 49=a], Please explain why you removed the pipe wrap. [Record response]

51. Did you already have water heater pipe wrapping installed before you received the ActOnEnergy PerformanceSavers in-home audit? *[NTG]*

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

52. If you had not received the free water heater wrap during the ActOnEnergy PerformanceSavers in-home audit, how many, if any, would you have bought on your own within the next year? *[NTG]*

a) [Record #]
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

[If 52 = 0, b, c, skip to 53]

53. Our records indicate you had a smart power strip installed, is that correct? [If customer is unclear about the smart strip, provide the following explanation: Smart strips are special kinds of power strips that shut off the electronics that are plugged into them if the electronics are not being used.]

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

54. [If 53=No], Why are you no longer using the smart strip? [Record response, skip to Q62]

55. [If 53=Yes], I'd like to ask you about the smart power strip installed during the audit. Is the smart strip plugged in and operating?

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

56. I have a few questions for you about the types of equipment plugged into various outlets on the strip. If you need to put the phone down to look at the strip, that's fine, I will hold on. First, which device, or devices, is/are plugged into the black outlets labeled, "Always on"?

a) TV
b) DVD Player/Media Player/Gaming System
c) Cable box
d) Stereo system
e) Computer
f) Printer
g) Fax or scanner
h) Other [specify] _____
i) N/A
j) DON'T KNOW **[DO NOT READ]**
k) REFUSED **[DO NOT READ]**

57. And which device is plugged into the black outlet labeled, "Controller"?

a) TV
b) DVD Player/Media Player/Gaming System

c) Cable box
d) Stereo system
e) Computer
f) Printer
g) Fax or scanner
h) Other [specify] _____
i) N/A
j) DON'T KNOW **[DO NOT READ]**
k) REFUSED **[DO NOT READ]**

58. And lastly, which device or devices are plugged into the green outlets, labeled "Switched"?

a) TV
b) DVD Player/Media Player/Gaming System
c) Cable box
d) Stereo system
e) Computer
f) Printer
g) Fax or scanner
h) Other [specify] _____
i) N/A
j) DON'T KNOW **[DO NOT READ]**
k) REFUSED **[DO NOT READ]**

59. [If computer is plugged in] Is your computer a laptop or a desktop computer?

a) laptop
b) desktop
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

60. [If TV is plugged in] About how old is your TV?

61. [If TV is plugged in] About what size is it? Your best estimate is fine.

62. How many smart strips were you already using in your home, if any, before you received the ActOnEnergy PerformanceSavers in-home audit? [NUMERIC OPEN END] *[NTG]*

a) None
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

63. If you had not received the free smart strip during the ActOnEnergy PerformanceSavers in-home audit, how many, if any, would you have bought on your own within the next year? *[NTG]*

a) **[RECORD #]**
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

[IF 63=0, a or b, SKIP TO 65]

64. And, when would you have purchased those smart strips on your own, would it be…*[NTG]*

a) At roughly the same time
b) Within a few months
c) Within a year
d) More than a year **[DO NOT READ]**
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

65. Did the auditor recommend any additional energy efficient upgrades to be installed?

a) Attic Insulation
b) Air Sealing
c) Windows
d) Other (Specify_____)
e) None **[Skip to SO1]**
f) DON'T KNOW **[DO NOT READ] [Skip to SO1]**
g) REFUSED **[DO NOT READ] [Skip to SO1]**

66. [If 65=a,b,c,d] Have you completed any upgrades recommended by the auditor?

a) Yes
b) No **[Skip to Question 72]**
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

67. Which upgrades have you completed? [Allow multiple responses]

a) Attic Insulation
b) Air Sealing
c) Windows
d) Other (Specify_____)
e) None
f) DON'T KNOW **[DO NOT READ]**
g) REFUSED **[DO NOT READ]**

68. Why did you decide to complete these upgrades? [Record Response]

69. [If 67 ≠ 65] Why haven't you completed the other recommended upgrades [do not read answers; accept multiple responses]?

a) High initial cost
b) Long payback period
c) Don't have time
d) Too difficult to get measure installed
e) Perceived lower quality measure due to heightened efficiency
f) Other, please describe
g) DON'T KNOW **[DO NOT READ]**
h) REFUSED **[DO NOT READ]**

70. [If 67 ≠ 65] Do you plan to install the remaining the recommended upgrades?

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

71. **[If 70=Yes] What is your timeframe for installing the remaining recommended upgrades? [Ask timeframe for each measure]**
a) Within the year
b) Within next year
c) Other_____
d) DON'T KNOW **[DO NOT READ]**
e) REFUSED **[DO NOT READ]**

72. **[If Q67 = e] Why haven't you completed any of the upgrades?**

a) High initial cost
b) Long payback period
c) Don't have time
d) Too difficult to get measure installed
e) Perceived lower quality measure due to heightened efficiency
f) Other, please describe
g) DON'T KNOW **[DO NOT READ]**
h) REFUSED **[DO NOT READ]**

73. **Do you plan to install any of the recommended upgrades?**

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

74. **[If 73=a] What is your timeframe for installing the recommended upgrades?**
a) Within the year?
b) Within next year
c) Other_____
d) DON'T KNOW **[DO NOT READ]**
e) REFUSED **[DO NOT READ]**

75. **[If 73=a] Which upgrades do you plan to install?**
a) Attic Insulation
b) Air Sealing
c) Windows
d) Other (Specify_____)
a) DON'T KNOW **[DO NOT READ]**
b) REFUSED **[DO NOT READ]**

75. **[If 67 = Attic insulation] What is the R-value of your attic insulation now?** Record response_____

a) DON'T KNOW **[DO NOT READ]**
b) REFUSED **[DO NOT READ]**

76. [If 67 = Attic insulation and 75 = 'Don't Know'] How many inches of new insulation were added?

e) Record Response: _____
f) DON'T KNOW **[DO NOT READ]**
g) REFUSED **[DO NOT READ]**

77. [If Q 67 = Attic insulation and 75 = 'Don't Know'] What kind of insulation was added?

a) Blown fiberglass
b) Blown cellulose
c) Fiberglass batts
d) Rigid foam
e) Other_____
f) DON'T KNOW **[DO NOT READ]**
g) REFUSED **[DO NOT READ]**

78. [If 67 = Windows] How many windows did you replace? [Record response]

79. What is the approximate size of each window? [if exact value unknown, ask participant to estimate the dimensions of each window replaced]

Record Response: _____

NTG Questions

Windows / Ceiling Insulation Incented Measure Freeridership Questions

[If installed windows and insulation, run through FR1 to FR12, twice, once while referring to each measure]

Now I am going to ask you about the **[SURVEYMEASURE]** for which you received an incentive from Ameren.

FR1. [IF Q14=a or c, ELSE SKIP TO AS1] Had you already purchased your new *[SURVEYMEASURE]* before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit?

a) (Yes)
b) (No) **[SKIP TO FR2]**
c) DON'T KNOW **[DO NOT READ] [SKIP TO FR2]**
d) REFUSED **[DO NOT READ] [SKIP TO FR2]**

FR1a. To confirm, you purchased your new *[SURVEYMEASURE]* and *then* found out about Ameren's ActOnEnergy PerformanceSavers in-home audits, is that correct?

a) (Yes, that's correct) **[SKIP TO FR12]**
b) (No, that's not correct)
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

FR2. Before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, were you already planning to purchase *[SURVEYMEASURE]?*

a) (Yes)
b) (No)
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

FR3. Would you have purchased the same type of *[SURVEYMEASURE]* had you not heard about Ameren's ActOnEnergy PerformanceSavers in-home audit?

a) (Yes) [SKIP TOFR7]
b) (No)
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

FR4. Help me understand, without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased a different type of *[SURVEYMEASURE]*, or would you have decided not to purchase at all?

a) (I would have purchased a different type) **[Continue]**
b) (I would not have purchased at all) **[SKIP TO FR8]**
c) DON'T KNOW **[SKIP TO FR12]**
d) REFUSED **[SKIP TO FR12]**

100% FREERIDER PATH

FR5. When you say you would have purchased *[SURVEYMEASURE]* without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased *[SURVEYMEASURE]* that were just as energy efficient?

a) (Yes)
b) (No)
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

FR6. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of *[SURVEYMEASURE]*?

a) (Yes, I would have purchased same amount)
b) (No, I would have purchased less)
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

FR7. Thinking about timing, without hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, is it most likely that you would have purchased the *[SURVEYMEASURE]…[*READ LIST]

a) At the same time
b) Within the same year
c) One to two years out
d) More than two years out
e) Never
f) DON'T KNOW **[DO NOT READ]**
g) REFUSED **[DO NOT READ]**

[SKIP TO FR12]

PARTIAL FREE RIDER PATH

FR8. To confirm, you indicated that *without* hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, you would not have purchased your *[SURVEYMEASURE]* at all, is that correct?

a) (Yes) **[SKIP TO FR12]**
b) (No)
c) DON'T KNOW **[DON'T READ]**
d) REFUSED **[DON'T READ]**

FR9. Without the Ameren ActOnEnergy PerformanceSavers in-home audit, would you have purchased *[SURVEYMEASURE]* that was just as energy-efficient?

a) (Yes)
b) (No)
c) DON'T KNOW **[DON'T READ]**
d) REFUSED **[DON'T READ]**

FR10. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of *[SURVEYMEASURE]*?

a) (Yes, I would have purchased same amount)
b) (No, I would have purchased less)
c) DON'T KNOW **[DON'T READ]**
d) REFUSED **[DON'T READ]**

FR11. With respect to timing, without hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the *[SURVEYMEASURE]*…

a) At the same time
b) Within the same year
c) One to two years out
d) More than two years out
e) Never
f) DON'T KNOW **[DON'T READ]**
g) REFUSED **[DON'T READ]**

FR12. **Will you describe in your own words on the ActOnEnergy PerformanceSavers in-home audit affected your decision to purchase the [SURVEYMEASURE] [RECORD VERBATIM]** _____

Air Sealing Incented Measure Freeridership Questions

AS1. **[ASKI IF Q14=b, ELSE SKIP TO END]Had you already had the *[SURVEYMEASURE]* performed before you heard about the ActOnEnergy PerformanceSavers in-home audit?**

a) (Yes)
b) (No) ***[SKIP TO FR2]***
c) DON'T KNOW ***[SKIP TO FR2]***
d) REFUSED ***[SKIP TO FR2]***

AS1a. **To confirm, you had the *[SURVEYMEASURE]* performed and *then* found out about the ActOnEnergy PerformanceSavers in-home audits and rebates, is that correct?**

a) (Yes, that's correct) ***[SKIP TO AS12]***
b) (No, that's not correct)
c) DON'T KNOW ***[DON'T READ]***
d) REFUSED ***[DON'T READ]***

AS2. **Before learning about the Ameren's ActOnEnergy PerformanceSavers in-home audit, were you already planning to have *[SURVEYMEASURE]* performed?**

a) (Yes)
b) (No)
c) DON'T KNOW ***[DON'T READ]***
d) REFUSED ***[DON'T READ]***

AS3. **Would you have had *[SURVEYMEASURE]* performed had you not heard about the Ameren ActOnEnergy PerformanceSavers in-home audit or the rebate?**

a) (Yes) ***[SKIP TO AS5]***
b) (No)
c) DON'T KNOW ***[DON'T READ]***

d) REFUSED ***[DON'T READ]***

AS4. **Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have had a different type of *[SURVEYMEASURE]* performed, or would you have decided not to *[SURVEYMEASURE]* at all?**

a) (I would have had a different type of ***[SURVEYMEASURE]***) ***[CONTINUE]***
b) (I would not have purchased at all) ***[SKIP TO AS8]***
c) DON'T KNOW ***[SKIP TO AS12]***
d) REFUSED ***[SKIP TO AS12]***

100% FREERIDER PATH

AS5. **When you say you would have had *[SURVEYMEASURE]* performed without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have had *[SURVEYMEASURE]* performed that was just as energy efficient?**

a) (Yes)
b) (No)
c) DON'T KNOW ***[DON'T READ]***
d) REFUSED ***[DON'T READ]***

AS7. **Thinking about timing, without hearing about Ameren's ActOnEnergy PerformanceSavers in-home, is it most likely that you would have performed the *[SURVEYMEASURE]…[READ LIST]***

a) At the same time
b) Within the same year
c) One to two years out
d) More than two years out
e) Never
f) DON'T KNOW ***[DON'T READ]***
g) REFUSED ***[DON'T READ]***

[SKIP TO AS12]

PARTIAL FREE RIDER PATH

AS8. **To confirm, you indicated that *without* hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, you would not have had *[SURVEYMEASURE]* performed at all, is that correct?**

a) (Yes) ***[SKIP TO AS12]***
b) (No)
c) DON'T KNOW ***[DON'T READ]***
d) REFUSED ***[DON'T READ]***

AS9. **Without the Ameren ActOnEnergy PerformanceSavers in-home audit, would you have had *[SURVEYMEASURE]* performed that was just as energy-efficient?**

a) (Yes)

b) (No)
c) DON'T KNOW ***[DON'T READ]***
d) REFUSED ***[DON'T READ]***

AS10. **Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of *[SURVEYMEASURE]*?**

a) (Yes)
b) (No)
c) DON'T KNOW ***[DON'T READ]***
d) REFUSED ***[DON'T READ]***

AS11. **With respect to timing, without hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have performed the *[SURVEYMEASURE]*…**

a) At the same time
b) Within the same year
c) One to two years out
d) More than two years out
e) Never
f) DON'T KNOW ***[DON'T READ]***
g) REFUSED ***[DON'T READ]***

AS12. **Will you describe in your own words on the ActOnEnergy PerformanceSavers in-home audit affected your decision to purchase the *[SURVEYMEASURE] [RECORD VERBATIM]***

_____

Spillover Questions

SO1. Did you purchase any other energy-efficient products after you received Ameren's ActOnEnergy PerformanceSavers in-home audit that were not rebated through an Ameren energy efficiency program? This could include things like ENERGY STAR appliances, compact fluorescent light bulbs (CFLs), installing home insulation, etc.

1. Yes
2. No **[SKIP TO NEXT SECTION]**

SO2. [ASK IF SO1=1] **Please tell me the additional energy-efficient products that you purchased since receiving the in-home audit that you did not receive a rebate from Ameren. [DO NOT READ]**

1. CFLs [#]
2. LED light bulbs [#]
3. ENERGY STAR light fixtures or ceiling fan [#]
4. ENERGY STAR refrigerator
5. ENERGY STAR freezer

6. ENERGY STAR clothes washer
7. ENERGY STAR dishwasher
8. ENERGY STAR room air conditioner [#]
9. ENERGY STAR electronics (e.g. TV, DVD, computer) [#]
10. ENERGY STAR dehumidifier [#]
11. ENERGY STAR water heater [#]
12. ENERGY STAR Central air conditioner [#]
13. ENERGY STAR Air source heat pump [#]
14. Geothermal heat pump [#]
15. Heat pump hot water heater [#]
16. Low-flow showerhead or faucet aerator_[#}
17. Programmable thermostat [#]
18. Installed insulation? [#of Insulation]
19. Installed windows? [# in Square Feet of Windows]

20. Other. ***[SPECIFY VERBATIM]*** _____

SO3. [ASK FOR PRODUCT 1-3; 8-19 MENTIONED IN 0, Do not ask SO3 if SO2 is 4-7] **How many *[INSERT APPLIANCE FROM 0]* did you purchase?**

SO4. [ASK if SO2=18] **In what location in your home was the insulation installed?**

Location: ___
D. DON'T KNOW

SO5. [ASK FOR EACH PRODUCT MENTIONED IN 0][SKIP IF SO2=1,2,3,4,5,6,7,9,10,16,18,19] **Did you receive or apply for an Ameren Missouri rebate for *[INSERT PRODUCT FROM 0]***?

1. Yes **[RECORD FOR EACH MEASURE MENTIONED IN SO2]**
2. No **[RECORD FOR EACH MEASURE MENTIONED IN SO2]**
98. Don't Know
99. Refused

SO6. [ASK FOR EACH PRODUCT MENTIONED IN 0][SKIP IF SO2=14-19] **Did the *[INSERT PRODUCT FROM 0] have an ENERGY STAR label on it***?

1. Yes **[RECORD FOR EACH MEASURE MENTIONED IN SO2]**
2. No **[RECORD FOR EACH MEASURE MENTIONED IN SO2]**
98. Don't Know
99. Refused

SO7. [ASK FOR EACH PRODUCT MENTIONED IN SO2] **How important was the fact that you received Ameren's ActOnEnergy PerformanceSavers in-home audit in your decision to purchase *[INSERT PRODUCT FROM SO2]*? Would you say it was:**

1. Important
2. Somewhat Important

3. Not too Important
4. Not important
98. Don't Know
99. Refused

Satisfaction

Now I'd like to ask you a few questions about your satisfaction with the program

80. Thinking about your overall experiences with Ameren Missouri as your utility, how satisfied would you say you are with Ameren Missouri?

a) Very satisfied
b) Somewhat satisfied
c) Not too satisfied
d) Not at all satisfied_____
e)

81. [If answer is c or d] Why did you give this rating?

82. Please tell me if you were very satisfied, somewhat satisfied, not too satisfied, or not at all satisfied with the following aspects of Ameren's PerformanceSavers program…? (request explanation for any rating of 'not too satisfied' or 'not satisfied at all)

a) The information provided on Ameren's website (if applicable) _____
b) Communication with Ameren and/or the program employees_____
c) The variety of products that are eligible for rebates from the program _____
d) The contractor who provided the audit and direct install measures _____
e) **[ASK IF 67=a,b,c]** the contractor who installed the upgrades _____

83. In your opinion, why do you think some people would not take advantage of this program from Ameren? [Do not Read, multiple responses okay]

a) Initial audit cost is too high
b) Rebate amounts are too low/installation cost too high
c) Rebate process is too cumbersome
d) Other (Specify) _____
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

84. Is there anything Ameren could improve about the program? [Do not Read, multiple responses okay]

a) Lower audit cost
b) Provide clearer information about available rebates
c) Give larger incentives/rebate amounts
d) Simplify the rebate application form
e) Increase awareness of all rebates available
f) Offer more rebated measures
g) Create a more user-friendly website
h) Other (Specify)
i) DON'T KNOW **[DO NOT READ]**
j) REFUSED **[DO NOT READ]**

85. Would you recommend this program to a friend or neighbor?

a) Yes
b) No, Why? _____
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

86. Generally speaking, how satisfied are you with your experience as an Ameren Missouri customer overall? Would you say…

a) Very satisfied,
b) Somewhat satisfied,
c) Not very satisfied, or
d) Not at all satisfied
e) DON'T KNOW **[DO NOT READ]**
f) REFUSED **[DO NOT READ]**

87. Based on your experience with the program, would you say your opinion of Ameren Missouri… [READ LIST]

a) Increased,
b) Stayed about the same, or
c) Decreased?
d) DON'T KNOW **[DO NOT READ]**
e) REFUSED **[DO NOT READ]**

Demographics

[Only ask Q88-Q103 if not provided in audit reports]

88. Which of the following best describes your home/residence?

a) Single-family home, detached
b) Single-family, mobile home
c) Row house/townhome
d) Two or three family attached residence
e) Apartment
f) Condominium
g) Other (Specify):_____
h) DON'T KNOW **[DO NOT READ]**
i) REFUSED **[DO NOT READ]**

89. How many people live in your home year-round?

90. What is the age of your home?

91. What is the approximate size of your home, in square feet?

92. What is your primary heat system type?

a) Gas Furnace
b) Electric Furnace
c) Wood Stove
d) Gas Stove
e) Ground Source Heat Pump
f) Air Source Heat Pump
g) Space Heater
h) Gas boiler--Baseboard
i) Gas boiler—Radiant
j) Gas boiler – other
k) Baseboard--Electric
l) Radiant--Electric
m) Other: _____

n) DON'T KNOW **[DO NOT READ]**
o) REFUSED **[DO NOT READ]**

93. What is the efficiency rating of your heating system?

a) Record Response: _____
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

94. [If Q 93 = Don't Know]

How old is your heating system: _____

a) DON'T KNOW **[DO NOT READ]**
b) REFUSED **[DO NOT READ]**

95. What is your water heater fuel type?

a) Electric
b) Gas
c) Propane
d) Fuel Oil
e) Solar
f) DON'T KNOW **[DO NOT READ]**
g) REFUSED **[DO NOT READ]**

96. Is your water heater a tankless type or storage type?

a) Tankless
b) Storage
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

97. What is the capacity of the water heater in gallons?

Record Response: _____

98. What is the efficiency of your water heater?

a) Record Response: _____%
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

99. [If Q98 = Don't Know]

a) How old is your water heater: _____

100. Do you currently have a cooling system?

a) Yes
b) No
c) DON'T KNOW **[DO NOT READ]**
d) REFUSED **[DO NOT READ]**

101. What is your cooling system type?

a) Central Air Conditioner
b) Window Air Conditioner

c) Evaporative cooler
d) Air Source Heat Pump
e) Ground Source Heat Pump
f) Other (Specify): _____
g) DON'T KNOW **[DO NOT READ]**
h) REFUSED **[DO NOT READ]**

102. What is the efficiency rating of your cooling system?

a) Record Response: _____
b) DON'T KNOW **[DO NOT READ]**
c) REFUSED **[DO NOT READ]**

103. [If Q 102 = Don't Know]

How old is your cooling system: _____
a) DON'T KNOW **[DO NOT READ]**
b) REFUSED **[DO NOT READ]**

THANK AND TERMINATE

APPENDIX D. ADVANCED POWER STRIP SAVINGS METHODOLOGY

SMART POWER STRIPS

Introduction

Smart-strip technology has been available for several years. Although it is becoming more common, the technology has not yet been widely evaluated. In this document, Cadmus reviews some of the leading research on smart-strip technology to date, summarizes differences among the three Ameren programs offering smart strips, and offers a preliminary estimate of the gross energy savings for each program.

Smart strips typically have one master or controller outlet, several controlled or switched outlets, and one or two uncontrolled or always-on outlets. The controlled outlets automatically draw no power when the homeowner turns off the controller device. This creates energy savings by reducing the power draw from the controlled devices' standby mode. (Devices continue to draw power when inactive but still plugged into a live outlet.)

Some smart strips contain occupancy sensors. These turn off controlled outlets when no motion has been detected for 30 minutes in the room containing the smart strip. When motion is again detected, the smart strip turns the controlled devices back on.

Devices plugged into the always-on socket will not save energy, as we assume that the installation of a smart strip will not cause the homeowner's behavior to change.

Ameren offers smart-strip technology to its residential customers as part of three programs:

- RebateSavers
- PerformanceSavers
- CommunitySavers.

Each of these programs has different smart-strip technologies, delivery mechanisms, and installation requirements. These differences can greatly impact evaluated savings. We have listed these differences in Table 1 and Table 2.

Table 1. Available Smart Strips

Manufacturer and Model	Type	Image
TrickleStar 12 Outlet Advanced Power Strip	Load-sensing	
TrickleStar Motion Sensor Advanced Power Strip	Occupancy-sensing/load-sensing	
TrickleStar 7-Outlet Advanced Power Strip	Load-sensing	

Table 2. Program Differences

Program	Available Smart Strips	Delivery	Direct Installation Requirements
RebateSavers (Participation: Home Energy Kit – 2,248*; On-line Store – 10,061**)	All three TrickleStar devices	Purchased and installed by customers at their discretion through Ameren's online store, or received in free home energy kit and installed by customer	Not Applicable
CommunitySavers (Participation: 619*)	TrickleStar 7-Outlet Advanced Power Strip	Directly installed by program implementer staff.	Installed only if two or more peripherals are attached to primary device. Cable boxes and DVRs are not considered an eligible peripheral device
PerformanceSavers (Participation: 192*)	TrickleStar 7-Outlet Advanced Power Strip	Directly installed by program implementer staff.	Installed only if two or more peripherals are attached to primary device. Cable boxes and DVRs are not considered an eligible peripheral device.

*As of September 30, 2013
**As of November 26, 2013

Current Available Research

Few reports have documented the usage and savings of smart strips. All research on the measure applies different data collection models and different assumptions to determine usage and savings.

Below, we have summarized the two reports providing the best data on smart strips. We believe these represent the best primary research conducted on smart strips to date. We also reviewed other reports and TRMs and include their findings and assumptions following the review of the two highlighted reports.

Ecos Report

The 2009 Ecos Report, "Smart Plug Strips: Draft Report," reviews a variety of smart-strip technologies and, like the SDG&E report, provides estimated savings for both home office and home entertainment center applications.

To verify that installing smart strips results in energy savings, Ecos conducted a field study, using power metering equipment to track the energy consumption before and after installation of the smart strip. Ecos was able to verify that the use of smart strips resulted in energy savings for these applications. In addition, the Ecos study found an incremental increase in energy use from the smart strip itself of 8.8 kWh per year.

The controlled devices for both home office and home entertainment center are shown in Table 3.

Table 3. Controlled Devices by Smart Strip Application

Home Office	Home Entertainment
LCD Monitor	Audio Receiver
Computer Speaker	DVD Player

Multi-Function Device	-

Ecos calculated smart strip energy savings by accounting for the device power consumption (active, low, and standby mode), hours of use, and saturation in the home. These variables are based on a 2006 technical report "Final Field Research Report." 1 In this study, each metered smart power strip had all of the devices plugged in.

In the Ecos report, smart-strip savings are calculated in three steps:

1. Calculate the consumption associated with the controlled devices in active, low, and standby mode without the hours of use being impacted by the controller device.
2. Calculate the consumption associated with the controlled devices in active, low, and standby mode with the hours of use being impacted by the controller device.
3. Take the difference in consumption between steps 1 and 2 and remove 8.8 kWh to account for the added load from the smart strip.

The overall calculated smart-strip savings are shown in Table 4.

Table 4. Ecos Report Calculated Savings per Smart Strip Application

Smart Strip Location	Energy Savings (in kWh/yr)	Per Unit
Home Office	38.4	Per Home Office
Home Entertainment	79.0	Per Home Entertainment Center

NYSERDA Report

The 2011 NYSERDA report, "Advanced Power Strip Research Report" was developed by Lockheed Martin, Inc and provides potential savings for both home office and home entertainment center smart strip applications.

To establish which peripheral technologies would be considered for home office and entertainment smart strip savings, the NYSERDA report looked at a consumer electronics market characterization and included peripherals with an average New York household saturation of 50% or greater. The peripherals chosen for inclusion in the smart strip analysis are listed below in Table 5.

Table 5. Controlled Devices by Smart Strip Application

Home Office	Home Entertainment
LCD Monitor	Cable Set Top Box
Printer	DVD Player
-	VCR
-	Video Game Console

Similar to the Ecos report, the NYSERDA report uses the device power consumption (active, low, and standby mode), hours of use, and saturation in the home in order to calculate smart strip energy

1 Moorefield, L., Porter, S., May-Ostendorp, P. Final Field Research Report. Technical Report. California Energy Commission Public Interest Energy Research Program, October 31, 2006.

savings. The NYSERDA report compiles data from six sources to establish the power consumption and hours of use for the devices.

1. Energy Center of Wisconsin2
2. IT Energy – Denmark3
3. Ecos Consulting4
4. Lawrence Berkeley National Laboratory5
5. TIAX LLC6
6. Energy Efficient Strategies7

To calculate smart strip savings, the NYSERDA report uses the combined savings from the following two calculations:

$$\frac{\Delta kWh_e}{Year} = \sum_m SDW_{e,m} \times \frac{SDHrs_{e,m}}{Day} \times \frac{kW_e}{1000\ W_e} \times \frac{365\ Days}{Year}$$

Where:

- e = type of home electronic equipment
- m = shutdown mode (standby or off)
- $\mathbf{SDW_{e,m}}$ = shutdown watts, the watts drawn by e in shutdown mode m
- $\mathbf{SDHrs_{e,m}}$ = number of hours e is in shutdown mode m with respect to the number of hours the product in the master control is in shutdown mode

$$\frac{\Delta kWh_e}{Year} = \sum_m SDW_{e,m} \times \frac{SDHrs_{i,m}}{Day} \times \frac{kW_e}{1000\ W_e} \times \frac{365\ Days}{Year}$$

Where:

- e = type of home electronic equipment
- i = type of home electronic equipment in the master control outlet
- m = shutdown mode (standby or off)
- $\mathbf{SDW_{e,m}}$ = shutdown watts, the watts drawn by e in shutdown mode m

2 Energy Center of Wisconsin. 2010 May. Electricity Savings Opportunities for Home Electronics and Other Plug-In Devices in Minnesota Homes. Madison, Wis.: Energy Center of Wisconsin.
3 Fjordbak Larson, Troels. 2007 Dec 7. Standby and Energy Savings Sockets. Herlev, Denmark.: IT Energy.
4 Ecos Consulting. 2009 Jul 31. Energy Trust of Oregon Smart Plug Strip Project: Final Meeting.
5 Lawrence Berkeley National Laboratory. 2011. Standby Power Summary Table. Berkeley, Calif.: Lawrence Berkeley National Laboratory.
6 Roth, Kurt W. and McKenney, Kurtis. 2007 Jan. Energy Consumption by Consumer Electronics in U.S. Residences. Cambridge, Mass.: TIAX LLC.
7 Energy Efficient Strategies. 2006 Mar. 2005 Intrusive Residential Standby Survey Report.

- $\mathbf{SDHrs_{i,m}}$ = number of hours i is in shutdown mode m; = 24 – Number of operating hrs

The overall calculated smart-strip savings are shown below in Table 6.

Table 6. NYSERDA Report Calculated Savings per Smart Strip Application

Smart Strip Location	Energy Savings (in kWh/yr)	Per Unit
Home Office	31.0	Per Home Office
Home Entertainment	75.1	Per Home Entertainment Center

Additional Studies

Cadmus reviewed additional studies to understand the range of savings values being considered for smart strips. It should be noted that many of these studies and reports were intended to determine potential savings for smart strips and hence do not include factors that can affect final savings values such as installation rates and net-to-gross ratios. The studies and reports are listed below in Table 7, along with some of the key assumptions made in each.

Table 7. Smart Strip References and Estimated Savings

Source	Smart Strip Location	Controlled Devices	Smart Strip Type	Savings (kWh)
Ameren Technical Reference Manual 2012 Filing	Home Office	4	Load-Sensing Smart Strip	146.7
Michigan Energy Measures Database 2009	Home Office	4	Load-Sensing Smart Strip	146.7
ECEEE 2009 Summer Study, Jensen & Fjorkbak	Home Office	2.5	Load-Sensing Smart Strip	90
Arkansas Technical Reference Manual, Version 3.0, 2013	Home Office	4	Load-Sensing Smart Strip	84
Ecos Field Study 2009 Metering Exercise	Home Office	3	Load-Sensing Smart Strip	82
Ecos Field Study 2009	Home Office	3	Load-Sensing Smart Strip	38.4
NYSERDA Report, 2011	Home Office	2	Load-Sensing Smart Strip	31
SDG&E Report, 2009	Home Office	Unknown	Load-Sensing Smart Strip	26.3
Advanced Power Strip Measure Workbook, Regional Technical Forum, 2013	Home Office	2.5	Load-Sensing Smart Strip, Direct-Install	20
BPA Smart Power Strip Energy Savings Evaluation, 2011	Office Cubicle	3	Load-Sensing Smart Strip, Direct-Install	145
Ecos Field Study 2009 Metering Exercise	Home Entertainment	5	Remote Control Smart Strip and Timer	626.3
Ecos Field Study 2009 Metering Exercise	Home Entertainment	5	Load-Sensing Smart Strip and Timer	610.3
Ecos Field Study 2009 Metering Exercise	Home Entertainment	5	Remote Control Smart Strip	265
Ecos Field Study 2009 Metering Exercise	Home Entertainment	5	Load-Sensing Smart Strip	248.9

Source	Smart Strip Location	Controlled Devices	Smart Strip Type	Savings (kWh)
Ameren Technical Reference Manual 2012 Filing	Home Entertainment	5	Load-Sensing Smart Strip	221.9
Michigan Energy Measures Database 2009	Home Entertainment	5	Load-Sensing Smart Strip	221.9
Arkansas Technical Reference Manual, Version 3.0, 2013	Home Entertainment	4	Load-Sensing Smart Strip	141
Ecos Field Study 2009	Home Entertainment	2	Load-Sensing and Occupancy-Sensing Smart Strip	86
Ecos Field Study 2009	Home Entertainment	2	Load-Sensing Smart Strip	79
NYSERDA Report, 2011	Home Entertainment	4	Load-Sensing Smart Strip	75.1
ECEEE 2009 Summer Study, Jensen & Fjorkbak	Home Entertainment	3.4	Load-Sensing Smart Strip	61
Advanced Power Strip Measure Workbook, Regional Technical Forum, 2013	Home Entertainment	2.3	Load-Sensing Smart Strip, Direct-Install	40
SDG&E Report, 2009	Home Entertainment	Unknown	Load-Sensing Smart Strip	21.7
Embertec Field Trials (as reported in Research Plan: Residential Advanced Power Strips by Bonneville Power Administration, 2013)	Unknown	Unknown	Load-Sensing and Occupancy-Sensing Smart Strip, Direct-Install	258
Advanced Power Strip Measure Workbook, Regional Technical Forum, 2013	Either	Unknown	Occupancy-Sensing Smart Strip, owner- or direct-installed.	70
PECO's Smart House Call Program Filing, 2013	Either	Unknown	Unknown	57

Cadmus reviewed each of these reports in detail, examining the assumptions, secondary sources, engineering algorithms, and metering tests used to calculate savings. As shown in the table, the notable differences between all these findings are largely the average number of controlled devices assumed in each equation and the type of smart-strip technologies used.

The Ecos field study found especially large savings for smart strips and remote-control smart strips having five controlled peripherals. Even higher savings are achieved when those smart strips are plugged into a programmable timer, which turns off all electronics on the smart strip, not just those in the controlled socket.

Table 8 and Table 9 below show the range of savings claimed in the studies above for load-sensing smart strips.

Table 8. Home Entertainment Range of Savings and Number of Controlled Devices

Home Entertainment	Savings	Controlled Devices
Min	21.7	Unknown

Max	248.9	5.0
Mean	130.5	3.6

Table 9. Home Office Range of Savings and Number of Controlled Devices

Home Office	Savings	Controlled Devices
Min	20	2.5
Max	146.7	4.0
Mean	73.9	3.1

Cadmus approach

This memo section reviews the following for the above studies and for the suggested Cadmus approach:

- Energy-savings algorithm
- Input assumptions (number and type of peripherals)
- Hours of use
- Modes of use
- Installation rates

Following this detailed information is a discussion of the smart-strip data-collection efforts undertaken by Cadmus to date. Finally, we propose using the findings of the NYSERDA report of 75.1 kWh savings for home entertainment systems and 31.0 kWh savings for home office applications (adjusted by installation/retention rates). Cadmus believes this report combines the most in-depth research with the most reasonable assumptions to calculate energy savings.

Our conclusion will provide a summary of expected savings for each of the types of smart strips by program, considering the differing installation rates and applications as found in participant surveys.

Energy-Savings Algorithm

The Ameren TRM determines savings from the smart strip using the algorithm below:

$$Energy\ Savings\ \left(\frac{kWh}{Year}\right) = \left(\frac{(Base\ Watts_{AVG} - Efficient\ Watts_{AVG}) \times 24 \times 365}{1{,}000}\right)$$

Where:

- Base Idle $Watts_{AVG}$ = weighted average of controlled devices' energy used when in standby mode.
- Idle Hours per Day_{AVG} = weighted average hours per day by device when system is assumed to be turned off.
- Base $Watts_{AVG}$ = weighted average of all devices' energy use.

- Efficient Idle $Watts_{AVG}$ = weighted average of controlled all device(s) energy used when controlled devices are turned off by controller device.

This algorithm is similar to those used to calculate savings in the other reports and studies we cited above. Below we review the inputs to the Ameren TRM algorithm versus those used in the NYSERDA Report.

Input Assumptions

The most critical algorithm input assumptions relate to the type and number of peripherals plugged into the smart strip, as this determines the base idle watts and efficient idle watts. As shown in Table 7, the number of peripherals assumed to be present in each study varied greatly, as did the associated savings estimates. In addition, we consider the type of peripherals assumed to be plugged into the smart strip. Table 10 below shows the assumptions made by Morgan Measures Library in calculating the average watts of controlled devices for the Ameren TRM.

Table 10. Ameren TRM: Controlled Devices by Smart Strip Application

Home Office	Home Entertainment
Computer Speakers	Audio System
Inkjet Printer	Speakers
Internet Terminal	DVD
Phone/Fax/Copier	VCR
-	Cable Box
-	Video Game Console
Average Daily Wattage Decrease: 20W	**Average Daily Wattage Decrease: 32W**

In contrast to these assumptions, the NYSERDA report (see Table 5 on page 32) researched the average number of peripherals present and found two peripherals for home office applications and four for home entertainment centers.

While we expect that homes will have internet terminals (i.e., modems and wireless internet routers), we do not anticipate that participants will control these devices with their smart strips, as household electronics other than computers (e.g., phones, tablets, and some home entertainment systems) rely on internet access when the home office computer is not in use. Similarly, we do expect most homes to have cable boxes and HD-DVRs but do not believe these should be included as a controlled device, as these devices often do not function properly if powered down. Both CommunitySavers and PerformanceSavers have officially excluded these as eligible controlled devices for this reason.

Hours of Use

The hours of use for the controller and controlled device contribute to the savings estimates. The Ameren TRM assumes that the television is on for 5 hours per day and that the computer is on for 4 hours per day (citing the Morgan Measure Library for both assumptions). These assumptions result in a total time in standby mode of 19 hours for the television and 20 for the computer. The NYSERDA report shows that televisions are in active use 5.3 hours per day, and that computers are in active use 3.2 hours per day. This results in 18.7 hours in standby for the television and 4.1 hours in standby for the computer with 16.7 hours switched off completely.

Modes of Use

Most of the above referenced studies consider the amount of time each controller and controlled device is in each of four modes during an average day:

- Active use – where a device is switched on and being actively used
- Low-power mode – where the device is switched on, but is not being actively used
- Standby mode – where the device is switched off, but still plugged in and able to be turned on with a remote control
- Unplugged mode – where the device is unplugged or power to the device is turned off through use of a smart strip

The Ameren TRM calculations do not differentiate among these types of use, but assumes that all measures plugged into the smart strip are on and in active use while the controlled device is turned on. The NYSERDA report opts for the more common approach8, where device hours of use are divided into these different modes and savings are calculated from the difference between the baseline scenario without a smart strip and the smart strip scenario.

Occupancy Sensors

A few smart strips come with occupancy sensors that turn off peripherals when a room is unoccupied for a length of time.9 These are mainly designed to work in an office setting, where computers may remain turned on for long periods of time without being used. Almost no research exists on the improvement in savings from this type of device. The Ecos field study estimates an increase of savings of 9% for an occupancy-sensing smart strip used with entertainment centers.

Cadmus Savings Estimates

In an effort to gather as much Ameren and program-specific primary data as possible to inform the savings algorithm and inputs shown above, Cadmus surveyed participants in all three programs to determine how participants were using smart strips in their homes. The survey responses led to several conclusions:

8 This approach is mapped out in the Ecos field study, and followed in the ECEEE report, the Arkansas TRM, and the Regional Technical Forum estimates.

9 The occupancy-sensing smart strip available for reduced cost through Ameren turn off peripherals after a room has been vacant for 30 minutes.

1. People are generally confused about smart-strip technology, its purpose, and how to use it.10
2. This technology is not a good candidate for survey self-reports. Participants were unable or unwilling to correctly report the number and type of devices plugged into the smart strip.

Since the self-reported peripheral data we collected were unreliable, Cadmus has decided to use the NYSERDA report savings estimates to estimate savings for all three Ameren programs. This report combines data from numerous other studies and provides a detailed picture of all the inputs into their savings estimates. These savings are detailed in Table 11.

Table 11. NYSERDA Report Savings Estimates

Home Office	Home Entertainment
31.0 kWh	75.1 kWh

The NYSERDA report was written to assess the potential of savings in the market, and therefore leaves out a key variable for evaluation. The in-service rate for the smart strips was determined through participant surveys and will be used for each of the three programs.11

Table 12 shows the in-service rates for smart strips found through participant surveys12, as well as the percentage of smart strips used for each application: home office or home entertainment center.

Table 12. Participant Survey Findings on Installation of Smart Strips

Program/Measure	ISR	Home Office Saturation	Entertainment Center Saturation
CommunitySavers Smart Strip	100%*	0%	100%
PerformanceSavers Smart Strip	90%	36%	64%
RebateSavers – Home Energy Kit Smart Strip	46%	48%	52%
RebateSavers - Online Store Smart Strip	100%	36%**	64%**

*As of October 31, 2013, all CommunitySavers respondents indicated their smart strips were still installed and functioning. A second wave of surveys is currently in the field and this number may change.
** We have assumed that the application of these smart strips is consistent with the PerformanceSavers program.

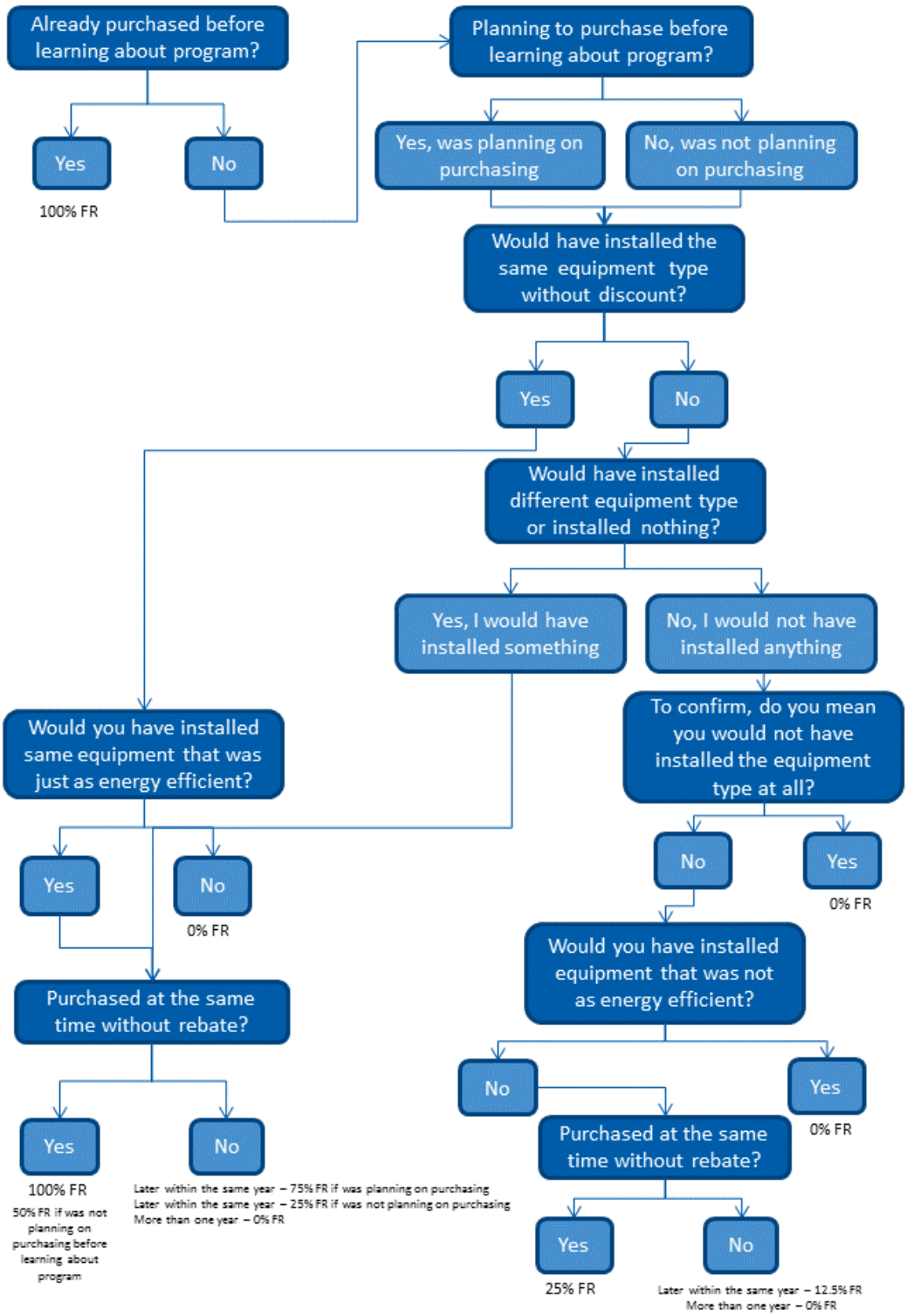
10 This was also shown in the NYSERDA report, where respondents indicated their level of knowledge of phantom load averaged at 1.65 on a scale of 1 to 5. Respondents also indicated a lack of familiarity with smart strips, 42% said they had never heard of them and 30% had heard of them but knew little about them.
11 While survey respondents struggled to report the number and type of devices plugged into the smart strip, they were able to confirm whether or not they were using the smart strip.
12 The evaluation team expected most smart strips to be delivered through the PerformanceSavers and CommunitySavers direct-install programs as well as through the RebateSavers Home Energy Kit program. Initially, Ameren did not collect contact data for participants purchasing smart strips through the on-line store. Hence, the evaluation team did not conduct surveys of these participants. In lieu of primary data on installation rates, we are assuming a 100% in-service rate as the customer sought out and purchased the strips (which indicates their likely intention to use them).

The savings by measure and application type, considering in-service rates and the baseline energy use of the smart strips, are shown in Table 13.

Table 13. Smart-Strip Savings by Program and Measure

Program/ Measure	Number Purchased/ Direct-Installed	Home Office Application kWh Savings (adjusted for ISR)	Entertainment Center Application kWh Savings (adjusted for ISR)
CommunitySavers Smart Strip	619	31	75
PerformanceSavers Smart Strip	192	28	67
RebateSavers - Kit Participant Smart Strip	2,248	14	35
RebateSavers - Online Store Smart Strip	10,006	31	75
RebateSavers - Online Store Smart Strip with Occupancy Sensor	55	34	82

APPENDIX E. FREERIDERSHIP SCORING FLOW CHART



APPENDIX F. INCENTED MEASURE FREE RIDERSHIP SCORING TABLES

Table 64 illustrates how the initial survey responses are translated into the responses "yes," "no," or "partially" to indicate free ridership (in parentheses).

Table 64. Raw Survey Responses Translation to Free Ridership Scoring Matrix Terminology

FR1. Had you already purchased your new [SURVEYMEASURE] before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit?	FR1a. To confirm, you purchased your new [SURVEYMEASURE] and then found out about Ameren's ActOnEnergy PerformanceSavers in-home audits, is that correct?	FR2. Before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, were you already planning to purchase [SURVEYMEASURE]?	FR3. Would you have purchased the same type of [SURVEYMEASURE] had you not heard about Ameren's ActOnEnergy PerformanceSavers in-home audit?	FR4. Help me understand, without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased a different type of [SURVEYMEASURE], or would you have decided not to purchase at all?	FR5. When you say you would have purchased [SURVEYMEASURE] without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased [SURVEYMEASURE] that were just as energy efficient?	FR6. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of [SURVEYMEASURE]?	FR7. Thinking about timing, without hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, is it most likely that you would have purchased the [SURVEYMEASURE]…	FR8. To confirm, you indicated that without hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, you would not have purchased your [SURVEYMEASURE] at all, is that correct?	FR9. Without the Ameren ActOnEnergy PerformanceSavers in-home audit, would you have purchased [SURVEYMEASURE] that was just as energy-efficient?	FR10. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of [SURVEYMEASURE]?	FR11. With respect to timing, without hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the [SURVEYMEASURE]…
Yes (Yes)	Yes, that's correct (Yes)	Yes (Yes)	Yes (Yes)	I would have purchased a different type (Yes)	Yes (Yes)	Yes, I would have purchased same amount (Yes)	At the same time (Yes)	Yes (No)	Yes (Yes)	Yes (No)	At the same time (Yes)
No (No)	No, that's not correct (No)	No (No)	No (No)	I would not have purchased at all (No)	No (No)	No, I would have purchased less (No)	Within the same year (Partial)	No (Yes)	No (No)	No (No)	Within the same year (Partial)
Don't Know (No)	Don't Know (No)	Don't Know (Partial)	Don't Know (Partial)	Don't Know (No)	Don't Know (Partial)	Don't Know (Partial)	One to two years out (No)	Don't Know (Partial)	Don't Know (Partial)	Don't Know (Partial)	One to two years out (No)
Refused (No)	Refused (No)	Refused (Partial)	Refused (Partial)	Refused (No)	Refused (Partial)	Refused (Partial)	More than two years out (No)	Refused (Partial)	Refused (Partial)	Refused (Partial)	More than two years out (No)
							Never (No)				Never (No)
							Don't Know (Partial)				Don't Know (Partial)
							Refused (Partial)				Refused (Partial)

Table 65 shows how the string of responses from Table 64 is then translated into a free ridership score.

Table 65. Sample of Incented Measure Free Ridership Scores

FR1. Had you already purchased your new [SURVEYMEASURE] before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit?	FR1a. To confirm, you purchased your new [SURVEYMEASURE] and then found out about Ameren's ActOnEnergy PerformanceSavers in-home audits, is that correct?	FR2. Before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, were you already planning to purchase [SURVEYMEASURE]?	FR3. Would you have purchased the same type of [SURVEYMEASURE] had you not heard about Ameren's ActOnEnergy PerformanceSavers in-home audit?	FR4. Help me understand, without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased a different type of [SURVEYMEASURE], or would you have decided not to purchase at all?	FR5. When you say you would have purchased [SURVEYMEASURE] without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased [SURVEYMEASURE] that were just as energy efficient?	FR6. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of [SURVEYMEASURE]?	FR7. Thinking about timing, without hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, is it most likely that you would have purchased the [SURVEYMEASURE]…[READ LIST]	FR8. To confirm, you indicated that without hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, you would not have purchased your [SURVEYMEASURE] at all, is that correct?	FR9. Without the Ameren ActOnEnergy PerformanceSavers in-home audit, would you have purchased [SURVEYMEASURE] that was just as energy-efficient?	FR10. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of [SURVEYMEASURE]?	FR11. With respect to timing, without hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the [SURVEYMEASURE]…	FR Score
Yes	Yes	x	x	x	x	x	x	x	x	x	x	100%
Yes	No	Yes	Yes	x	x	x	Yes	x	x	x	x	100%
Yes	No	Yes	Yes	x	x	x	Partial	x	x	x	x	75%
Yes	No	Yes	Yes	x	x	x	No	x	x	x	x	0%
Yes	No	Yes	Yes	x	x	x	Partial	x	x	x	x	75%
Yes	No	Yes	Partial	Yes	Yes	Yes	Yes	x	x	x	x	75%
Yes	No	Yes	Partial	Yes	Yes	Yes	Partial	x	x	x	x	50%
Yes	No	Yes	Partial	Yes	Yes	Yes	No	x	x	x	x	0%
Yes	No	Yes	Partial	Yes	Yes	Partial	Yes	x	x	x	x	50%
Yes	No	Yes	Partial	Yes	Yes	Partial	Partial	x	x	x	x	25%
Yes	No	Yes	Partial	Yes	Yes	Partial	No	x	x	x	x	0%
Yes	No	Yes	Partial	Yes	Yes	No	Yes	x	x	x	x	25%
Yes	No	Yes	Partial	Yes	Yes	No	Partial	x	x	x	x	12.5%
Yes	No	Yes	Partial	Yes	Yes	No	No	x	x	x	x	0%
Yes	No	Yes	Partial	Yes	Partial	Yes	Yes	x	x	x	x	50%
Yes	No	Yes	Partial	Yes	Partial	Yes	Partial	x	x	x	x	25%
Yes	No	Yes	Partial	Yes	Partial	Yes	No	x	x	x	x	0%
Yes	No	Yes	Partial	Yes	Partial	Partial	Yes	x	x	x	x	25%
Yes	No	Yes	Partial	Yes	Partial	Partial	Partial	x	x	x	x	12.5%
Yes	No	Yes	Partial	Yes	Partial	Partial	No	x	x	x	x	0%
Yes	No	Yes	Partial	Yes	Partial	No	Yes	x	x	x	x	12.5%
Yes	No	Yes	Partial	Yes	Partial	No	Partial	x	x	x	x	0%
Yes	No	Yes	Partial	Yes	Partial	No	No	x	x	x	x	0%
Yes	No	Yes	Partial	Yes	No	x	x	x	x	x	x	0%

Each participant free ridership score starts with 100%, which we decrement based on their responses to the twelve questions as shown in Table 66.

Table 66. Incented Measure Free Ridership Scoring Legend

Q#	Decrement
FR1	0% decrement for "No," "Partial" level not needed
FR2	100% FR if "Yes," "No" level not needed, "Partial" level not needed
FR3	50% decrement for "No," 25% decrement for "Partial"
FR4	50% decrement for "No," 25% decrement for "Partial"
FR5	0% decrement for "No," Partial level not needed
FR6	100% decrement for "No," 25% decrement for "Partial"
FR7	50% decrement for "No," 25% decrement for "Partial"
FR8	100% decrement for "No," 25% decrement for "Partial"
FR9	100% decrement for "No," 25% decrement for "Partial"
FR10	100% decrement for "No," 25% decrement for "Partial"
FR11	50% decrement for "No," 25% decrement for "Partial"
FR12	100% decrement for "No," 25% decrement for "Partial"

Below, we illustrate the unique response combinations from applicants answering the Performance Savers online survey (actual responses mapped to "yes," "no," or "partial," as indicative of free ridership); the free ridership score assigned to each combination; and the number of responses. We calculated free ridership scores for each measure category based on the distribution of scores within the matrix.

Table 67. Frequency of Incented Measure Free Ridership Scoring Combinations

FR1. Had you already purchased your new [SURVEYMEASURE] before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit?	FR1a. To confirm, you purchased your new [SURVEYMEASURE] and then found out about Ameren's ActOnEnergy PerformanceSavers in-home audits, is that correct?	FR2. Before hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, were you already planning to purchase [SURVEYMEASURE]?	FR3. Would you have purchased the same type of [SURVEYMEASURE] had you not heard about Ameren's ActOnEnergy PerformanceSavers in-home audit?	FR4. Help me understand, without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased a different type of [SURVEYMEASURE], or would you have decided not to purchase at all?	FR5. When you say you would have purchased [SURVEYMEASURE] without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased [SURVEYMEASURE] that were just as energy efficient?	FR6. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of [SURVEYMEASURE]?	FR7. Thinking about timing, without hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, is it most likely that you would have purchased the [SURVEYMEASURE]…	FR8. To confirm, you indicated that without hearing of Ameren's ActOnEnergy PerformanceSavers in-home audit, you would not have purchased your [SURVEYMEASURE] at all, is that correct?	FR9. Without the Ameren ActOnEnergy PerformanceSavers in-home audit, would you have purchased [SURVEYMEASURE] that was just as energy-efficient?	FR10. Without having heard of Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the same amount of [SURVEYMEASURE]?	FR11. With respect to timing, without hearing about Ameren's ActOnEnergy PerformanceSavers in-home audit, would you have purchased the [SURVEYMEASURE]…	FR Score	Frequency
No	x	Yes	Yes	x	x	x	No	x	x	x	x	0%	1
No	x	Yes	Yes	No	x	x	x	No	x	x	x	0%	3
No	x	Yes	No	No	x	x	x	No	x	x	x	0%	1
No	x	No	Yes	x	x	x	Partial	x	x	x	x	25%	1
No	x	No	Yes	x	x	x	No	x	x	x	x	0%	1
No	x	No	No	No	x	x	x	No	x	x	x	0%	4