Ameren Missouri ConstructionSavers Impact and Process Evaluation: Program Year 2013

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EXECUTIVE SUMMARY

Ameren Missouri (Ameren) engaged the Cadmus team (composed of Cadmus and Nexant) to perform annual process and impact evaluations of the ConstructionSavers 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 ConstructionSavers program to its residential Act On Energy® portfolio in PY13. The program, implemented by ICF International (ICF), promotes energy-efficient new home construction. Targeting builders, the program offers a package of training, technical assistance, marketing assistance, and incentives for constructing ENERGY STAR® homes. The program is designed to increase consumer awareness of and demand for ENERGY STAR version 3.0 single-family homes, while increasing the building industry's willingness and ability to construct ENERGY STAR homes. To verify energy savings and program compliance, ConstructionSavers uses independent, third-party Home Energy Rating System (HERS) raters.

All homebuilders constructing new homes or conducting a major renovation of existing single-family homes (or townhouses) in Ameren's service territory are eligible to participate in ConstructionSavers. The program provides two tiers for building options:

- Tier I homes are eligible for a $500 rebate and must meet the previous version (version 2.5) of ENERGY STAR guidelines.
- Tier II homes are eligible for an $800 dollar rebate and must meet the current ENERGY STAR guidelines.

Key Impact Evaluation Findings

In PY13, ConstructionSavers completed 101 qualifying homes through 13 unique participating builders. As shown in Table 1, the evaluated savings (*ex post*) are less than the planning estimate (*ex ante*) based on Ameren's technical resource manual (TRM). Specifically, the Cadmus team found that the deemed savings from the Ameren TRM resulted in an overstatement of program savings by 183%. This, in turn, resulted in low realization rates for both program tiers.

Table 1. Gross Energy Savings (kWh/Year)

Tier Level	Homes Constructed	*Ex Ante* (kWh/yr)[1]	*Ex Post* (kWh/yr)	Realization Rate
Tier I – High Performance Home	88	334,829	170,490	50.9%
Tier II – ENERGY STAR Home	13	99,753	67,515	67.6%
Overall	**101**	**434,582**	**238,005**	**54.8%**

[1] *Ex ante* savings value update provided by Ameren Missouri.

To estimate the program's net-to-gross (NTG) ratios for PY13, the Cadmus team used this formula:

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

We determined that nonparticipant spillover was not appropriate for ConstructionSavers. As the program marketing focused exclusively on builders, the program was unlikely to generate energy-efficient actions among the general public. We also determined that the nascent program was unlikely to achieve market effects, so we deemed them at 0% for PY13.

To determine NTG, we used findings from our program builder surveys and from our program home REM/Rate analyses.

- We calculated free ridership as the difference in energy consumption between a program home and a non-program home constructed by a participant builder.
- We calculated spillover as the energy savings derived from: (1) any building practices introduced by the program and employed in a non-program home, and (2) any measures installed in a program home that were neither rebated by the program nor typically installed in participant builders' non-program homes.

The Cadmus team discovered that, typically, the participating builders were already building energy-efficient homes and low-income homes that met current high-efficiency standards. As a result, there was a high rate of free ridership (77.6% for Tier I and 60.0% for Tier II homes), which drastically reduced the program's net savings. We also determined that participant spillover was insignificant - only 3.2% for Tier II homes and 0.0% for Tier 1 homes. Table 2 lists our NTG findings and applies the results to the total *ex post* gross energy savings.

Table 2. Program Gross and Net *Ex Post* Savings (kWh/yr)

Measure	*Total Ex Post* Gross Energy Savings (kWh/yr)	Free Ridership	Participant Spillover	NTG Ratio	Net Savings (kWh/yr)
Tier I – High Performance Home	170,490	77.6%	0.0%	22.4%	38,187
Tier II – ENERGY STAR Home	67,515	60.0%	3.2%	43.2%	29,163
Overall	**238,005**	**72.1%**	**0.4%**	**28.3%**	**67,350**

The Public Service Commission (PSC) proposes annual energy and demand savings targets for each program year. As shown in Table 3 ConstructionSavers realized only 9.9% of its proposed net energy savings target (679 MWh) yet achieved 101.2% of its demand savings target (82 kW) for PY13.

Table 3. ConstructionSavers Savings Comparison

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)	679	435	238	67	10%
Demand (kW)	82	73	83	23	28%

[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

Key Process Evaluation Findings

During PY13, the participation rate in the ConstructionSavers program was low. Initially, builders withdrew several homes from the program due to certain program requirements (specifically, those of the ENERGY STAR 3.0 thermal enclosure checklist). After developing a course correction plan in summer 2013 that relaxed these requirements, Ameren and ICF convinced builder drop-outs to re-enroll their homes. However, despite the course correction plan, the program was still unable to attract a sufficient number of builders to meet the expected participation and savings goals for the first year.

Surprised at the lack of response to the program in the St. Louis metropolitan area, ICF learned over the course of the program year of these factors that affected participation:

- The local new-construction market was fragmented.
- Regional macroeconomic factors have made builders concerned about their margins.
- Energy efficiency in new construction is not a priority for many Missouri builders.

To address these issues and to boost participation, Ameren and ICF intend to introduce a redesigned version of the program in the spring of PY14. The redesigned program will replace the current tiered offerings with a performance-based design that is more flexible for builders and has performed well in other regions of the country.

Key Conclusions and Recommendations

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

Conclusion 1. The program suffered in PY13 from low builder participation and a high rate of free ridership. Participating builders were comprised primarily of energy efficient builders or low-income builders that are required to build to high efficiency standards outside of the program. It is not

uncommon for recently established new construction programs to attract this builder type as these builders have prior knowledge and experience with high efficiency homes.

> **Recommendation 1a. To address both program free ridership and low participation, target builders that do not currently construct to high energy efficiency building standards.** ICF should expand networking activity with builders, HERS raters, realtors, Home Builder Associations, and other stakeholders to encourage program acceptance.
>
> **Recommendation 1b. Reduce barriers to entry as much as possible.** Ameren and ICF should implement the new performance-based program re-design to allow greater flexibility for builders. If participation remains low after the program re-design is implemented, then Ameren and ICF may need to revise the program incentive levels.

Conclusion 2: Both program tiers had very low realization rates. Tier I homes achieved a realization rate of 50.9% and Tier II achieved a realization rate of 67.6%.

> **Recommendation 2.** Update the Ameren TRM deemed savings value to ensure they are representative of new home construction. The Ameren TRM should also be updated to include ENERGY STAR appliances as these are common measures in new residential construction projects. Lastly, savings should be deemed at a whole house level rather than at a measure level. It is difficult for measure-level TRM savings to accurately represent interactive effects among measures within a home, and extrapolating a single measure savings value to the population of homes may overestimate savings.

Conclusion 3. Interviews with Ameren and ICF program managers indicated that Missouri homebuilders lack awareness of and knowledge about building high-efficiency homes, and they may not fully understand the benefits from participating in the program.

> **Recommendation 3. Continue active pursuit of builders through training and educational outreach.** Investigate opportunities to reach builders through partnerships with home builder associations and with local nonprofits focused on energy efficiency and sustainability (such as Earthways Center). Provide collateral materials promoting the program for distribution to partners and other appropriate organizations that engage potential homebuyers (such as, mortgage lenders, realtors, appraisers, and home improvement retailers).

Conclusion 4. Missouri may lack customer demand for high-efficiency housing, as indicated in the program manager interviews and the findings from the Shelton Group segmentation study.

> **Recommendation 4. Use the Act On Energy campaign to educate both builders and home buyers about the benefits of energy-efficient homes.** Builder reluctance is, in part, a function of insufficient customer awareness and demand, so providing customer education about the value of high-efficiency homes through the Ameren Act On Energy campaign could have a positive effect on the building market. This effort, combined with the implementer's work in educating

the building community, would help bridge the gap between participating builders and future new home buyers.

INTRODUCTION

Ameren Missouri (Ameren) engaged The Cadmus team to perform a process and impact evaluation of the ConstructionSavers 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

ConstructionSavers promotes the building of new energy-efficient homes that have these high-efficiency features:

- Envelope (outer walls, windows, doors, skylights, roof, and insulation);
- HVAC system; ductwork; and
- Lighting

Targeting builders, the program offers a package of training, technical assistance, marketing assistance, and incentives for constructing ENERGY STAR homes. The program is designed to increase consumer awareness of and demand for ENERGY STAR version 3.0 single-family homes, while increasing the building industry's willingness and ability to construct ENERGY STAR homes. To verify energy savings and program compliance, ConstructionSavers uses independent, third-party Home Energy Rating System (HERS) raters.

All homebuilders constructing new homes or conducting a major renovation on existing single-family homes (or townhouses) in Ameren's service territory are eligible to participate in ConstructionSavers. The program provides two tiers for building options:

- Tier I homes are eligible for a $500 rebate and must meet the previous version (v2.5) of ENERGY STAR guidelines.
- Tier II homes are eligible for an $800 dollar rebate and must meet the current ENERGY STAR guidelines.

The program has two paths through which a project can qualify:

- The prescriptive path allows participants to choose their savings measures from the ENERGY STAR Reference Design Specifications. For this path, the construction methods must hold true to the measures selected at the time the project application was submitted to the program.
- The performance path requires that savings for the proposed measures be calculated using approved modeling software that determines a HERS score for the home. These measures can be adjusted during construction, provided that the adjusted HERS score remains less than or equal to the original target.

ConstructionSavers uses these approaches to promote the program: recruiting homebuilders; providing builder training; and supporting builders through the use of the ENERGY STAR brand. (Note that ENERGY STAR branding is only applicable to Tier 2 homes.)

ICF International (ICF) markets and delivers the program, providing these services:

- Conducting the marketing by providing: ENERGY STAR flags, yard signs, and other materials for Tier 2 homes; and custom signage for Tier 1 homes.
- Performing outreach efforts such as conducting recruitment meetings with builders and HERS raters.
- Managing and maintaining an online portal that allows builders to register with the program and to submit the required documentation.

Program Activity

As shown in Table 4, under the ConstructionSavers program, 13 builders completed a total of 101 homes.

Table 4. Program Participation (PY13)

Tier	Homes Constructed
Tier I – High Performance Home	88
Tier II – ENERGY STAR Home	13
Total	**101**

EVALUATION METHODOLOGY

In evaluating the ConstructionSavers program, the Cadmus team identified these objectives for PY13:

- Establish a residential new construction baseline to determine nonparticipant building practices.
- Evaluate participants' non-program homes to determine building practices.
- Determine whether homeowners recognize the value of ENERGY STAR homes.
- Assess the impacts of program design changes, marketing activities, and program processes.
- Assess the program's achievements against goals.
- Examine participants' experience, satisfaction, and decision-making motivations.
- Identify primary market barriers and offer suggestions for effectively overcoming those barriers through improvements to program design and delivery.

Table 5 lists our evaluation activities and a brief explanation of the purpose each activity. Following the table are overviews of each activity.

Table 5. PY13 Process and Impact Evaluation Activities and Rationale

Evaluation Activity	Process	Impact	Rationale
Review the Technical Resource Manual (TRM)		•	Review TRM values and assumptions and provide updated information for future program years.
Review the Tracking Data	•	•	Provide ongoing support to ensure all necessary program data are tracked accurately; identify gaps for EM&V purposes.
Review Marketing Materials	•		Identify gaps and opportunities in the program's marketing and outreach strategies and activities.
Conduct Nonparticipant Builder Plan Review and Surveys and Site Visits		•	Collect data on nonparticipant building practices to inform baseline assumptions for gross savings analysis.
Conduct Participant Builder Surveys And Non-program Home Site Visits	•	•	Collect data on participant builders' homes built outside of the program to inform baseline assumptions for net savings analysis. Obtain insights on builders' experience of participating in the program.
Conduct Program Home REM/Rate Reviews and On-site Spot Checks		•	Gather program home models to conduct gross and net savings analysis. Verify program homes are built to program requirements.
Interview Program Managers	•		Enhance our understanding of the program to identify program successes and challenges.
Conduct a 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.

TRM Review

At the outset of the PY13 evaluation, the Cadmus team reviewed individual measure algorithms in the Ameren TRM used by ICF to calculate *ex ante* savings for the ConstructionSavers program. However, it was difficult for the Cadmus team to assess how well individual measure *ex ante* savings values may represent savings within a whole home as final measure counts, installation locations, and baseline conditions were unknown. We re-assessed the TRM-based *ex ante* savings after completing the evaluation analysis to understand the impact of TRM savings at the end use level (e.g., the impact of lighting measures on overall *ex ante* savings). 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 feedback that could potentially allow Ameren's implementer to make course corrections for improving program delivery.

Data Tracking Review

In conjunction with the TRM review, the Cadmus team reviewed the program tracking database (Vision) used by ICF. Specifically, we assessed whether ICF was gathering the data necessary for an accurate evaluation and for use with the algorithms detailed in the Ameren TRM. Because of the timing of our review—including an assessment of data quality and completeness—we were able to notify Ameren and its implementer early in the program about the issues we observed.

Program Manager Interviews

For the ConstructionSavers PY13 evaluation, the Cadmus team interviewed Ameren and ICF program managers in July and December 2013, as shown in Table 6. 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 A.)

Table 6. Completed Program Manager Interviews

Program Managers	Interviews Conducted
Ameren Program Staff	2
ICF Program Management	2
Total	4

Marketing Review

In mid-2013, the Cadmus team reviewed the ConstructionSavers marketing materials. To enhance our understanding of the marketing planning, coordination, and outreach efforts, we also interviewed key marketing staff from ICF. 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 and ICF on November 13, 2013, we provided our 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.

Gross Savings Methodology

The Cadmus team defined ConstructionSavers' gross savings as the difference in energy consumption between a ConstructionSavers program home and that same home built to nonparticipant building standards. We targeted an *ex post* gross savings estimate with a precision level of ±10% at a 90% confidence level.

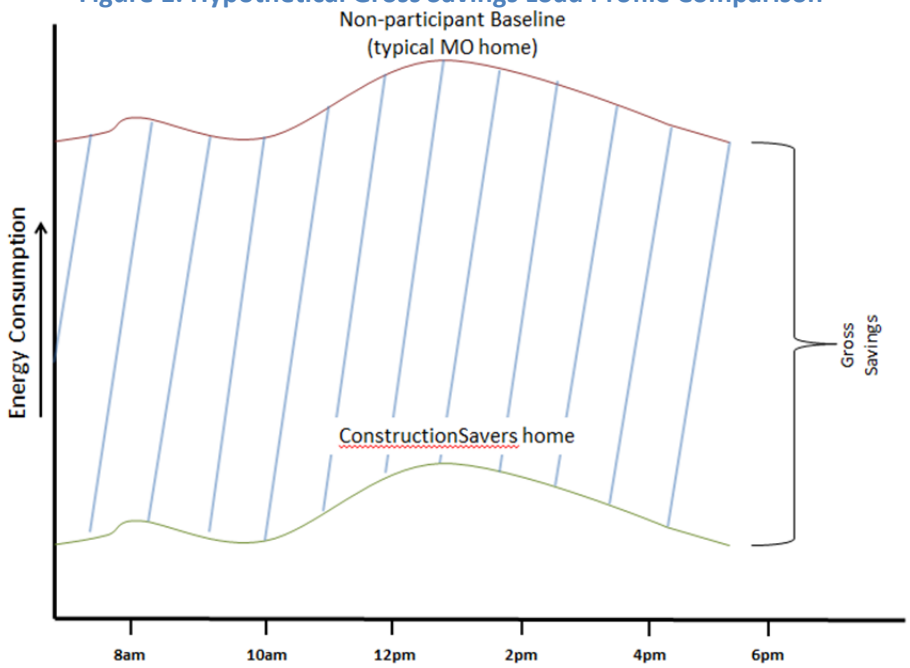
We determined gross savings through use of two pertinent datasets:

- ***A sample of 88 2012-2013 nonparticipant building plans***, supplemented by nonparticipant builder surveys and site visits. This material allowed us to assess nonparticipant building practices in new residential construction within Ameren's territory; and
- ***A sample of 40 program home REM/Rate files.*** These files provided an assessment of building practices used in the ConstructionSavers program homes.

Using the datasets, we followed these steps to calculate gross savings.

1. For each of the 40 sampled homes, we estimated total household energy consumption using a simulation model developed with REM/Rate software (version 14.3).
2. We modified each model by replacing the participating homes' key energy-related characteristics with nonparticipant building practice information that we collected from nonparticipant builders.
3. To determine the *ex post* gross savings achieved by a particular ConstructionSavers home, we compared each home's modeled energy consumption (as built through the program) with the same home built to nonparticipant practices (see Figure 1).
4. After conducting this analysis for each home in the sample, we calculated the ratio of the total *ex post* program savings to the program total *ex ante* reported savings (based on the Ameren TRM), which resulted in the program realization rate.

Figure 1. Hypothetical Gross Savings Load Profile Comparison



Determining Nonparticipant Baseline Building Practices

To assess gross savings, we first reviewed the current building practices across Ameren's territory. Through our evaluation work in other states, we have found that baseline practices often deviate from local building energy codes (builders either over-perform or underperform against the code requirements). In the case of Missouri, which is a home-rule state,[1] there is no single code standard against which to benchmark building practices. This situation reinforces the need for conducting a baseline assessment of new-construction building practices to determine whether and to what extent building practices vary between jurisdictions within Ameren's territory.

In determining the baseline building practices, we used a multifaceted approach that entailed these research tasks: (1) code review; (2) nonparticipating builder plan reviews; (3) nonparticipating builder telephone survey; and (4) nonparticipating builder site visits.

Code Review

The Cadmus team reviewed the Missouri Code Gap Analysis[2] to have a context for energy codes currently used throughout the state. The gap analysis confirmed the Missouri home-rule status that restricts the ability of the state to adopt a statewide energy code and that requires only new or renovated state-owned buildings to meet the 2006 IECC code standards.

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1 A home-rule state permits each jurisdiction to dictate what, if any, code is required for building practices.

2 Building Codes Assistance Project, June 2011.

In our initial outreach to the jurisdictions in our baseline assessment sample, we discovered that some jurisdictions had not adopted an energy code (or were unsure whether their department had adopted any energy code). While more than half of the jurisdictions we contacted did report having an energy code on record, the staff members with whom we spoke in these jurisdictions could not confirm that the energy code was enforced. We also learned from building department staff in several jurisdictions that energy code requirements had been removed from their building inspections. Additionally, some building code staff members said that the energy code was only on record to comply with Midwest Independent System Operator (MISO) requirements.

Nonparticipant Builder Plan Reviews

As previously mentioned, the Cadmus team's baseline assessment of nonparticipants included a review of a sample of 88 building plans from nine jurisdictions within Ameren's service territory. We selected jurisdictions from a sample of counties weighted by the number of residential permits issued in the 2012 calendar year[3]. Because Ameren's territory covers only parts of certain counties, the Cadmus team had to discount the total number of permits issued by county. To do this, we estimated the total number of households per county and estimated the number of Ameren residential customers per county. We then applied the resulting ratio of Ameren residential customers per county to the reported number of permits issued, by county. As a result, we estimated that a total of 2,227 permits for multifamily and single-family homes were issued within Ameren's territory in 2012. (Note that for the counties with the greatest building activity in 2012, we proportionally weighted them in the sample so as to increase the likelihood that we would successfully receive building data from jurisdictions within these sampled counties.)

The Cadmus team contacted the various jurisdictions and requested energy measure documentation, such as the following:

- Building permits,
- REScheck files/certificates,
- HVAC worksheets (e.g., Manual J), and
- Floor plans, elevations, and building sections.

Jurisdictions did not have all of the requested documents available (specifically, REScheck files and Manual J).

To increase the variation in building types by preventing the receipt of similar or identical plans filed by a single builder, we also asked the jurisdictions to provide one building plan issued for each month from March 2012 through March 2013. We collected hard copies of building plans and associated documentation by mail or on site at the jurisdiction office. Of the 19 jurisdictions we contacted, 10 did

[3] The US Census Bureau provided us with the total number of 2012 permits issued by each county.

not have the supporting documentation we required, were unwilling to cooperate in the assessment, or did not respond to our inquiries.

We completed a thorough review of all the documentation provided by the nine jurisdictions to determine crucial building parameters, including conditioned square footage, foundation type, insulation details, and glazing area. We then used this documentation in conjunction with data gathered from phone surveys and site visits to develop descriptions of the baseline building conditions and to create parameter inputs for baseline REM/Rate models. After we reviewed the collected plans for completeness, we aggregated the 88 unique plans to establish our assessment of the standard building practices.

Nonparticipant Builder Telephone Survey

Drawing from a representative sample of nonparticipant builders throughout Ameren's territory, we conducted surveys to assess typical building practices. We developed our sample from information obtained through building permit documentation collected from the jurisdiction and from Missouri Home Builder Association (HBA) lists. We used the HBA lists to supplement our builder sample and to reduce the self-selection bias that could potentially be present in our jurisdiction sample. Because the HBA builder lists were not confined to Ameren's territory, we designed the survey instrument so that we only collected details regarding building activity within Ameren's territory. In total we completed 24 phone surveys. Each survey contained 53 questions about building practices that affect a home's energy usage.

Nonparticipant Builder Site Visits

To verify and augment the data collected from the building plans and phone surveys of builders, we asked survey respondents to allow us to visit either the home depicted in the building plans or a similar home in the surrounding vicinity. We requested that our engineers be allowed on site during either the rough-in/insulation phase or the final construction phase. As an incentive, we offered builders a $75 gift card, and we completed our goal of 15 site visits.

- For visits that occurred in the rough-in/insulation phase, we typically were able to validate the reported duct insulation, window U-factors and SHGC values, air sealing, wall and rim joist insulation, and some HVAC components.
- During site visits at homes in final phases of construction, we usually were able to validate the reported lighting efficacy, ceiling insulation, and appliances, and conduct performance testing including blower door and duct blaster testing.

As needed, we asked the builder about specific building conditions that were not observable.

We cross-referenced the data we collected on site with building plans and, when we noted a discrepancy, we used the values recorded from the site visit in our baseline assessment.[4] Overall, we made adjustments to less than 10% of survey responses.

From this multifaceted effort, we compiled a list of energy measure values (insulation R-values, window U-factors, HVAC efficiencies, etc.) that represent the typical building practices used in Ameren's territory. The information we collected is summarized in Table 7, and our findings meet a ±9% precision level at a confidence interval of 90%, based on a population of 2,227 permits issued in the 2012 calendar year and a sample of 88 building plans (Table 7). We did not include the phone survey and site visit as additional sample points in the confidence and precision calculation, as these efforts mainly provided supplemental data for our building plan analysis.

Table 7. Summary of Nonparticipant Builder Baseline Assessment Tasks

Information Source	Population	Sample Size	Site Visits	Phone Surveys	Document Reviews	Precision at 90% Confidence
Nonparticipant Builder Homes	2,227	88	15	23	88	8.5%

Program Home REM/Rate Models

The second pertinent set of data used by the Cadmus team for the gross savings analysis was a sample of program home REM/Rate models. Each home in the program was required to have a REM/Rate model developed by a certified HERS Rater.

At the time we pulled our sample, 93 program models were complete. To meet the precision goal of ±10% at the 90% confidence level, we requested a sample of 40 models from the program implementer, and this sample contained all available Tier II home REM/Rate models (n=4). We used these models to stratify the savings between Tier I and Tier II homes.

Additionally, we found that five of the 40 models had an exempt status regarding the requirement to test duct sealing. Because the program implementer was unable to provide clarification on this at the time of the analysis, we had no clear guidance for interpreting this status. Thus, we dropped these five models from the sample, replacing them with alternates.

[4] However, if builders indicated that the home at which the site visit was conducted was not representative of their typical building practice, the Cadmus team used information collected from the building plan and/or survey.

Table 8. REM/Rate Savings Analysis Sample

REM/Rate Savings Analysis	Population[1]	Sample Size	Precision at 90% Confidence
Tier I – High Performance Homes	89	36	8.5%[2]
Tier II – ENERGY STAR Homes	4	4	Census

[1]Population as December 6, 2013 when sample was drawn.
[2]Confidence calculated using t-score of 1.689; precision adjusted using finite population correction factor.

Net Savings Methodology

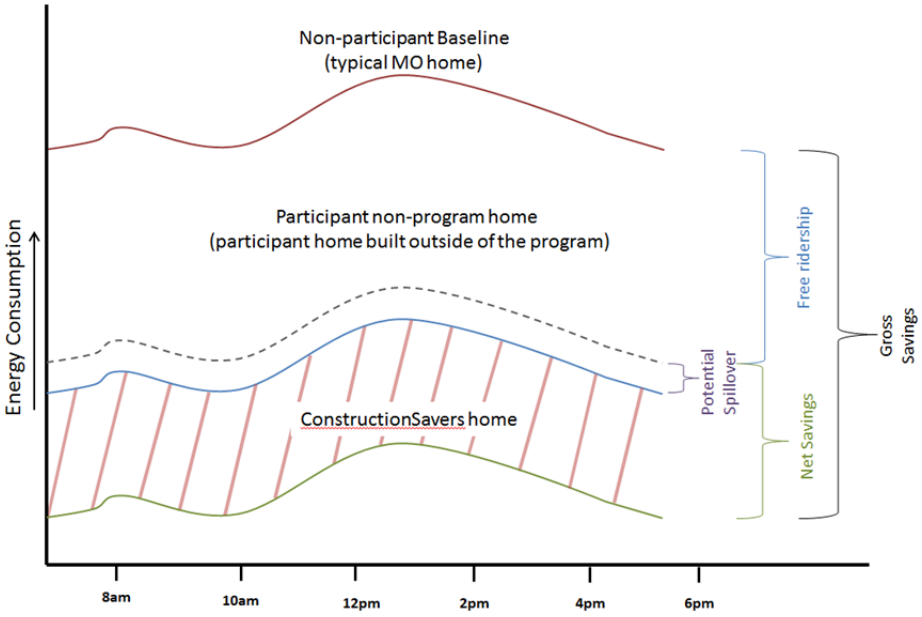
The Cadmus team's net savings analysis determined the portion of gross savings attributable to the ConstructionSavers program. Our net savings approach followed a method similar to that for the gross savings analysis, in that it requires two pertinent sets of data:

- ***A sample of 10 participant builders***, for understanding their typical building practices (building practices they use on homes built outside of the ConstructionSavers program). These data provide insights into the building standards of participant builders in the program's absence.
- ***A sample of 40 program home REM/Rate files.*** These data provided an assessment of building practices used in the ConstructionSavers program homes.

Using a simulation model developed with REM/Rate software, we determined the energy consumption for each sampled program home. We also modified each model in accordance with the data collected from the participants' non-program homes. This resulted in a model of a program home that was constructed to the typical building practices of participant builders. The difference in the modeled energy consumption between a program home and its associated non-program home determined the net savings achieved by that particular house before the incorporation of any potential spillover effects (see Figure 2).

After we collected spillover data via the phone survey and site visits, we incorporated the findings of our spillover analysis into the final net-to-gross (NTG) ratio.

Figure 2. Hypothetical Net Savings Load Profiles



The Cadmus team's first step in calculating net savings was to understand the practices of participating builders when they are constructing non-program homes. This is to confirm that the participants' non-program homes are built above and beyond the baseline (typical) standards of nonparticipant builders.

In the event that a non-program home is built to the same standards as nonparticipant baseline homes, then the net savings would be equal to gross savings. To address this question, we completed the following research tasks: (1) participant phone interviews; (2) participant site visits; and (3) program home REM/Rate models.

Participant Builder Phone Surveys

Due to a low participation population of 13 builders, we attempted to interview each builder and, ultimately, completed interviews with 10 of them. (The remaining three builders did not respond to multiple interview requests.)

In our surveys, the questions we asked about building practices were generally similar to the questions we asked in nonparticipant interviews; however, we focused on building practices employed outside of the program. We also asked participant builders how (if at all) the ConstructionSavers program influenced them in changing their building practices. At the time of our interviews, we solicited site visits at non-program homes with participants, and the four builders who had available non-program homes agreed to a follow-up site visit.

Participant Builder Site Visits

Again, we provided a $75 gift card to participant builders who allowed site visits at their recently completed or mid-construction homes built *outside* of the ConstructionSavers program. Through these participant site visits, we validated the information collected from phone interviews to assess the extent

that the self-reported building practices accurately represented the builders' work on homes built outside of the program. When we found discrepancies between a participant's interview responses and the conditions observed on site, we prioritized data from the site visit.[5]

We completed a total of four site visits: two homes in framing/insulation phase and two homes in final construction phase. We conducted the site visits in the same manner as those conducted with nonparticipant builders, collecting the same types of data for developing a baseline of typical building practices used by participant builders outside of the program.

From the phone surveys and site visits, the Cadmus team developed a list of energy-measure values that represent the typical building practices employed by participant builders. Table 9 contains a summary of the information we collected and analyzed for preparing the baseline assessment.

Table 9. Summary of Participant Builder Baseline Assessment Tasks

Information Source	Population	Sample Size	Site Visits	Phone Surveys	Document Reviews	Precision at 90% Confidence
Participant Builders	13[1]	10	41	10	N/A	7.5%[2]

[1]Site visits are nested within the overall builder sample of 10.
[2]Confidence calculated using t-score of 1.833; precision adjusted using finite population correction factor.

Program Home REM/Rate Models

For the net savings analysis, the Cadmus team used the same sample of REM/Rate models as was used in the gross savings analysis (Table 10). After modifying each model in accordance with the findings from the participant baseline, we calculated the consumption of the recalibrated model via REM/Rate.

Table 10. REM/Rate Savings Analysis Sample

REM/Rate Savings Analysis	Population[1]	Sample Size	Precision at 90% Confidence
Tier I – High Performance Homes	89	36	8.5%[2]
Tier II – ENERGY STAR Homes	4	4	Census

[1]Population as of December 6, 2013 when sample was drawn.
[2]Confidence calculated using t-score of 1.689; precision adjusted using finite population correction factor.

Cost-Effectiveness Analysis

Using final PY13 ConstructionSavers participation data, implementation data, and the *ex post* gross and net savings estimates presented in this report, Morgan Marketing Partners determined the program's cost-effectiveness using DSMore.[6] Morgan Marketing Partners also calculated measure-specific cost-

[5] However, if a builder indicated that the home at which the site visit was conducted was not representable of their typical building practice, the Cadmus team did revert to the information collected from the survey.

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

effectiveness. 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 ConstructionSavers program. We have organized our findings into three sections: Program Design and Delivery, Marketing and Outreach, and Builder Feedback.

Program Design and Delivery

ConstructionSavers is a new program that was added to the Ameren portfolio in PY13. It was developed and launched following an opportunity recognized through Ameren's potential studies. As noted in the program marketing plan, ICF's role in promoting the program includes the recruitment, retention, and support of qualified homebuilders. The program launched in January 2013 and the participant web portal was first made available to builders beginning in February 2013.

The program targets builders through a package of training, technical assistance, marketing assistance, and incentives for constructing ENERGY STAR homes. The program is designed to increase consumer awareness of and demand for ENERGY STAR version 3.0 single-family homes. It is also designed to educate those in Missouri's building industry, increasing their knowledge about and willingness to construct ENERGY STAR homes.

The program implementer, ICF, characterized ConstructionSavers as a market transformation program, since it is designed to persuade builders to increase their level of investment in developing a better-performing home. Thus, ICF designed its marketing campaign to meet these objectives:

- Increase participation by qualified home builders and meet energy savings goals;
- Help participating home builders promote their energy-efficient homes; and
- Assist Ameren in increasing residential electric customer awareness of energy-efficient homes and participating builders.

All homebuilders constructing new single-family homes or conducting a major renovation of existing single-family homes (or townhouses) in Ameren's service territory are eligible to participate in the ConstructionSavers program. As shown in Table 11, the program offers two options.

Table 11. Program Home Tiers and Rebates

Program Home Tiers	Rebate Amount
Tier I – High Performance Home: required to meet the ENERGY STAR version 2.5 guidelines	$500
Tier II – ENERGY STAR Home: required to meet the current ENERGY STAR guidelines, version 3.0 guidelines	$800

Progress Toward Goals

Ameren has portfolio-wide 2015 regulatory goals for energy savings. Although meeting interim targets on an annual basis and at the program level are not required, for planning purposes, it is important to examine programmatic achievements against stated goals.

Ameren's integrated resource plan (IRP) informs the program's three-year energy-savings goals, which are contained in the Ameren tariff. Program staff reported that annual goal-setting is a bottom-up process: ICF 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 experienced a lack of participation during PY13. Initially, builders withdrew several homes from the program due to the ENERGY STAR v3.0 thermal enclosure inspection checklist requirement. In summer of 2013, the program adopted a course correction plan that replaced this program requirement with the ENERGY STAR v.2.0 thermal bypass inspection checklist. This action convinced participant drop-outs to re-enroll their homes in the program. Despite the course correction plan, however, the program was still unable to attract a sufficient number of builders to meet the expected participation and savings goals for the program's first year.

One outreach technique used by ICF involved conducting program training events. While these events were received well by the attendees, participation was initially low; also, the events did not occur on a regular schedule or with much frequency.

Ameren described progress toward its impact goals as very slow with regard to the number of houses in the program; however, Ameren also reported a higher-than-expected *ex ante* savings per home due to the type of equipment installed by builders.

With regard to non-impact goals, the Cadmus team had difficulty assessing such factors as builder satisfaction because the low participation resulted in a small pool of builders.

While Ameren has enjoyed working with ICF to date, during the Cadmus team's interviews in July 2013, Ameren's program managers discussed the need for a dedicated local ICF program manager to actively recruit builders. In response to this need, ICF filled this position, relieving ICF's program senior manager from recruitment work. (The senior manager had been operating the program remotely, using local resources to facilitate program operations.) Ameren believe that a local presence will allow for better networking with stakeholders in the new-construction community, such as builders, realtors, and lenders.

ICF expressed surprise at the lack of response to the program in the St. Louis metropolitan area; however, over the course of the program year, ICF learned of these factors that affected participation:

- The local new-construction market is fragmented.
- Regional macroeconomic factors have made builders concerned about their margins.
- Energy efficiency in new construction is not a priority for many Missouri builders.

To address these issues and to boost participation, Ameren and ICF intend to introduce a redesigned version of the program in the spring of PY14. The redesigned program will replace the current tiered offerings with a performance-based design that is more flexible for builders and has performed well in other regions of the country.

Communication and Program Processes

Both ICF and Ameren characterized their program communication as "very good." They have weekly telephone calls and conduct other communications through e-mail. In-person meetings occurred approximately monthly when ICF's senior manager was visiting from Dallas; however, in-person communication is expected to occur on a more regular basis in PY14 with the addition of the local program manager. The ICF senior program manager will continue to be involved in the program as a subject matter expert, but will reduce his overall involvement in the program. HERS raters and builders are primarily contacted by ICF via e-mail.

Program Implementation Challenges and Solutions

In interviews with the Cadmus team, Ameren and ICF program managers identified several challenges in PY13 that negatively affected program participation and savings.

- **Builder enrollment.** Both Ameren and ICF said the low program enrollment was a major problem.
  - Ameren stated that there was a lack of recruitment ownership by ICF and that even with the addition of a local program manager, the ConstructionSavers program was not receiving sufficient attention as ICF staff focused more on the needs of the ICF-led CoolSavers program.
  - ICF believed that the low program participation was result of macroeconomic effects, citing builders' concerns over the risk of increasing their construction expenses with no guaranteed return as a barrier to enrollment. Moreover, the residential new construction market in Ameren's territory does not have a history of embracing energy-efficient or ENERGY STAR practices, so builders must be convinced to make this shift.
- **Energy-efficient home building.** ICF noted there are only approximately 4,000 ENERGY STAR homes currently in Missouri. (In contrast, there are approximately 400,000 ENERGY STAR homes in Texas.) This suggests that Missouri builders lack both knowledge and experience about highly efficient and/or ENERGY STAR homes.
- **Program design.** Realizing that using the Tier I/Tier II approach to home building is likely too aggressive for the local builders, Ameren believes an initial program design with easier efficiency targets would have been more appropriate and would likely have yielded significant energy savings, due to the modest energy code requirements in the region.

  ICF learned that the Tier I and Tier II requirements (specifically the thermal enclosure requirements) have been a major issue, causing multiple builders to withdraw from the program. At the time of the July interviews, ICF was implementing a course correction plan that

reduced the thermal enclosure requirement to address this issue. However, ICF said that to attract a more builders, the program needs to have a performance-based design. This redesign began in early fall of PY13, but will not be completed until the spring of PY14. ICF also said that miscommunication prevented the redesign from being ready for implementation at the beginning of PY14.

- **Builder buy-in.** Program managers from Ameren and ICF stated the greatest challenge facing the program is convincing builders to buy into the value proposition of the program—that up-front investments will yield greater returns for their business. Ameren believes a local program manager will be a significant help to overcome this challenge and ultimately meet the program goals. ICF believes that redesigning the program to a performance-based model will give builders the flexibility they require and will increased number of builders enrolled in ConstructionSavers.

Delivery Successes and Program Achievements

When the Cadmus team asked about aspects of the program that were working particularly well, the Ameren and ICF program managers mentioned the program operations and trainings most often. Both Ameren and ICF were pleased with the development and performance of the program infrastructure, such as the intake tool that allows builders to upload pertinent project documents.

Additionally, program managers said the content provided during program builder training events had considerable impact. The training sessions provided new information on the value of energy-efficient building practices to builders, realtors, and lenders who do not have experience with energy-efficient homes.

While the trainings initially had low attendance, as the program year progressed, this was remedied with better promotion and better tailoring of the subject matter to the various audiences.

Marketing and Outreach

The Cadmus team conducted a marketing materials review, a program marketing interview with key Ameren staff, and a follow-up interview with ICF marketing staff, in support of the PY13 ConstructionSavers process evaluation. Additionally, we conducted an assessment on homebuyer attitudes toward ENERGY STAR homes.

Program Marketing Goals and Primary Channels

The ConstructionSavers marketing primarily targets builders; however, HERS raters are also a target audience, as each program home requires modeling from a HERS rater.

To capitalize on the ENERGY STAR brand, ICF sourced much of the marketing material from ENERGY STAR (including brochures, videos, yard signs, and flags). Program managers said that builders understand the value of this marketing tactic and react positively to the brand; however, Ameren was unsure how well builders were making use of ENERGY STAR in their interactions with customers.

Moreover, Ameren believes that ICF should dedicate more resources to management of its relationship with the builder community.

In addition to ENERGY STAR marketing, ICF worked to generate word-of-mouth by sponsoring an energy-efficient housing contest, attending and presenting at trade shows and building expos, and networking with the realtor community. This overall marketing approach is fairly similar to that of other ENERGY STAR new-home programs that ICF implements throughout the country. ICF noted that, in general, marketing budgets for these types of programs have fallen significantly over the past 10 to 15 years.

ICF reached out to other organizations to support program marketing. For example, it hosted events to train realtors to communicate the value of high-efficiency and/or ENERGY STAR homes. To learn more about current building conditions and to receive builder contact information, ICF also connected with various Home Builder Association (HBA) chapters across the state. However, the HBAs have been not been particularly proactive in encouraging members to consider high-efficiency and/or ENERGY STAR homes. ICF said the program lacks a strong presence on the Act On Energy website, so promoting ConstructionSavers there would be beneficial.

Marketing Materials

The Cadmus team worked with Ameren to collect copies of the program's marketing materials, planning or strategy documents (such as marketing plans and recaps), and marketing metrics tracking reports. We also reviewed these program marketing resources from ICF:

- 2012–2013 Ameren Missouri ConstructionSavers Program Marketing Plan (dated 12/31/12)
- 2013 Marketing materials:
  - Homebuilder Overview Sheet
  - Customer Overview Sheet

Figure 3.Sample Marketing Materials

Marketing Design and Execution

Ameren provides program implementers with Act On Energy brand guidelines and marketing templates to ensure that a consistent brand and message are delivered across all programs and advertisements. ICF greatly appreciated these resources and described them as extremely thorough. ICF also noted that Ameren has expended great effort in preparing the resources, and that the guidelines and templates provide a strong foundation, allowing implementers to focus on execution.

Over the past year, ICF has developed and implemented the following strategies and tactics:

- **2012**: ICF prepared these materials for the program's launch: website content, incentive applications, program overview guides, and coordination of program meeting announcements (via e-mails, flyers, and other methods).
- **2013**: Outreach during the program launch and through PY13 focused on engaging and recruiting homebuilders, using techniques such as e-mail blasts (Constant Contact), follow-up phone calls/meetings, event participation, and trade ally association outreach (e.g., housing building authorities). According to program managers, the first quarter focused on recruiting builders into the program, so consumer marketing did not launch until late spring, after development of the builder base. Program managers believe it will be beneficial to start earlier in 2014, now that the foundation has been established.

ICF also said the program's marketing will focus on the following during PY14: creating partnerships with organizations (such as the EarthWays Center); attending events and trade shows; and engaging with realtors to increase word-of-mouth promotion. ICF also plans to increase efforts to conduct outreach through collaborations with homebuilder associations.

In 2014, a slight shift in the program design will occur, with the program changing to a performance-based model (that is, any work a builder does at a more energy-efficient level than a predetermined baseline will earn rebate dollars). Program managers indicated this would not greatly affect marketing, as ENERGY STAR remains an option.

In terms of market transformation, the program managers also discussed the importance of identifying builders who wish to separate themselves as leaders in energy-efficient home building. Such builders will likely participate in the program because they understand the benefits of high-performance homes and how these homes will set them apart from competitors.

In response, Ameren recently suggested that ICF partner with the EarthWays Center to leverage contacts, partners, and relationships with member homebuilders. Through this partnership, program marketing can be delivered to the targeted audience through channels such as EarthWays' Facebook page, Twitter, and newsletters.

Marketing Plan

The Cadmus team reviewed the original PY13 ConstructionSavers marketing plan and two creative samples. Overall, the pieces presented a consistent look and feel. They prominently and appropriately

displayed both the Ameren and program logos, and they closely following the Act On Energy brand guidelines for fonts, colors, and layout. However, the pieces do not include the ENERGY STAR logo.

Both pieces used a mix of calls-to-action: the program's phone number, website, and e-mail address to "get started" or "apply today" (based on the audience). Also, both pieces utilized appropriate, engaging imagery and described the program details and benefits in a manner designed to connect the target audience with the program offerings.

Figure 4. Sample Marketing Materials

ENERGY STAR Homeowners

The Cadmus team intended to survey new ENERGY STAR homeowners to obtain information regarding their motives for purchasing a high-efficiency home and the value homeowners see in these homes. However, we were unable to solicit homeowner contact information from any of the ConstructionSavers builders, so we could not administer our survey.

While there was limited participation in ENERGY STAR homes in the program (only 13 Tier II ENERGY STAR homes were completed in PY13), we believe that having the perspective of the homeowner would be useful to the process evaluation results. To present this perspective, we used secondary data from a report[7] published by the Northwest Energy Efficiency Alliance (NEEA) entitled "Understanding the Importance of Energy Efficiency in the Home Purchase Process."

According to the NEEA report, only 5% of the people surveyed considered the energy efficiency of a new home to be the most important feature in the purchase of their next home. In contrast, among potential homebuyers who already owned ENERGY STAR homes, 12% believed that a home's energy efficiency was the most important feature.

[7] Northwest Energy Efficiency Alliance, "Understanding the Importance of Energy Efficiency in the Home Purchase Process," November 25, 2013.

According to NEEA, slightly more than 35% of homebuyers are seeking certified green or energy-efficient homes, indicating there is room for growth in this market. Moreover, four out of 10 homeowners surveyed by NEEA did not realize their home was ENERGY STAR certified. This demonstrates that additional advertising or outreach could positively affect the market for certified green or energy efficient homes.

According to NEEA, ENERGY STAR homeowners specified the following as the top reasons to purchase a certified energy-efficient home:

- "To have a home with lower home operating costs" (25%),
- "To save money" (17%)
- "To protect our environment and save natural resources" (11%).

The least important reasons cited by the homeowners were: "To reduce greenhouse gas emissions and curb climate change" (4%); "to have a healthier home" (4%); and "to have a home with higher resale value" (3%).

While this study was conducted in the Northwest region, we believe the results of the study may be applicable to the ConstructionSavers program, because they provide the perspectives of the homebuyer with regard to purchasing an energy-efficient or ENERGY STAR home.

Builder Feedback

The Cadmus team asked the sample of 10 participant builders multiple questions regarding their experience with the program, with Ameren as their utility, and with the Act On Energy brand.

Outreach, Marketing, and Training

We asked builders about program awareness, the marketing support offered through the program, and the trainings sessions. With regard to program awareness, 50% of builders learned of the program through HERS raters. The remaining builders learned about the program through word-of-mouth (including Home Builder Association, Ameren personnel, or a colleague), and one builder discovered the program via online research.

When we asked builders about their marketing techniques and how, if at all, they had leveraged the program's marketing services, the results were mixed. Half of the builders said they did not engage in any form of marketing or advertising; instead, they relied on word-of-mouth. The remaining builders reported placing newspaper or magazine advertisements, online advertising, and open houses. None of the builders used any program services to market their homes.

With regard to the trainings offered by the program, 60% of surveyed builders reported attending at least one training session. The builders who did not attend said that the trainings were offered at inconvenient times or that the training would not be helpful.

Act On Energy Awareness

We asked builders about their awareness of the Act On Energy brand and the program name ConstructionSavers.

- Although 70% of builders indicated they had heard of the Act On Energy name, only 50% of builders reported being somewhat or very familiar with the brand.
- When we asked builders what they associate with the name ConstructionSavers, most builders said they associated it with rebate programs and incentivizing energy efficiency in new homes. As a follow up question, we asked what the name "ConstructionSavers," meant to them, and most builders said that it meant saving costs on construction.

Builder Satisfaction

We asked participating builders a battery of questions regarding their experience with program. Overall satisfaction was high.

- 40% of builders said they were *very satisfied* with the program.
- 60% said they were *somewhat satisfied*.

One builder reported having trouble enrolling his homes through the program online portal until the senior program manager assisted him in person.

Overall, builders gave high satisfaction ratings to the program website, the program staff, and the HERS raters. Moreover, all of the surveyed builders indicated they would re-enroll in the program in PY14.

With regard to satisfaction with Ameren, 60% of builders said they were *very satisfied* and 40% said they were *somewhat satisfied*. When we asked whether the builder's opinion of Ameren had changed since participating in the ConstructionSavers program, 90% responded that their opinion had improved.

Program Value

We asked builders what they felt was the primary value of the program for builders. Only 30% of respondents mentioned the rebate incentive, while 70% mentioned the education about high-efficiency building practices. Builders saw value in both learning new building practices and promoting these practices in the new-construction market in Missouri. With regard to homebuyers, all builders agreed the primary value of the program was providing a home that would have reduced energy costs.

Suggestions to Improve the Program

The Cadmus team received few suggestions for improving the ConstructionSavers program.

- 20% mentioned increasing the incentive levels for the program.
- 20% suggested allowing multi-family buildings participate in the program.
- 60% had no suggestions and felt that the program operated well.

CSR Summary

According to the Missouri Code of State Regulations (CSR),[8] 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 the process evaluation findings touch 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 high efficient new construction homes. Additionally, there is lack of marketing infrastructure to expose the target market segment to these benefits.
2	Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The current target segment market would benefit from additional stratification. However, it may be difficult to successfully define and segment additional strata to builder types such as high efficient/green builders.
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?	No. The program should include additional end-use technologies including appliances.
4	Are the communication channels and delivery mechanisms appropriate for the target market segment?	Yes, current communication 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 networking with the target market segment to spread program awareness is needed.

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

GROSS IMPACT EVALUATION RESULTS

This section details how the Cadmus team calculated gross savings and determined realization rates for participating Tier I and Tier II homes.

TRM Review Findings

ICF used the Ameren TRM measure-level savings to calculate program *ex ante* savings (whole house savings are not provided in the TRM). The Cadmus team found this approach overestimated savings relative to the evaluated *ex post* savings. We found the greatest impact was lighting which accounted for 56% of *ex ante* savings and was three times greater than evaluated *ex post* lighting savings. Additionally, we found *ex ante* HVAC and shell measure savings, which accounted for 42% of *ex ante* savings, to be one and a half times greater than evaluated *ex post* savings. These discrepancies are largely reflective of TRM assumptions. We explain potential causes of these discrepancies in Table 13.

Table 13. *Ex Ante/Ex Post* Savings Discrepancy Rationale

End Use Energy Savings Category	*Ex Ante/Ex Post* Savings Discrepancy Rationale
Lighting	The TRM savings assume a baseline scenario in which a CFL bulb replaces an equivalent wattage incandescent bulb. However, field data and program REM/Rate models collected by the Cadmus team demonstrated that approximately 35% of lighting in baseline nonparticipant homes are CFL or high efficient lighting and 8% of lighting in program homes is *not* high efficient.
	Ex ante savings were derived from just one bulb type (13W CFL), therefore assuming no variation in bulbs for each home in the program. This assumes that only one bulb type was used throughout the home.
HVAC/Shell	The TRM baseline conditions are not well documented for these measures (e.g., the TRM does not stipulate insulation R-values, HVAC efficiencies, etc.). Moreover, the TRM does not provide specific new construction savings for measures such as central air conditioners, duct sealing, air sealing, and air source heat pumps. Therefore, the Cadmus team was unable to assess how the TRM savings assumptions varied from program REM/Rate models and field data.
	Windows accounted for 13% of *ex ante* program savings. Ameren provided details regarding the TRM's window baseline assumptions. We found that *ex ante* window savings were based on a mix of home vintages (new construction only accounting for 10.4% of the vintage mix), various HVAC systems (20% of homes assumed to have electric furnaces whereas 0% of program homes have electric furnaces), and an assumed installation rate of 350 square feet of windows per home (actual average installed window quantity was 171 square feet per program home). Based on program REM/Rate models, we found these baseline parameters to not be representative of program homes and overestimated savings by 277%.
	It is unclear if the TRM savings for HVAC and shell measures account for interactive effects. Because ConstructionSavers is a whole house performance program, individual measure savings may be overestimated if they do not account for other high efficient measures installed in the home (e.g., energy savings from a central air conditioner may be less when the unit is installed in a newly constructed home with high insulation R-values and air sealing).
	Ground source heat pump TRM savings are 14,349 kWh/yr; however, the average annual energy consumption of an existing single-family home in Missouri is 12,721 kWh/yr.*

*U.S. Energy Information Administration. *Residential Energy Consumption Survey*. 2012.

Gross Energy Savings

We estimated the program's gross energy savings using the following equation:

$$Energy\ Savings_{gross} = Non\ Participant\ Home_{energy\ consumption} - ConstructionSavers\ Home_{energy\ consumption}$$

We used the program home REM/Rate models to determine annual energy consumption for the sampled homes; however, we modified the model for each home, based on the data collected from nonparticipant building plans, phone surveys, and site visits.

The Nonparticipant Baseline column in Table 14 lists the measure values used to customize each REM/Rate model to nonparticipant baseline standards and, for comparison, the table lists the values for the 2006 and 2009 IECC Climate Zone 4 requirements. The results of our baseline analysis showed that nonparticipant builders build to standards that fall between the 2006 and 2009 IECC requirements. Also, we did not observe significant differences in building methods in different regions within Ameren's territory. This indicates that there is a general market standard building practice, which obviates the need to establish multiple region-specific baselines for this evaluation.

Table 14. Findings for Nonparticipant Baseline Average Building Practices

Measure	Unit	Nonparticipant Baseline[1]	IECC 2006	IECC 2009
Slab foundation insulation	R-value	1.7	10	10
Interior foundation wall insulation	R-value	11.2	13 framed or 10 continuous	13 framed or 10 continuous
Exterior foundation wall insulation	R-value	10.4	n/a	n/a
Rim joist insulation	R-value	16.0	n/a	n/a
Frame floor insulation	R-value	25.8	19	19
Above grade wall insulation	R-value	14.6	13	13
Ceiling/Attic insulation	R-value	34.8	38	38
Duct Insulation	R-value	6.6	6 (floor trusses)	6 (all other)
(unconditioned space)			8 (all others)	8 (in attics)
Window U-factor	U-factor	0.35	0.4	0.35
Window SHGC Value	SHGC value	0.36	n/a	n/a
Forced air furnace efficiency	AFUE	89.4%	78%	78%
Heat pump efficiency	HSPF	7.7	7.7	7.7
A/C efficiency	SEER	13.2	13	13
Air leakage	ACH50	6.41	n/a	7
Duct leakage (total leakage, post-construction test)	cfm/100 ft2	21.2	n/a	12
Percentage of high efficient lighting	%	34.7%	n/a	50%
Percentage of ENERGY STAR Refrigerators	%	29.0%	n/a	n/a

Measure	Unit	Nonparticipant Baseline[1]	IECC 2006	IECC 2009
Percentage of ENERGY STAR Dishwashers	%	34.7%	n/a	n/a
Percentage of ENERGY STAR Washing Machines	%	20.4%	n/a	n/a

[1]Baseline values are a weighted average of collected building plans, builder responses, and site visit data regarding measure values. Data are weighted by the number of homes built in 2012 by the builder.

Summary

The Cadmus team calculated *ex post* gross savings for each home in the sample by Tier level. The summation of the *ex post* as well as the *ex ante* savings are presented in Table 15. We calculated the *ex post* savings at 50.9% of the program's *ex ante* savings for Tier I homes and 67.6% of the program's *ex ante* savings for Tier II homes (Table 15). These low realization rates are largely attributable to overestimated *ex ante* savings based on the Ameren TRM (see TRM Review section above).

Table 15. Gross Savings for Sampled Homes and Program Realization Rates

Tier	Sample Homes	*Ex Ante* Sample Savings (kWh/yr)[1]	*Ex Post* Sample Savings (kWh/yr)	Realization Rate	Precision at 90% Confidence
Tier I – High Performance Home	36	123,817	63,071	50.9%	8.5%[2]
Tier II – ENERGY STAR Home	4	40,733	27,534	67.6%	Census

[1]Sample *ex ante* savings revised based on updated values provided by Ameren Missouri
[2]Confidence calculated using t-score of 1.689; precision adjusted using finite population correction factor.

We used the program realization rates to calculate the gross *ex post* savings for the program at each tier (Table 16).

Table 16. Program Gross Savings

Tier	*Ex Ante* Program Savings (kWh/yr)	Realization Rate	*Ex Post* Program Savings (kWh/yr)
Tier I – High Performance Home	334,829	50.9%	170,490
Tier II – ENERGY STAR Home	99,753	67.6%	67,515
Overall	434,582	54.8%	238,005

NET IMPACT EVALUATION RESULTS

This section details how the Cadmus team calculated the program's free ridership and spillover to estimate program net savings for Tier I and Tier II homes.

Net Energy Savings

We estimated the program's net of free ridership energy savings using the following equation:

$$Energy\ Savings_{net} = Participant\ Non\ program\ Home_{energy\ consumption} - ConstructionSavers\ Home_{energy\ consumption}$$

For each home in the sample, we used the program home REM/Rate models to determine annual energy consumption for each sampled home. Similar to the approach used to calculate gross savings, we customized each program home model to estimate net savings that were based on the data collected from participant builder's non-program home phone surveys and site visits. Net savings inputs are listed in Table 17 under the column entitled Participant Baseline. The table also contains comparison values for the nonparticipant baseline as well as the 2009 and 2012 IECC Climate Zone 4 requirements. We determined that the participants typically built to standards between those of IECC 2009 and IECC 2012 requirements, whereas nonparticipants built to standards between the 2006 and 2009 IECC requirements.

Because we were unable to collect sufficient data for air leakage and duct leakage, we used the average of the IECC 2009 and 2012 requirements as proxies for these measures. In most categories, we found that the participant builders' typical practices exceeded the standards of nonparticipant builders. We also found that nonparticipants slightly outperformed participants in both exterior foundation wall insulation and rim joist insulation standards; however, because of the limited number of responses, especially with regard to exterior wall foundation, these conclusions cannot be made with certainty. Still, the participant builders exceeded nonparticipant standards significantly in several other areas, including the use of ENERGY STAR appliances, lighting, and wall and ceiling insulation.

The Cadmus team calculated a weighted average of the participant builder responses regarding measure values and data collected from site visits, and this average is based on the proportion of homes the builder constructed during the 2012 calendar year.

Table 17.Findings for Participant Baseline Average Building Practices

Measure	Unit	Nonparticipant Baseline[1]	Participant Baseline[1]	IECC 2009	IECC 2012
Slab foundation insulation	R-value	1.7	2.3	10	10
Interior foundation wall insulation	R-value	11.2	13.0	13 framed or 10 continuous	13 framed or 10 continuous
Exterior foundation wall insulation	R-value	10.4	10.1	n/a	n/a
Rim joist insulation	R-value	16.0	14.3	n/a	n/a
Frame floor insulation	R-value	25.8	30.1	19	19
Above grade wall insulation	R-value	14.6	19.6	13	20
Ceiling/Attic insulation	R-value	34.8	41.7	38	49
Duct Insulation (unconditioned space)	R-value	6.6	7.1	6 (all other) 8 (in attics)	6 (all other) 8 (in attics)
Window U-factor	U-factor	0.35	0.32	0.35	0.35
Window SHGC Value	SHGC value	0.36	0.24	n/a	0.40
Forced air furnace efficiency	AFUE	89.4%	92.4%	78%	78%
Heat pump efficiency	HSPF	7.7	8.2	7.7	7.7
A/C efficiency	SEER	13.2	14.1	13	13
Air leakage	ACH50	6.41	5	7	3
Duct leakage (total leakage, post-construction test)	cfm/100 ft2	21.2	8	12	4
Percentage of high efficient lighting	%	34.7%	79.2%	50%	75%
Percentage of ENERGY STAR Refrigerators	%	29.0%	91.0%	n/a	n/a
Percentage of ENERGY STAR Dishwashers	%	34.7%	94.0%	n/a	n/a
Percentage of ENERGY STAR Washing Machines	%	20.4%	12.0%	n/a	n/a

[1]Baseline values are a weighted average of collected builder responses and site visit data regarding measure values. Data are weighted by the number of homes built in 2012 by the builder.

Free Ridership

We calculated free ridership using the following formula:

$$FR = 1 - \frac{Net\ Savings_{without\ SO}}{Gross\ Savings}$$

That is, free ridership represents the portion of gross savings that participant builders achieve in their non-program homes (see Figure 2 in the Net Savings Methodology section). Our calculations for the free ridership rate was 77.6% for Tier I homes and 60.0% for Tier II homes.

Spillover

The ConstructionSavers program did not rebate ENERGY STAR appliances. Therefore, the Cadmus team recorded as spillover any savings resulting from participants installing ENERGY STAR appliances in program homes. To quantify this spillover, we used ENERGY STAR calculators to derive energy savings resulting from upgrading from a non-ENERGY STAR appliance to an ENERGY STAR appliance, and we applied this to the refrigerators, clothes washers, and dishwashers we observed in program homes. We then discounted the savings on a per-builder basis, using the survey responses regarding the installation rate of these ENERGY STAR appliances in non-program homes. Thus, the spillover savings for appliances represented only an incremental increase in terms of ENERGY STAR appliances installed in ConstructionSavers homes.

Our analysis of builder survey responses regarding ENERGY STAR appliances showed that neither clothes washers nor dishwashers were installed at a greater rate in ConstructionSavers homes than participant builders' non-program homes. Thus, there were no spillover savings for either of these measures. However, Tier II builders reported a higher installation rate of ENERGY STAR refrigerators in their program homes relative to their non-program homes. (We did not observe an increased rate of ENERGY STAR refrigerators installed in Tier I builders.) Total spillover savings for Tier II homes based on the incremental increase of installed ENERGY STAR refrigerators was 874.2 kWh/year. Using this value, we calculated the Tier II spillover rate as 3.2%, based on Tier II gross savings.

As a second source of spillover, the Cadmus team considered the survey responses from participant builders regarding the level of influence the program had on their typical building practices. When builders said they had learned of (or were exposed to) new building practices that would increase the energy efficiency of the home *and* said they intended to adopt this new practice, we designated this as spillover. However, at the time of this evaluation, there were no new non-program homes at which we could confirm that the builder was using the new building practices from. In PY14, we will follow up with the builders who said they would adopt new practices to determine whether these new practices were followed in non-program homes.

NTG

We calculated the program's NTG ratio after we completed our final gross savings and net savings analyses. To calculate free ridership and spillover rates, we used the following formulas:

$$FR = 1 - \frac{Net\ Savings_{without\ SO}}{Gross\ Savings}$$

$$SO = \frac{Spillover\ Savings}{Gross\ Savings}$$

We calculated the program's final NTG ratio using this formula:

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

We did not assess market effects for ConstructionSavers in PY13 as the program's design was unlikely to generate significant market effects at this time. Future evaluation may include estimates of market effects. Nonparticipant spillover is not applicable to ConstructionSavers.

Our final NTG ratios for Tier I homes was 22.4% and for Tier II homes was 43.2%, (Table 18).

Table 18. Program Free Ridership, Spillover, and NTG results

Tier	Free Ridership	Spillover	Market Effects[1]	NTG	Precision at 90% Confidence
Tier I – High Performance Home	77.6%	0.0%	N/A	22.4%	8.5%[2]
Tier II – ENERGY STAR Home	60.0%	3.2%	N/A	43.2%	Census
Overall	72.1%	0.4%	N/A	28.3%	7.7%[2]

[1]Market effects were not quantified for the ConstructionSavers evaluation.
[2]Confidence calculated using t-score of 1.689; precision adjusted using finite population correction factor.

Summary

The Cadmus team applied the NTG ratios for each tier (Table 18) to the total population's *ex post* gross kWh savings Based on the final NTG ratios; we calculated the program net savings for each tier (Table 19).

Table 19. Program Net Savings

Tier	*Ex Post* Gross Program Savings (kWh/yr)	NTG	*Ex Post* Net Program Savings (kWh/yr)
Tier I – High Performance Home	170,490	22.4%	38,187
Tier II – ENERGY STAR Home	67,515	43.2%	29,163
Overall	238,005	28.3%	67,350

BENCHMARKING

The Cadmus team researched programs similar to ConstructionSavers that were offered by other utilities. Table 20 lists the participation levels (homes constructed), gross and net savings, and results for Total Resource Cost-Effectiveness of those utilities and Ameren. These data show that there is often low participation in the first year of a new-construction program. (For example, only two the five listed utilities completed more than 100 homes in its first year.) Also, participation growth across this sample of new-construction programs trends exponentially, with the number of homes constructed reaching into the thousands by a program's fourth year. This trend may indicate that new construction programs require additional time before establishing credibility with the builder community.

Net savings are also generally low for first-year programs. ConstructionSavers did perform below average with regard to its first-year program net savings (67.4 MWh/yr compared to group average of 83.1 MWh/yr). However, ConstructionSavers did record the lowest NTG value among all programs presented in Table 20.

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Table 20. ConstructionSavers Benchmarking Results

State or Utility	Program Launch Year/ Program Year	Homes Constructed	Range of Program Rebates	*Ex Post* Savings (MWh/yr)	NTG	Net Savings (MWh/yr)	TRC
Ameren Missouri	2013/2013	101	$500 - $800	238.0	0.28	67.4	0.27
DNREC[1]	2011/2011	201	$3,000 - $6,000	41.4	0.56	23.2	N/A
Georgia Power Company[2]	2009/2011	736	$150 - $300	968.6	1.04	1007.3	2.47
Rocky Mountain Power[3]	2005/2009	2093	$200 - $2,000	2,521.3	0.80	2,766.4	1.89
Salt River Project[4]	2005/2009	3,248	$450 - $1,150	5,706.0	0.52	2,967.0	1.06
Ontario Power Authority	2006/2007	265	N/A	4,782.0	0.76	3,602.0	N/A
South Utility 1[5]	2012/2012	44	N/A	93.7	0.84	78.7	N/A
South Utility 2[5]	2009/2009	84	N/A	163.0	N/A	163.0	N/A
Midwest Utility[5]	Unknown/ 2012	15	N/A	32.6	0.84	27.4	0.21
West Utility[5]	Unknown/ 2011	2,396	N/A	3,942.0	0.65	2,979.0	1.60

[1]Delaware Department of Natural Resources and Environmental Control. "SEU and State Energy Efficiency Program EM&V Report", Opinion Dynamics Corporation, July 2012.
[2]Impact Evaluation of Georgia Power Company's 2011 DSM Programs. Nexant, Inc. December 21, 2012.
[3]PacificCorp. "Rocky Mountain Power ENERGY STAR New Homes Impact Evaluation for 2009-2010", The Cadmus Group, Inc., April 27, 2012.
[4]Salt River Project. "SRP FY2010 Energy Efficiency Evaluation," The Cadmus Group, Inc., August 2010.
[5]Report is not publicly available.

COST-EFFECTIVENESS RESULTS

To analyze the cost-effectiveness of the PY13 ConstructionSavers program, MMP utilized DSMore. MMP assessed cost-effectiveness using the following five tests as defined by the California Standard Practice Manual:[9]

- 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 ConstructionSavers, 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 ConstructionSavers participation counts, per-unit gross savings and NTG), consistency is assured. In particular the assumptions in the model are driven by measure load shapes, which tells the model when to apply the savings during the day. This assures that the load shape 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

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

the program level, not the measure level. While applying incentives at the measure level is useful for planning purposes, it is unnecessary for the cost effectiveness modeling as the results are based on the program overall. 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 21 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 ConstructionSavers program did not pass any of the test, had a CCE is $0.437 per kWh, and negative net lifetime benefits.

Table 21. Cost-Effectiveness Results (PY13)

	TRC	UCT	RIM	PART	Societal	CCE - $/kWh	Net Lifetime Benefits
ConstructionSavers	0.18	0.18	0.16	1.62	0.22	$0.437	-$333,638

APPENDIX A. PROGRAM MANAGER INTERVIEW GUIDE

Respondent name:_____

Respondent phone: _____

Interview date: _____ Interviewer initials: _____

A. Introduction

1) What are your main responsibilities for Ameren Missouri's Construction Savers Program?
2) What percent of your time is dedicated to ConstructionSavers?
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 ICF and Ameren conducted?
5) How does ICF communicate with home builders and HERS raters?
6) Can you provide a summary of how the program is intended to perform?
7) [Question for ICF only] Can you describe how the program's tracking database is populated and what level of detail is collected?
8) [Question for ICF only] How do you feel the tracking database has performed to date? Do you anticipate any updates or changes to the database?
9) How did Ameren determine the incentive levels for each program Tier?
10) What would you say is working particularly well so far in PY5? Why is that?
11) Conversely, what is not working as well as anticipated? Why is that?
12) Have there been any lessons learned from the PY5 launch?

13) What have been the most influential program or market factors to date to attract program participation?

14) Have you observed any program or market factors that have acted as a barrier to participation?

C. Program Goals

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

16) How are these goals determined?

17) Does the program have any process or non-impact goals for PY5? (**Probe:** type of builder recruited, educational campaign for builders, trade allies, and home buyers, increased awareness in ENERGY STAR brand, etc.)?

18) How are 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. Marketing Efforts

23) Can you please describe your marketing strategy for ConstructionSavers? Do you plan to change marketing tactics for each program year as the program becomes increasingly established?

24) Is the program conducting any joint marketing efforts with retailers, trade organizations, etc.? If yes, please describe.

25) How do you plan to increase participation by qualified home builders? How much do you expect participation to increase?

26) [Question for ICF only] How do the marketing efforts used for ConstructionSavers differ from other ENERGY STAR New Home programs ICF has implemented elsewhere?

E. Participants

27) Can you please describe your targeted builder profile for the program? (e.g., 'green' builders, custom or track builders, large (100+ homes per year) or small builders, etc.)

28) What type of builders have been the first to engage with the program? (e.g., 'green' builders, custom or track builders, large (100+ homes per year) or small builders, etc.)

29) Are builders revealing a preference for either Tier 1 or Tier 2 homes? If so, why?

30) What type of feedback have you received to date from builders on the program? (Probe: satisfaction, meeting program requirements and schedule, application/rebate process, etc.)

F. Summary

31) From your perspective, what are the largest challenges facing the program moving forward?

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

33) 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?

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

APPENDIX B. PARTICIPANT BUILDER SURVEY INSTRUMENT

Builder Survey – ConstructionSavers

Hello, I'm [INSERT NAME], and I'm calling 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]

[Participant - 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 participation in Ameren Missouri's ConstructionSavers program where you built an energy efficient home and received a rebate. All your answers are confidential.

[INTERVIEWER: When interviewing Participant Builders, please ask respondent not to include/consider ConstructionSavers homes

Program Awareness

1. **Have you ever seen or heard the term 'Act on Energy'? [if 'don't know' or 'refused', skip to Q4]**

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

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

   1. Not at all familiar
   2. Not too familiar
   3. Somewhat familiar
   4. Very familiar
   5. DON'T KNOW **[DO NOT READ]**

3. **How did you first learn about Ameren's ConstructionSavers program?**

   a) Radio
   b) Online research
   c) Ameren website
   d) Colleague/Coworker/another Builder
   e) Direct contact by Ameren representative
   f) Other. Please specify: ____
   g) Not sure

4. **How familiar are you with the term ConstructionSavers? [if 'don't know' or 'refused', skip to Q7]**

   a) Not at all familiar
   b) Not too familiar

c) Somewhat familiar
d) Very familiar
e) DON'T KNOW **[DO NOT READ]**

5. **What do you associate with ConstructionSavers? [open-ended]**

6. **What does the term ConstructionSavers mean to you? [open-ended]**

7. **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)
   f) (Refused)

Profile Questions

8. **How many homes did you build in Missouri in 2012?**

9. **Do you expect a similar number of homes to be built in 2013?**

   a) Yes _____
   b) No _____ [describe magnitude/direction of change and reason for change]

10. **What percentage of these homes in Missouri was single-family and what percentage was multi-family?[Multi-family does NOT include side-by-side townhomes, duplexes, triplexes, or quadplexes; these building types are all eligible (any other MF are ineligible). If builder has not built any program-eligible homes, skip to Q69 for participant builders.]**

    a) Single Family: _____
    b) Multi-family: _____

11. **What percentage of homes that you built in 2012 were[read all]**:
    a) Energy Star
    b) "green" or high efficiency home, **[please describe]**
    c) LEED or NGBS certified

12. **What percentage of homes that you built in 2012 were:**
    a) Model
    b) Spec
    c) Custom

13. **What percentage of the homes do you design…**

    a) Using the prescriptive compliance approach?: _____%
    b) Using the performance compliance approach?: _____%

c) Don't know

14. What proportion of your homes is built in the following areas of Missouri? [Total should add to 100%. Read all options]

a) St. Louis Metro (Eastern-Central Missouri) : _____%
b) Cape Girardeau(Southeast) : _____%
c) Jefferson City (Central): _____% **[Interviewer: Inform builder not to include Columbia, MO in response]**
d) Moberly/Kirkville (Northeast) : _____%
e) Excelsior Springs (Northwest): _____% **[Interviewer: Inform builder not to include Kansas City, MO in response]**
f) Other: _____% [describe by county/jurisdiction]

*Thank you. For the remainder of my questions, please only consider single-family homes including townhomes, duplexes, triplexes, and quadplexes built in these specific regions and that are NOT part of Ameren's ConstructionSavers Program. We'd like to understand your **standard** building practices when you are not participating in Ameren's ConstructionSavers Program.*

Impact

HVAC & Appliance Questions

15. In what proportion of your homes do you typically install the following heating systems?

a) Furnace: _____%
b) Boiler: _____%
c) Air Source Heat Pump: _____%
d) Electric Resistance: _____%
e) Other [describe]: _____%

16. What is the typical efficiency of the heating equipment?[PROVIDE RESPONSE FOR EVERY SYSTEM IN Q15≠ 0%]

a) Furnace: _____ AFUE
b) Boiler: _____ AFUE
c) Air Source Heat Pump: _____ HSPF
d) Other [describe]: _____

17. Whatproportion of your homes typically include the following cooling systems?

a) Central A/C: _____%
b) Window A/C: _____%
c) Air Source Heat Pump: _____%
d) Evaporative (swamp) cooler: _____%
e) Other (Specify): _____%
f) None: _____%

18. **[If Q17 ≠ None 100%] What is the typical SEER value for the cooling systems you install? [PROVIDE RESPONSE FOR EVERY SYSTEM IN Q17≠ 0%]**

    a) Central A/C: _____
    b) Window A/C: _____
    c) Air Source Heat Pump: _____
    d) Other (Specify): _____

19. **In about what percentage of homes do you locate the central HVAC system in…**

    a) Conditioned space _____%
    b) Garage _____%
    c) Attic _____%
    d) Unconditioned space _____%
    e) Other _____%

20. **Approximately what percentage of your homes have the duct system located in unconditioned space? [RECORD %]**

21. **For your homes that have ducts located in unconditioned space, what percent of the ducts are located in unconditioned space: [RECORD %]**
    a) Less than 25%
    b) 25-49%
    c) 50-75%
    d) Greater than 75%

22. **Do you insulate ducts located in unconditioned space?**
    a) Yes
    b) No
    c) Sometimes
        22.c.1. Less than 25%
        22.c.2. 25-49%
        22.c.3. 50-75%
        22.c.4. Greater than 75%
    d) Don't Know

23. **[If 22=yes or sometimes] What is the approximate R-value used to insulate the ducts?**
    a) Less than R-4
    b) R-4 to R-5.9
    c) R-6 to R-8
    d) Greater than R-8

24. **In about what percentage of homes do you install programmable thermostats?**

    Record Response:_____%

25. **What proportion of the water heaters you install are conventional (storage tank), tankless, or a sidearm system?**

a) Conventional (storage tank): _____%
b) Tankless:_____%
c) Sidearm:_____%

26. What is the typical Energy Factor (EF) of the water heaters installed?

Record Response: _____

27. Where is the hot water system located?

a) Conditioned space
b) Garage
c) Attic
d) Unconditioned space

28. [If 25 = storage] Do you wrap storage tank-type water heaters with an insulating blanket?

a) Yes
b) No
c) Sometimes
   28.c.1. Less than 25%
   28.c.2. 25-49%
   28.c.3. 50-75%
   28.c.4. Greater than 75%
d) Don't Know

29. [If 28 = Yes] What is the R-value of the insulating blanket?

a) Less than R-3.5
b) R-3.5 to R-6.7
c) R-6.8 to R-10
d) Greater than R-10
e) Yes
f) No
g) Sometimes
   29.g.1. Can you estimate about how often you insulate the ducts?
h) Don't Know

30. I am going to list different home appliances, for each one, please tell me what percentage of homes you typically build in Missouri having ENERGY STAR versions of that appliance:

a) Refrigerator/Freezer: _____%
b) Dishwasher: _____%
c) Clothes Washer: _____%
d) Ceiling Fan: _____%
e) Water Heater: _____%
f) Heating/Cooling equipment: _____%

31. What is the typical glazing U-factor ofwindows installed in your homes? _____

32. **What is the typical solar heat gain coefficient (SHGC) value of**Windows installed in your homes?

_____

33. **What percentage of light fixturesin your homes is typically installed with high efficiency bulbs (CFL, LED, etc.)?**

a) Less than 25%
b) 25-49%
c) 50-75%
d) Greater than 75%

Insulation

The following section questions will focus on insulation levels across different areas of the home. Again, please think only of single family homes in Missouri areas that you build outside of the Ameren ConstructionSavers program.

34. **What percentage of your homes has slab-on-grade foundations?**

Record Response: _____%

35. **[If 34 ≠ 0] What is the typical insulation R-value on the slab edge?**

a) Record Response: _____
b) Don't Know

36. **[If 35=Don't Know] What material do you typically use to insulate the slab edge?**

Record Response: _____

37. **[If 35=Don't Know] How many inches of insulation do you typically install to insulate the slab edge?**

Record Response: _____

38. **In what percentage of your homes do you typically include a basement (finished or unfinished)?**

Record Response: _____%

39. **What percentage of your homeshas exterior insulation on the foundation wall?**

Record Response: _____%

40. **[If 39 ≠ 0] What is the typical R-value of insulation on the exterior foundation wall?**

a) Record Response: _____
b) Don't Know

41. **[If 40 = Don't Know] What material do you typically use to insulate the exterior basement wall?**

    Record Response: _____

42. **[If 40 = Don't Know]What is the thickness of the exterior foundation wall insulation you typically install to insulate the exterior basement wall?**

    Record Response: _____

43. **[If 39 ≠ 0] Does the exterior insulation typically cover the entire height of the foundation wall?**

    a) Yes
    b) No

44. **[If 43 = No] What is the depth (feet) of the exterior basement insulation?**

    Record Response: _____ feet

45. **What percentage of your homes has crawl spaces?**

    Record Response: _____%

46. **[If 45 ≠ 0]In those homes with crawl spaces, what is the typical insulation R-value used to insulate either the exterior or interior crawl spacewall?**

    a) Record Response: _____
    b) Don't Know

47. **[If 46 = Don't Know] What material do you typically use to insulate either the exterior or interior crawlspace walls?**

    Record Response: _____

48. **[If 46 = Don't Know]What is the thickness of the insulation you typically install in crawl space walls?**

    Record Response: _____

49. **What is the typical R-value of floor insulation above unconditioned spaces (cantilevers, garages, unconditioned basements, etc.) in your homes?**

    a) Record Response:_____
    b) Don't Know

50. **[If 49 = Don't Know] What material do you typically use to insulate the floors?**

Record Response:_____

51. **[If 49 = Don't Know] How many inches of insulation do you typically install in the floor above unconditioned space?**

    Record Response:_____

52. **What is the typical R-value of the rim joist insulation in your homes?**

    a) Record Response:_____
    b) Don't Know

53. **[If 52 = Don't Know] What material do you typically use to insulate the rim joist?**

    Record Response:_____

54. **[If 52 = Don't Know] How many inches of insulation do you typically install on the rim joist?**

    Record Response:_____

55. **What is the typical R-value of wall insulation in your homes?**

    a) Record Response:_____
    b) Don't Know

56. **[If 55 = Don't Know] What material do you typically use to insulate the walls?**

    Record Response:_____

57. **[If 55 = Don't Know] How many inches of insulation do you typically install in the walls?**

    Record Response:_____

58. **What is the typical R-value for the insulation for the interior basement wall?**

    a) Record Response:_____
    b) Don't Know

59. **[If 58 = Don't Know]What material do you typically use to insulate the interior basement walls?**

    Record Response:_____

60. **[If 58 = Don't Know] How many inches of insulation do you typically install on the interior basement walls?**

Record Response:_____

61. What is the typical R-value of the ceiling insulation in your homes?

a) Record Response:_____
b) Don't Know

62. [If 61 = Don't Know] What material do you typically use to insulate the ceilings below unconditioned space?

Record Response:_____

63. [If 61 = Don't Know] How many inches of insulation do you typically install in ceilings?

Record Response:_____

Performance Testing

64. Do you typically test for air sealing with a blower door test?

a) Yes
b) No
c) Sometimes, what percent of the time?

65. [IF 64 = Yes or sometimes] What measurement is typically provided for blower door tests?

a) ACH50: _____
b) NACH: _____
c) Other [describe]: _____
d) Don't know: _____

66. [If 64 = Yes or sometimes] What is the [ANSWER Q52] you typically achieve?

Record Response:_____

67. Do you typically perform a post-construction test for duct tightness?

a) Yes
b) No

68. [If 67 = Yes] If yes, what results in CFM25 do you typically achieve?

Record Response:_____

Program Training and Marketing

69. Has the ConstructionSavers Program influenced your building practices for non-program homes in any way?

a) Yes
b) No

70. [If 69 = Yes] In what way has the program influenced your building practices?

_____

_____

71. [If 69 = Yes] What techniques from ConstructionSavers, if any, do you use on your homes built outside of the program?

_____

_____

72. As part of the program, have you participated in any of the sales and/or technical training courses provided by Ameren?

a) Yes
b) No

73. [If Question 71 = No]Why have you not attended any sales and/or technical training courses? [Do not read, accept multiple answers]

a) Sent another staff memberto attend the training
b) The training time was not convenient
c) The training location was not convenient
d) I was able to get the information online or from other sources
e) I did not think the training would be useful
f) Other (Specify) _____

74. What method do you use most frequently to promote your homes?

a) Newspaper ads
b) TV/Radio
c) Real estate ads
d) Outdoor signs/billboards
e) Model homes
f) Brochures/sales materials
g) Internet advertising
h) Other (Specify): _____

75. Have you taken advantage of the marketing support and marketing materials provided by Ameren?

a) Yes
b) No**[Skip to 78]**

76. What type of Ameren marketing support and materials have you utilized?

a) Newspaper ads
b) TV/Radio
c) Real estate ads
d) Outdoor signs/billboards
e) Model homes
f) Brochures/sales materials
g) Internet advertising
h) Other (Specify): _____

77. Do you believe this marketing support has helped to increase your customer base?

a) Yes
b) No

78. Have you seen an increase in homebuyers inquires about High Performance or ENERGY STAR Homes since participating in the program?

a) Yes, please describe by increase percentage over the previous year
b) No
c) Don't Know

79. [If Question 78 = Yes]Why do you think this is?[Accept Multiple Answers]

a) They are more aware of the program now
b) There is more marketing of the program now (by others, generally)
c) I am marketing these homes more now
d) Energy prices are increasing
e) More realtors are marketing these homes now
f) Other (Specify) _____
g) Don't Know
h) Refused

80. Do you plan to continue participating in the program moving forward?

a) Yes
b) No
c) Don't Know

81. [If 80 = No] Why are you not planning to continue participating in the program?

_____
_____

82. In the next few years, do you believe the number of program-qualifying homes you build will increase, decrease, or stay the same?

a) Increase
b) Decrease
c) Stay the same
d) Don't Know **[Skip to 84]**

83. Why do you think the number of program-qualifying homes you build will [Answer from 82]?

_____

_____

Satisfaction

You will now be asked about your satisfaction with the program

84. Thinking about your experience with this program, how would you rate your satisfaction with your program experience overall, would you say…

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

75. [If answer is c or d] What was less than satisfactory?

_____

_____

76. Please tell me if you were very satisfied, somewhat satisfied, not too satisfied, or not at all satisfied with…?

a) The information provided on Ameren's website (if applicable) _____
b) The program account manager/program staff you communicated with through the program _____
c) The RESNET-accredited HERS Rater_____

77. [If answer is 'not too satisfied' or 'not satisfied at all']What was less than satisfactory?

_____

_____

_____

78. To the best of your knowledge, what do you believe is the primary benefit to the builder, if any, of building ConstructionSavers Program-qualifying homes?

a) Higher quality
b) Higher price/profit
c) Sells faster
d) Rebate from utility
e) Promotion assistance available
f) No benefit
g) Other, please specify:_____
h) Don't Know

79. In your opinion, what is the most beneficial feature of program-qualifying homes to the homebuyer?

a) Construction tightness, air seal, building envelope
b) Reduced energy bills
c) High-efficiency appliances
d) High-efficiency/ENERGY STAR lighting
e) Whole-house design
f) Higher overall quality
g) Program brand name/resale advantages
h) Air exchanger/better air quality
i) Water conservation/reduced water use
j) Good for environment/planet
k) Other _____

80. Are there any products or building practices that DON'T qualify for incentives from the ConstructionSavers Program that you think should qualify?

a) Yes
b) No
c) Don't Know
d) Refused

81. [If Question 80 = Yes]What products or building practices do you think should qualify for incentives from the program?

_____
_____
_____

82. What changes, if any, would you like to see to the ConstructionSavers Program?

_____
_____

85. 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)
e) (Refused)

THANK AND TERMINATE

APPENDIX C. NON-PARTICIPANT BUILDER SURVEY INSTRUMENT

Non-participant Builder Survey – ConstructionSavers

Hello, I'm [INSERT NAME], and I'm calling 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]

[Non-participant - Once contact is reached]Hello, my name is _____ and I'm calling on behalf of Ameren Missouri. We are contacting residential builders to better understand their typical building practices in order to inform Ameren Missouri's residential new construction program. All your answers are confidential.

Profile Questions

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

g) Very satisfied,
h) Somewhat satisfied,
i) Not very satisfied, or
j) Not at all satisfied
k) (Don't know)
l) (Refused)

87. How many homes did you build in Missouri in 2012?

88. Do you expect a similar number of homes to be built in 2013?

a) Yes _____
b) No _____ [describe magnitude/direction of change and reason for change]

89. What percentage of these homes in Missouri was single-family and what percentage was multi-family?[Multi-family does NOT include side-by-side townhomes, duplexes, triplexes, or quadplexes; these building types are all eligible (any other MF are ineligible). If builder has not built any program-eligible homes, skip to Q69 for participant builders, terminate for non-participant builders.]

a) Single Family: _____
b) Multi-family: _____

90. What percentage of homes that you built in 2012 were[read all]:

a) Energy Star

b) "green" or high efficiency home, **[please describe]**
c) LEED or NGBS certified

91. What percentage of homes that you built in 2012 were:

a) Model
b) Spec
c) Custom

92. What percentage of the homes do you design…

a) Using the prescriptive compliance approach?: _____%
b) Using the performance compliance approach?: _____%
c) Don't know

93. What proportion of your homes is built in the following areas of Missouri? [Total should add to 100%. Read all options]

a) St. Louis Metro (Eastern-Central Missouri) : _____%
b) Cape Girardeau(Southeast) : _____%
c) Jefferson City (Central): _____% **[Interviewer: Inform builder not to include Columbia, MO in response]**
d) Moberly/Kirkville (Northeast) : _____%
e) Excelsior Springs (Northwest): _____% **[Interviewer: Inform builder not to include Kansas City, MO in response]**
f) Other: _____% [describe by county/jurisdiction]

Thank you. For the remainder of my questions, please only consider single-family homes including townhomes, duplexes, triplexes, and quadplexes built in these specific regions.

Impact

HVAC & Appliance Questions

94. In what proportion of your homes do you typically install the following heating systems?

a) Furnace: _____%
b) Boiler: _____%
c) Air Source Heat Pump: _____%
d) Electric Resistance: _____%
e) Other [describe]: _____%

95. What is the typical efficiency of the heating equipment?[PROVIDE RESPONSE FOR EVERY SYSTEM IN Q15≠ 0%]

a) Furnace: _____ AFUE
b) Boiler: _____ AFUE
c) Air Source Heat Pump: _____ HSPF
d) Other [describe]: _____

96. Whatproportion of your homes typically include the following cooling systems?

a) Central A/C: _____%
b) Window A/C: _____%
c) Air Source Heat Pump: _____%
d) Evaporative (swamp) cooler: _____%
e) Other (Specify): _____%
f) None: _____%

97. [If Q17 ≠ None 100%] What is the typical SEER value for the cooling systems you install? [PROVIDE RESPONSE FOR EVERY SYSTEM IN Q17≠ 0%]

a) Central A/C: _____
b) Window A/C: _____
c) Air Source Heat Pump: _____
d) Other (Specify): _____

98. In about what percentage of homes do you locate the central HVAC system in…

a) Conditioned space _____%
b) Garage _____%
c) Attic _____%
d) Unconditioned space _____%
e) Other _____%

99. Approximately what percentage of your homes have the duct system located in unconditioned space? [RECORD %]

100. For your homes that have ducts located in unconditioned space, what percent of the ducts are located in unconditioned space: [RECORD %]

a) Less than 25%
b) 25-49%
c) 50-75%
d) Greater than 75%

101. Do you insulate ducts located in unconditioned space?

a) Yes
b) No
c) Sometimes
   101.c.1.Less than 25%
   101.c.2.25-49%
   101.c.3.50-75%
   101.c.4.Greater than 75%
d) Don't Know

102. [If 22=yes or sometimes] What is the approximate R-value used to insulate the ducts?

a) Less than R-4
b) R-4 to R-5.9

c) R-6 to R-8
d) Greater than R-8

103. In about what percentage of homes do you install programmable thermostats?

Record Response:_____%

104. What proportion of the water heaters you install are conventional (storage tank), tankless, or a sidearm system?

a) Conventional (storage tank): _____%
b) Tankless:_____%
c) Sidearm:_____%

105. What is the typical Energy Factor (EF) of the water heaters installed?

Record Response: _____

106. Where is the hot water system located?

a) Conditioned space
b) Garage
c) Attic
d) Unconditioned space

107. [If 25 = storage] Do you wrap storage tank-type water heaters with an insulating blanket?

a) Yes
b) No
c) Sometimes
107.c.1.Less than 25%
107.c.2.25-49%
107.c.3.50-75%
107.c.4.Greater than 75%
d) Don't Know

108. [If 28 = Yes] What is the R-value of the insulating blanket?

a) Less than R-3.5
b) R-3.5 to R-6.7
c) R-6.8 to R-10
d) Greater than R-10
e) Yes
f) No
g) Sometimes
108.g.1.Can you estimate about how often you insulate the ducts?
h) Don't Know

109. I am going to list different home appliances, for each one, please tell me what percentage of homes you typically build in Missouri having ENERGY STAR versions of that appliance:

a) Refrigerator/Freezer: _____%
b) Dishwasher: _____%
c) Clothes Washer: _____%
d) Ceiling Fan: _____%
e) Water Heater: _____%
f) Heating/Cooling equipment: _____%

110. What is the typical glazing U-factor ofwindows installed in your homes?

_____

111. What is the typical solar heat gain coefficient (SHGC) value of Windows installed in your homes? _____

112. What percentage of light fixturesin your homes is typically installed with high efficiency bulbs (CFL, LED, etc.)?

a) Less than 25%
b) 25-49%
c) 50-75%
d) Greater than 75%

Insulation

The following section questions will focus on insulation levels across different areas of the home. Again, please think only of single family homes in Missouri areas that you build outside of the Ameren ConstructionSavers program.

113. What percentage of your homes has slab-on-grade foundations?

Record Response: _____%

114. [If 34 ≠ 0] What is the typical insulation R-value on the slab edge?

a) Record Response: _____
b) Don't Know

115. [If 35=Don't Know] What material do you typically use to insulate the slab edge?

Record Response: _____

116. [If 35=Don't Know] How many inches of insulation do you typically install to insulate the slab edge?

Record Response: _____

117. In what percentage of your homes do you typically include a basement (finished or unfinished)?

Record Response: _____%

118. What percentage of your homeshas exterior insulation on the foundation wall?

Record Response: _____%

119. [If 39 ≠ 0] What is the typical R-value of insulation on the exterior foundation wall?

a) Record Response: _____
b) Don't Know

120. [If 40 = Don't Know] What material do you typically use to insulate the exterior basement wall?

Record Response: _____

121. [If 40 = Don't Know]What is the thickness of the exterior foundation wall insulation you typically install to insulate the exterior basement wall?

Record Response: _____

122. [If 39 ≠ 0] Does the exterior insulation typically cover the entire height of the foundation wall?

a) Yes
b) No

123. [If 43 = No] What is the depth (feet) of the exterior basement insulation?

Record Response: _____ feet

124. What percentage of your homes has crawl spaces?

Record Response: _____%

125. [If 45 ≠ 0]In those homes with crawl spaces, what is the typical insulation R-value used to insulate either the exterior or interior crawl spacewall?

a) Record Response: _____
b) Don't Know

126. **[If 46 = Don't Know] What material do you typically use to insulate either the exterior or interior crawlspace walls?**

Record Response: _____

127. **[If 46 = Don't Know]What is the thickness of the insulation you typically install in crawl space walls?**

Record Response: _____

128. **What is the typical R-value of floor insulation above unconditioned spaces (cantilevers, garages,unconditioned basements, etc.) in your homes?**

a) Record Response:_____
b) Don't Know

129. **[If 49 = Don't Know] What material do you typically use to insulate the floors?**

Record Response:_____

130. **[If 49 = Don't Know] How many inches of insulation do you typically install in the floor above unconditioned space?**

Record Response:_____

131. **What is the typical R-value of the rim joist insulation in your homes?**

a) Record Response:_____
b) Don't Know

132. **[If 52 = Don't Know] What material do you typically use to insulate the rim joist?**

Record Response:_____

133. **[If 52 = Don't Know] How many inches of insulation do you typically install on the rim joist?**

Record Response:_____

134. **What is the typical R-value of wall insulation in your homes?**

a) Record Response:_____
b) Don't Know

135. **[If 55 = Don't Know] What material do you typically use to insulate the walls?**

Record Response:_____

136. **[If 55 = Don't Know] How many inches of insulation do you typically install in the walls?**

Record Response:_____

137. What is the typical R-value for the insulation for the interior basement wall?

a) Record Response:_____
b) Don't Know

138. [If 58 = Don't Know]What material do you typically use to insulate the interior basement walls?

Record Response:_____

139. [If 58 = Don't Know] How many inches of insulation do you typically install on the interior basement walls?

Record Response:_____

140. What is the typical R-value of the ceiling insulation in your homes?

a) Record Response:_____
b) Don't Know

141. [If 61 = Don't Know] What material do you typically use to insulate the ceilings below unconditioned space?

Record Response:_____

142. [If 61 = Don't Know] How many inches of insulation do you typically install in ceilings?

Record Response:_____

Performance Testing

143. Do you typically test for air sealing with a blower door test?

a) Yes
b) No
c) Sometimes, what percent of the time?

144. [IF 64 = Yes or sometimes] What measurement is typically provided for blower door tests?

a) ACH50: _____
b) NACH: _____
c) Other [describe]: _____
d) Don't know: _____

145. [If 64 = Yes or sometimes] What is the [ANSWER Q52] you typically achieve?

Record Response:_____

146. Do you typically perform a post-construction test for duct tightness?

a) Yes
b) No

147. [If 67 = Yes] If yes, what results in CFM25 do you typically achieve?

Record Response:_____

THANK AND TERMINATE

APPENDIX D. *EX POST* DEMAND REDUCTIONS

The Cadmus team 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 22. PY13 Summary: Ex Post Program Demand Reductions

Savers Home	PY13 Participation	Line Loss Adjustment	Gross Per-Unit *Ex Post* Demand Reduction (kW)	*Ex Post* NTG	Total Net *Ex Post* Savings (kW)
Overall	101	105.72%	82.64	28.3%	23.4